National Park Service
U.S. Department of the Interior

Grand Canyon National Park

Report To Congress On Transit Alternatives

Grand Canyon National Park

December 2004

REPORT TO CONGRESS ON TRANSIT ALTERNATIVES
Grand Canyon National Park

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EXECUTIVE SUMMARY

Background

In order to both improve visitor experience at Grand Canyon National Park and to protect park resources from development of more roads and parking lots, a transit system between the gateway community of Tusayan and stations in the park was proposed in the park's 1995 General Management Plan. In October 1997 the National Park Service (NPS) amended the 1995 GMP and decided to build a light rail system and locate all day-use parking in the Tusayan area on Forest Service lands 6 miles south of the canyon rim.

In November 2000 the NPS provided a congressional briefing on the light rail proposal. Congressmen Regula, Shadegg, and Senator Kyl were supportive of a park mass transit concept. However, fluctuating visitation and the rising costs of the light rail system, led them to suggest the merit of an interim bus-only alternative until visitation warranted a higher capacity system.

In December 2000, Congress passed legislation signed by the President requiring the Secretary of the Interior to halt the progress of the light rail solicitation and to report on bus alternatives to light rail transit and seasonal operation of a transit system for the park. From Public Law 106-554:

> *"Section 132 prohibits the Secretary of the Interior from using funds to pay the salaries or expenses related to the issuance of a request for proposal related to a light rail system at Grand Canyon National Park until June 1, 2001. In addition, the Secretary is directed to report directly to the Committee prior to any additional action regarding a request for proposal on alternative transportation options for the park. These options should include a phase-in period based on newly updated visitation numbers. The report should also address using a bus/transit option only during the high peak visitation months. Alternatives to be analyzed and costed in the report include: (1) an alternative fueled bus alternative with parking outside the park; (2) a rapid transit alternative and (3) a combination bus/rapid transit alternative."*

Options 1-5 in this Report to Congress became the initial concepts developed in response to the legislation. These options assume the same three stations proposed in the original light rail plan and that all day-use traffic would be removed from Grand Canyon Village when the transit system is operating.

<u>Developing an Achievable Option:</u> <u>Option A:</u> While preparing this report, the NPS became concerned that the costs of Options 1-5 were extremely high, ranging from $115 million to $252 million. Thus, the NPS developed a lower-cost option that would address the same basic principles of the other options, and would remain consistent with any future implementation of any of Options 1-5.

Basic differences between Options 1-5 and Option A are:

Congestion Reduction:

- Options 1-5 assume 100% elimination of day-use traffic in Grand Canyon Village.
- Option A assumes 15-25% reduction in traffic in Grand Canyon Village and targeted improvements at the Mather Point parking area.

Visitor Use Requirement:

- Transit system use under Options 1-5 is mandatory.
- Transit system use under Option A is voluntary.

Capital Costs:

- Under Options 1-5, initial system implementation costs rely primarily on new Congressional appropriations. Total investment: $115-252 million.
- Under Option A, initial implementation will be funded primarily through a combination of existing authorized fund sources (Fee Demo, Federal Lands Highway Program, and/or Line Item Construction). Total investment: $46 million.

Operating Costs**:**

- Options 1-5 funds operating costs through 100% user fees. Park pass holders would be charged an additional fee to use the system. Annual operating costs: $15-17.6 million.
- Option A funds system operations through a base operating subsidy along with a user fee. Park passes are accepted for use of the system with no additional fee required. Annual operating costs: $1.8 million.

All options help to:

- achieve the park's basic transit goals;
- provide a better quality visitor experience;
- ensure visitor safety;
- relieve traffic congestion; and,
- utilize Canyon View Information Plaza to its full potential.

"Express Rail" / "Regional Rail": In 2002, while this report was under formulation and review, a proposal, called "Express Rail", was submitted to Grand Canyon National Park by the Grand Canyon Railway (GCR). On January 29, 2003, the NPS received a letter signed by the ten members of the Arizona Delegation (Senators John McCain and Jon Kyl and eight Congressional members), requesting the NPS undertake a review of this initial proposal for Express Rail submitted by the Grand Canyon Railway. The NPS was asked to compare the costs and benefits of this proposal with Options 1-5.

GCR submitted an alternative transportation proposal called "Regional Rail" which included a Phase I option for high speed rail service between Williams, AZ and Grand Canyon Village, and a Phase II option for light rail service between Tusayan and Canyon View Information Plaza. *Regional Rail* has been reviewed and analyzed by the same consultants who assisted with this Report to Congress. A summary of the proposal and an analysis are included as an *addendum*. The analysis reviews the proposal, validates / contests assumptions, and compares scenarios applying assumptions used in the NPS options, such as rate of visitation growth. Capital and operational costs were also reviewed and adjusted for comparison.

The analysis concludes that the GCR proposal would be substantially more expensive than the transit options being considered by NPS, including light rail transit. It is highly unlikely that a project of the magnitude represented by the GCR proposal could be funded as proposed.

Transit Option A

The most pressing needs of the park today are to improve the visitor experience by alleviating traffic congestion that exists at the South Entrance during peak visitation, addressing the significant parking and safety problems at Mather Point caused by limited parking, and by providing visitor parking for Canyon View Information Plaza (CVIP).

Option A is both an adaptive management approach and a lower cost alternative. It is intended to reduce traffic congestion at the South Rim. Option A gives the NPS flexibility to **immediately begin implementation** of critical improvements to the existing situation using resources currently available to the park. It provides an opportunity to test concepts such as traffic management and the potential for greater use of Grand Canyon Railway. At the same time the park will be able to derive better visitation and cost estimates on visitor transit issues. Option A is consistent with Options 1-5 and could serve as an interim solution to future transit system solutions or, if successful, it could stand alone.

The park's most immediate needs can be addressed through a combination of three main elements:

1) A new visitor parking facility near CVIP would serve to alleviate parking congestion at Mather Point; provide parking for CVIP; and allow parking for visitors using the bus transit system to ride to Grand Canyon Village.
2) A new parking facility on Forest Service land outside the park near the South Entrance to be used as a transit staging area;
3) An enhanced shuttle bus system that builds on the park's current system and is used by visitors on a voluntary basis.

These new facilities, combined with expanded transit service and active traffic management will result in a reduction of traffic on the South Rim of between 15 percent and 25 percent during peak visitation periods. This option allows the park to practice an adaptive management approach to its transit needs, adjusting the system over time as necessary to respond to park and visitor needs.

The following table summarizes the general characteristics of Option A.

Option	Transit Route	Traffic Management	Vehicle Type	Energy Source
Option A	Uses new route parallel to AZ 64 from Long Jim Canyon to ¼ mile north of the South Entrance Station; uses existing roads to CVIP and Grand Canyon Village	Commercial tour buses and shuttles from Tusayan drive into park; 15-25% of day visitors board at Long Jim Canyon and CVIP on voluntary system	Standard (40') and Articulated transit buses	Alternative Fuels

Option A Financial Design:

The following table presents the estimated initial capital investment, operating expenses, and life cycle costs for the system.

Exhibit 1 - Estimated Initial Investment, Life Cycle Costs, and Operating Expenses (2006 – 2026) in Constant 2003 US Dollars

Initial Investment 2006 - 2010			Life Cycle Cost 2010 - 2026			O & M Expenses 2006 - 2026	Avg Annual O & M Expense
Real Property	Personal Property	Total	Real Property	Personal Property	Total		
$39,500,000	$6,500,000	$46,000,000	$7,900,000	$10,350,000	$18,250,000	$33,525,000	$1,752,000

(See page 6 for definitions of terms)

The implementation costs for Option A are $46 million for construction and equipment plus an additional annual operations and maintenance cost of $1.8 million. The proposed source of funds for construction are from Fee Demo made available from deferring currently approved and scheduled fee demonstration projects, and from some funds from the Federal Lands Highway Program (FLHP) and Line Item Construction (LIC) appropriations.

The viability of Option A rests upon some critical assumptions, including:

- That the park's visitation does not increase or decrease significantly.
- That an increase in fees will be approved for FY06 resulting in a per vehicle fee of $25 for which $10 will be for transportation (also called "transit fee").

Transit Options 1-5

Five basic options for line-haul (main) transit service between Grand Canyon Transit Center (Tusayan), Canyon View Information Plaza, and Grand Canyon Village were analyzed in this study. Three of the basic options use buses to transport visitors along the route. One option uses light rail transit and one option assumes a phased development beginning with buses and transitioning to light rail transit as visitation and the demand on the system increases. Each option assumes a route for the transit service and a traffic management policy for day-use visitor vehicles traveling into the South Rim area. Day-use visitors to the area would be required to use transit; overnight visitors and those passing through to Desert View could use their own vehicles under all scenarios. A range of energy sources is considered in the options, including overhead electric lines. The following table summarizes the general characteristics of the transit system options.

Option	Transit Route	Traffic Management	Vehicle Type	Energy Source
Option 1	Uses existing roads	Commercial tour buses and shuttle buses from Tusayan drive into park	Articulated transit buses	Compressed natural gas, diesel, or diesel/CNG electric hybrid
Option 2	Uses new route parallel to AZ 64, existing roads from CVIP to Village, and a new road from Maswik to Market Plaza	Commercial tour buses and shuttle buses from Tusayan drive into park	”Advanced” design buses	Compressed natural gas, diesel, or diesel/CNG electric hybrid
Option 3	Uses new route following proposed rail transit line	All day visitors board transit line at Grand Canyon Transit Center	”Advanced” design buses	Overhead electric lines
Option 4	Phase 1 same as Option 1, except uses new road from Maswik to Market Plaza Drive; Phase 2 route along proposed rail transit line	Phase 1: Commercial tour buses and private vehicles enter park up to capacity of defined parking areas; Phase 2: Same as Option 5	Phase 1: articulated transit buses; Phase 2: rail transit	Compressed natural gas (if available), diesel, or diesel/CNG electric hybrid (both buses and rail vehicles)
Option 5	Uses proposed rail transit route	All day visitors board transit line at Grand Canyon Transit Center	Two considered: A) Internal combustion or hybrid electric B) Electric light rail vehicles	A) diesel (or alternative) B) overhead electric lines

Visitation Forecasting: Visitation growth is expected to vary over the 20-year contract period, but the average annual compound rate of growth from 2001 to 2026 is expected to be about 1.7% for annual visitation.

The evaluation of the options also considered how the transit systems could be expanded to meet visitor transportation needs beyond 2026 or if visitation increased more rapidly than anticipated in the base case scenario. The maximum potential daily visitation to the South Rim area was determined through careful analysis during the formulation of the GMP and includes the combined capacity of the overlooks and other visitor use areas. The ability of each option to be expanded to serve this maximum demand was analyzed.

Financial Analysis for Options 1-5

The following table presents the estimated initial and expanded capital investment, operating expenses and life cycle costs for each system assuming *growth* in visitation. Costs are provided in 2003 dollars and are not inflated or adjusted to year of expenditure. Estimated costs for a *no growth* scenario are included under ‘Options 1-5’ in the body of the report.

Estimated Initial Investment, Life Cycle Costs, and Operating Expenses (2004-2026) in Constant 2003 US Dollars *with* Expansion (Growth Scenario).

Option	Initial Investment			Expansion		Total Investment	Life Cycle Costs		Operation and Maintenance	
	Real Property	Personal Property	Total Initial Investment	Real Property	Personal Property	Initial + Expansion	Real Property	Personal Property	Total 2008-2026	Average Annual
1	$75,756,410	$29,667,000	$105,423,410		$10,307,000	$115,730,410	$15,151,282	$42,026,550	$291,154,300	$15,323,911
2	$105,329,765	$37,394,500	$142,724,265		$13,002,000	$155,726,265	$21,065,953	$30,729,300	$304,612,100	$16,032,216
3	$162,111,022	$50,963,000	$213,074,022		$10,494,000	$223,568,022	$32,422,204	$23,826,800	$334,445,800	$17,602,411
4	$81,128,234	$26,999,500	$108,127,734	$95,190,392	$48,911,500	$252,229,626	$14,603,082	$18,309,438	$311,385,200	$16,388,695
5A	$155,019,809	$54,483,000	$209,502,809		$3,894,000	$213,396,809	$31,003,962	$19,962,800	$315,995,800	$16,631,358
5B	$196,942,839	$49,863,000	$246,805,839		$3,894,000	$250,699,839	$39,388,568	$20,424,800	$334,955,548	$17,629,239

Source – David Evans and Associates, PricewaterhouseCoopers LLP

(1)Real Property: land and improvements that are affixed to the land, such as buildings, tracks, and other permanent structures.
(2)Personal Property: assets that are not affixed to the land, such as rolling stock and equipment.
(3)Life Cycle Costs: the ongoing capital costs of a given transit system after initial development, including substantial real property refurbishment and replacement of rolling stock. Please note that this is not the standard definition of life cycle cost that is typically used in the context of analyzing economic investment alternatives.
(4)Operation and Maintenance: day to day system operations, including labor and personnel necessary to maintain and operate the system; also includes fuel and routine maintenance.
(5)Average Annual Operating Expense: day to day system operations, as described above, on a yearly basis. *Note*: Annual Operating Expenses shown here do not include yearly amortized life cycle costs, however, amortized life cycle costs are included in the transit fees, shown in the body of the document.
(6) Values are presented in unadjusted 2003 dollar amounts. Inflation adjustments are dependent upon visitation forecasts.
(7) Initial Investments for Option 4 represent Phase I and Expansion figures represent Phase II.
(8) For additional details on the Financial Analysis, see Options 1-5 in the body of the document.

Decision Making and Implementation

The options offered here, Option A and Options 1-5, are presented in response to the Congressional request contained in PL 106-554 to provide alternative transportation options for the park. In this report, the NPS has endeavored to be responsive to both the spirit and the letter of this law.

Should Congress provide additional direction to the NPS regarding the implementation of one of these options, the NPS stands ready to move forward. In implementing any of these options, the NPS would first need to conduct a National Environmental Policy Act (NEPA) analysis of that option to determine the effect it would have on park resources, including air quality, natural quiet, historic structures and landscape, etc. NEPA analysis also calls for public comment through public review. NEPA environmental analysis would result in a set of alternatives based on the option chosen, with one of those alternatives selected by the NPS for implementation.

I INTRODUCTION AND BACKGROUND

By Act of March 1, 1872, Congress established Yellowstone National Park in the Territories of Montana and Wyoming "as a public park or pleasuring ground for the benefit and enjoyment of the people" and placed it "under exclusive control of the Secretary of the Interior." The founding of Yellowstone National Park began a worldwide national park movement. Today more than 100 nations contain some 1,200 national parks or equivalent preserves.

On August 25, 1916, President Woodrow Wilson signed the act creating the National Park Service, a bureau in the Department of the Interior responsible for protecting the 40 national parks and monuments then in existence and those yet to be established.

This *Organic Act* states that, *The Service thus established shall promote and regulate the use of Federal areas known as national parks, monuments and reservations . . . by such means and measures as conform to the fundamental purpose of the said parks, monuments and reservations, which purpose is to conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations.*

The National Park Service still strives to meet those original goals, while filling many other roles as well: guardian of our diverse cultural and recreational resources; environmental advocate; world leader in the parks and preservation community; and pioneer in the drive to protect America's open space.

The National Park System of the United States comprises 388 areas covering more than 83 million acres in 49 States, the District of Columbia, American Samoa, Guam, Puerto Rico, Saipan, and the Virgin Islands. These areas are of such national significance as to justify special recognition and protection in accordance with various acts of Congress.

A THE NATIONAL PARK SYSTEM AND TRANSIT

A fundamental purpose of the National Park System is to preserve and protect historical, cultural, and recreation resources, while enhancing the experience for visitors and for future generations. Visitors can experience and learn about their natural and cultural heritage in parks. Park roads and visitor transportation systems are intended to enhance visitor experience while providing access to park features and protecting park resources. Transportation is, in many ways, the connection between the National Park Service mission of resource protection and visitor enjoyment.

Since the 1920's, the NPS has developed transportation systems in the national parks primarily for the private auto. The distinct character of park roads and parkways have been designed to harmonize with park settings and contribute to visitor appreciation and enjoyment of park values. Consequently, park roads are designed with extreme care and sensitivity with respect to the terrain and environment through which they pass – they are laid lightly on the land. There are currently 8,500 miles of roads and parkways (5,456 miles of which are paved), 1,736 bridges, 67 tunnels and extensive parking facilities. Most visitors arrive at parks and travel within them by private auto and, in some cases, this has begun to threaten the very resources parks were created to protect.

Congestion in many National Parks causes lengthy traffic delays and noise and air pollution that substantially detract from the visitor's experience and overall quality of park resources. Recognizing that expanding park roads and adding more parking lots are typically not viable solutions, the National Park Service has introduced alternative transportation systems to help alleviate traffic problems and make parks more accessible to all users. There are currently 110 Alternative Transportation Systems in 96 park units that include water, land and air transit services. These visitor transportation systems have proven effective in meeting visitor travel needs and contributing to the overall positive experience of the parks they serve.

Just as park roads are designed to contribute to a positive visitor experience, transit systems in parks should be planned and designed to be more than simply utilitarian. The design standards for park roads recognize that minimizing travel time and maximizing capacity are less important in park environments than in urban settings. A similar philosophy should guide the development of park transit systems. To maximize their benefits, transit systems for parks should be planned and designed using standards that reflect the unique settings and multiple purposes they must serve. The design standards for park roads recognize that minimizing travel time and maximizing capacity are less important in park environments than in urban settings. A similar philosophy should guide the development of park transit systems.

B THE NEED FOR A TRANSIT SYSTEM AT THE GRAND CANYON

Traffic and parking problems have plagued Grand Canyon National Park since cars overtook trains as the primary means of arrival in the 1930's. The response to the post-WW II boom in visitation was to build more roads and parking. A new South Entrance Road, Visitor Center, and East Rim Drive were completed by the early 1960's. Visitors continued to arrive in increasing numbers. As annual park visitation was nearing 3 million in 1974, a free shuttle service in Grand Canyon Village and West Rim Drive was initiated. From the 1976 "final master plan" come the following quotes:

> "Periods of high visitation on the South Rim sometimes create an atmosphere of congestion."
>
> "The facilities at Grand Canyon Village make this the most popular destination point in the park; occasionally, there is traffic congestion during peak-use periods."
>
> Under *Objectives*, "Continue and improve the public transportation system on the South Rim".

The 1976 master plan was largely not implemented. In 1995, as annual park visitation was nearing 5 million, a new master plan, now called a General Management Plan (GMP), was adopted. The following are a few quotes from that plan:

> "The South Rim is too crowded during summer. The road system is heavily congested and confusing; confusing traffic routing and signs further confound visitors. Parking for automobiles and buses is inadequate."

> "The shuttle system is crowded, and there are too few buses. Routes are inadequate, and the operating season is too short."

The 1995 GMP examined several alternative ways of handling the transportation problems, all of which included some form of transit system. An option without using transit was considered but rejected as follows:

> "*Action:* Another proposal was to provide a car-oriented experience in the village, with adequate parking in the village area and upgraded south entrance road and village loop road to meet the projected 2010 demand.
>
> *Reason for Rejecting:* This would require many more parking spaces in the village and a four-lane highway from the park entry to the village loop, with a two-lane, one-way village loop. This action would disturb a significant amount of park land for parking, and it would overwhelm the village with vehicles, making the visitor experience unsatisfactory and potentially unsafe."

In order to both improve the experience of visiting the Grand Canyon and to protect park resources from development of more roads and parking lots, a transit system from the gateway community of Tusayan to two stations in the park is proposed. A transit system would improve visitor experience by reducing congestion and confusion; providing frequent, comfortable and convenient service; and, would improve visitor distribution while still providing opportunities along the South Rim for solitude.

C PROJECT HISTORY

Upon the completion of the 1995 GMP, the park began exploring ways to implement a transit system. Initially, a "solicitation of interest" was sent to a large transit-oriented mailing list. Thirteen different types of transit technology were submitted for consideration. A small team reviewed these options and recommended "guided bus" technology for use at Grand Canyon.

Guided bus technology involves adding small, horizontally oriented guide wheels to the corners of a standard transit bus for use on a dedicated concrete roadway with short concrete curbs on both sides. The idea is that the buses travel on the dedicated roadway and are "guided" by the wheels rolling on the curbs. The advantages of this system are a narrower roadway and potentially safer operation than on standard roadways. Initially the team understood the buses could be linked into trains but that turned out to be untrue.

Systems using this technology are running in both Essen, Germany, and Adelade, Australia. There are none in the United States. This is reportedly because the patent owner is not interested in bringing the technology into the US market. Without the ability to link buses into trains, this technology is not a viable candidate for the park's situation. The primary advantage of guiding the bus is to squeeze a narrow dedicated bus lane into tight urban corridors – a normal dedicated road in the Grand Canyon situation, as analyzed in this report, can be built without the expense of the guiding system.

When it became apparent that the guided bus option was not available, light rail began to be considered more seriously. A 1997 Environmental Assessment compared light rail to a bus

alternative and looked at several rail configurations. A cursory economic comparison was included in that document. The Environmental Assessment also looked at parking options including modifying the GMP by eliminating parking near Mather Point. In October 1997, the National Park Service decided to pursue a light rail option and locate all day-use parking in the Tusayan area, on National Forest System lands.

With those decisions made, the design of Canyon View Information Plaza, the prime park terminus for light rail, began. That facility was built between 1999 and 2000, opening on October 26, 2000.

In 1998 and 1999, park planners were devising a way to finance a transit system without federal funding, which was assumed to be necessary due to the large capital requirements and the absence of existing NPS capital programs of sufficient size. Chairman Regula of the Subcommittee on Interior Appropriations later confirmed the assumption that federal funds would not be forthcoming and requested that language to that effect be included in any procurement documents. Concurrently, the project was being designed. It was decided that a concession contract, following new (1998) concession legislation and associated new regulations was the best way to finance a transit system. A concession contractor would be responsible for construction, financing, and operation and maintenance of the system. South Rim visitors would pay a "transit fee" to the concessioner with their entrance fee at the park entrance. In order to keep the combination of transit and entrance fees reasonable, the entrance fee portion would be reduced.

The park's GMP forecast in 1992 was that visitation in 2000 and beyond would continue to grow at the rapid rate that had occurred in the previous 10 to 15 years. The GMP planning process established a maximum visitor capacity for the South Rim area of 45,000 visitors per day based on the capacity of overlooks and other visitor use areas. If visitation continued to grow as projected, daily visitation in the summer was expected to reach this capacity well before 2020. At the time, it was decided that any transit system considered for the South Rim area should be able to serve this level of visitation.

In 1999, visitation projections originally done in 1992 were revised. Since 1993, annual visitation had been relatively flat rather than growing steadily as had been predicted. New visitation projections did not change the estimated visitor capacity of the South Rim area. However, the new projections suggested that it would take much longer than originally thought for visitation to reach the South Rim's capacity. The park proposed to proceed with the light rail project, starting with fewer rail cars and adding cars as necessary to handle increasing demand over time.

By January 2000, five bidding teams, representing 40 top firms in the transit industry, were pre-qualified to bid on the concession contract. By November 2000, the final Request for Proposals, having been reviewed by the 5 teams, was ready to be sent to these bidders.

D LEGISLATION REQUIRING THIS REPORT

In November 2000, the NPS provided a congressional briefing on the light rail proposal, prior to releasing a prospectus for contracting. Due to fluctuating/decreasing visitation periods between 1993 and 2000, Congressman Regula, Senator Jon Kyl, and Congressman John Shadegg, though

supportive of a park mass transit system, suggested the merit of an interim bus-only alternative until visitation warranted a higher capacity system

In December, 2000, Congress passed legislation that the President subsequently signed requiring the Secretary of the Interior to report on bus alternatives to light rail transit and seasonal operation of a transit system for the park. From Public Law 106-554:

"Section 132 prohibits the Secretary of the Interior from using funds to pay the salaries or expenses related to the issuance of a request for proposal related to a light rail system at Grand Canyon National Park until June 1, 2001. In addition, the Secretary is directed to report directly to the Committee prior to any additional action regarding a request for proposal on alternative transportation options for the park. These options should include a phase-in period based on newly updated visitation numbers. The report should also address using a bus/transit option only during the high peak visitation months. Alternatives to be analyzed and costed in the report include: (1) an alternative fueled bus alternative with parking outside the park; (2) a rapid transit alternative and (3) a combination bus/rapid transit alternative."

E DEVELOPMENT OF OPTION A

The ultimate cost of the transit alternatives that Congress asked the NPS to evaluate were significant, with initial costs ranging from $105 for articulated busses to $247 million for light rail. It is important to keep in mind that these systems were evaluated under the assumption that they would serve 100 percent of the day-use visitors at the park. However, understanding current federal budget constraints and the time required to implement such a system, park management felt that it was important to include a transit option in this report that had a more reasonable cost while still addressing the park's more pressing transit needs and ensuring a quality visitor experience.

It was based on this consideration that Option A was developed. Option A is distinct from Options 1-5 in several important respects: 1) it was developed by park personnel, and vetted by the park's transportation consulting firm, *after* Options 1-5 were developed; 2) as a result, it was not subject to the same level of analysis as Options 1-5, although park management believes that it can achieve the goals set for it; 3) it is based on the assumption that a *reduction* in day-use traffic (not an elimination) will alleviate the most aggravating congestion faced by park visitors; 4) and it recognizes that funding for transit is limited, and that the park will be asked to provide a significant share of funds through non-appropriated sources. This will result in a 4-5 year delay in a number of important fee demonstration projects previously approved by Congress.

II CONTEXT FOR PLANNING

A RELATIONSHIP TO THE GENERAL MANAGEMENT PLAN

The backbone of the many facility modifications in the 1995 General Management Plan (GMP) is the proposal to change the primary transportation system in Grand Canyon Village from automobiles to transit. Here is how it was worded in the GMP:

> "North of Tusayan, at a site to be determined in cooperation with the U.S. Forest Service, a large parking facility will be constructed. It will be closely associated with the gateway information center and will be the starting point for various alternatives to automobile travel into the park, as described below."
>
> "A shuttle service to the Mather Point orientation center [now called Canyon View Information Plaza (CVIP)] will be provided… This shuttle could use either rubber-tired buses on the existing road or a fixed guideway system (e.g., rail, light rail, monorail); such a system would likely be privately financed and operated if economically feasible and costs for visitors were reasonable."

The GMP also proposed that up to 1225 cars/recreational vehicles and 60 tour buses would be parked in the Mather Point area. This enabled the main transit route from Tusayan to be operated on a seasonal basis although the in-park routes would be year-round. A key concept of the GMP entails the removal of 100% of day-use visitor traffic from Grand Canyon Village. In 1997, when the decision was made to pursue light rail, a concurrent decision was made to locate all the parking in Tusayan, eliminate the Mather Point parking, and operate the main transit route from Tusayan year-round. The significant investment in light rail infrastructure and the available capacity of the light rail system made it beneficial to eliminate the 11-acre parking lot at Mather Point.

Options 1-5 in this report include a parking/transit staging area north of Tusayan, on Forest Service lands as proposed in the GMP. In all options, this will be the primary and long-term starting point for a visit to Grand Canyon Village. In keeping with the GMP, all five of Options 1-5 propose removal of 100% of day-use automobiles from Grand Canyon Village. Parking in Grand Canyon Village is reconsidered for some bus options in this report.

In most regards, Option A more closely resembles the GMP than do Options 1-5. A significant difference is that Option A does not propose to remove all day-use visitor traffic from Grand Canyon Village, but rather seeks to reduce traffic by as much as 25%. Option A proposes a near-term 470 vehicle parking lot at the location proposed for the 1225 vehicle lot in the GMP. This lot would serve visitors wanting to access the CVIP and Mather Point. This lot becomes the primary parking/transit staging area for visitor orientation and access to the transit system. Option A also proposes a 450 vehicle parking and staging area located north of Tusayan and connected to the CVIP by a shuttle operation as demand requires, which is consistent with the GMP.

The proposal by the Grand Canyon Railway is addressed in the GMP as follows.

> "The Park Service will encourage alternatives to private automobile travel to Grand Canyon. These alternatives should complement the transportation and orientation proposals. Current examples include the Grand Canyon Railway from Williams and various shuttles from Tusayan and the Grand Canyon Airport in Tusayan."

B DAY-USE, OVERNIGHT, AND PASS-THROUGH VISITORS

There are approximately 900 guestrooms, 75 RV sites, and 380 campsites without hookups in Grand Canyon Village. These provide overnight accommodation for 3-4000 visitors per night. When the park is at its busiest, 20,000-25,000 visitors pass through the South Rim in a day. Based on these figures, between 12% and 20% of all South Rim visitors are spending the night in Grand Canyon Village.

Because these visitors have more luggage than those visiting for just the day, the park's plan has consistently been to continue permitting access by private vehicle to the various accommodations. One exception is the hotels on the canyon rim. In order to remove the traffic, congestion, and associated noise from the rim, the GMP proposed that guests at those hotels would park at the Backcountry Information Center and be transported by the hotel concessioner to their rooms. All overnight guests would be expected to park their vehicles and use in-park transit and trails to travel to and from locations along the South Rim. Options 1-5 retain this concept, while Option A would continue parking for the hotels as it exists now.

Although it is difficult to predict percentages, some number of visitors will choose to avoid Grand Canyon Village and the transit system, preferring to see the canyon from Desert View and Desert View Drive only. In order to accommodate more traffic and parking, some facilities at Desert View have been improved. Desert View Drive will be open to through traffic from the East Entrance station to the South Rim Entrance station.

Today, about 28% of the day visitors enter the park through the East Entrance station at Desert View. If a transit system were implemented, it was assumed that 50% (about 14%) of these visitors would not choose to travel to the Grand Canyon Village area and would not ride the transit system. It was assumed that all day-use visitors entering through the South Rim Entrance station would ride the transit system at some time during their stay.

C VISITATION TRENDS, FORECASTS, AND VISITOR CAPACITY

Although there are myriad factors that affect visitation trends, it has been assumed that the perception of crowding – particularly vehicle crowding – at Grand Canyon has contributed to the recent lack of growth in visitation. As can be seen from the graph on page 19, visitation to Grand Canyon National Park took a big jump between 1984 and 1993 but has been relatively flat, since. The following quotes about Grand Canyon National Park from guidebooks suggest that crowding may be an important consideration to some visitors:

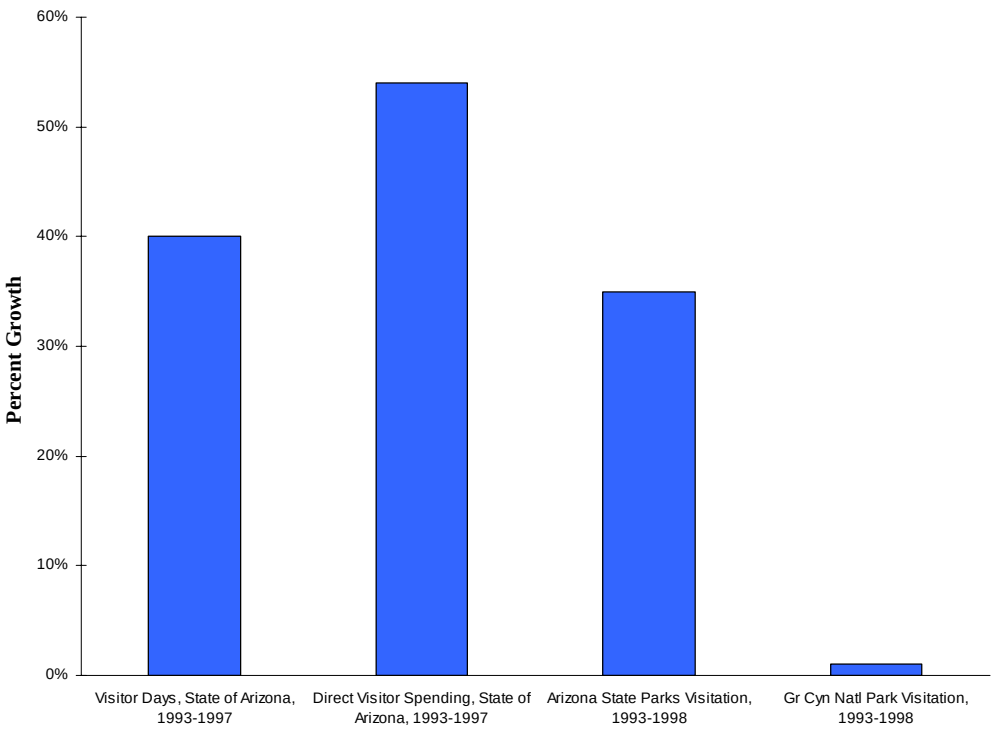
- "For at least two decades it has been apparent that the huge number of visitors, topping 5

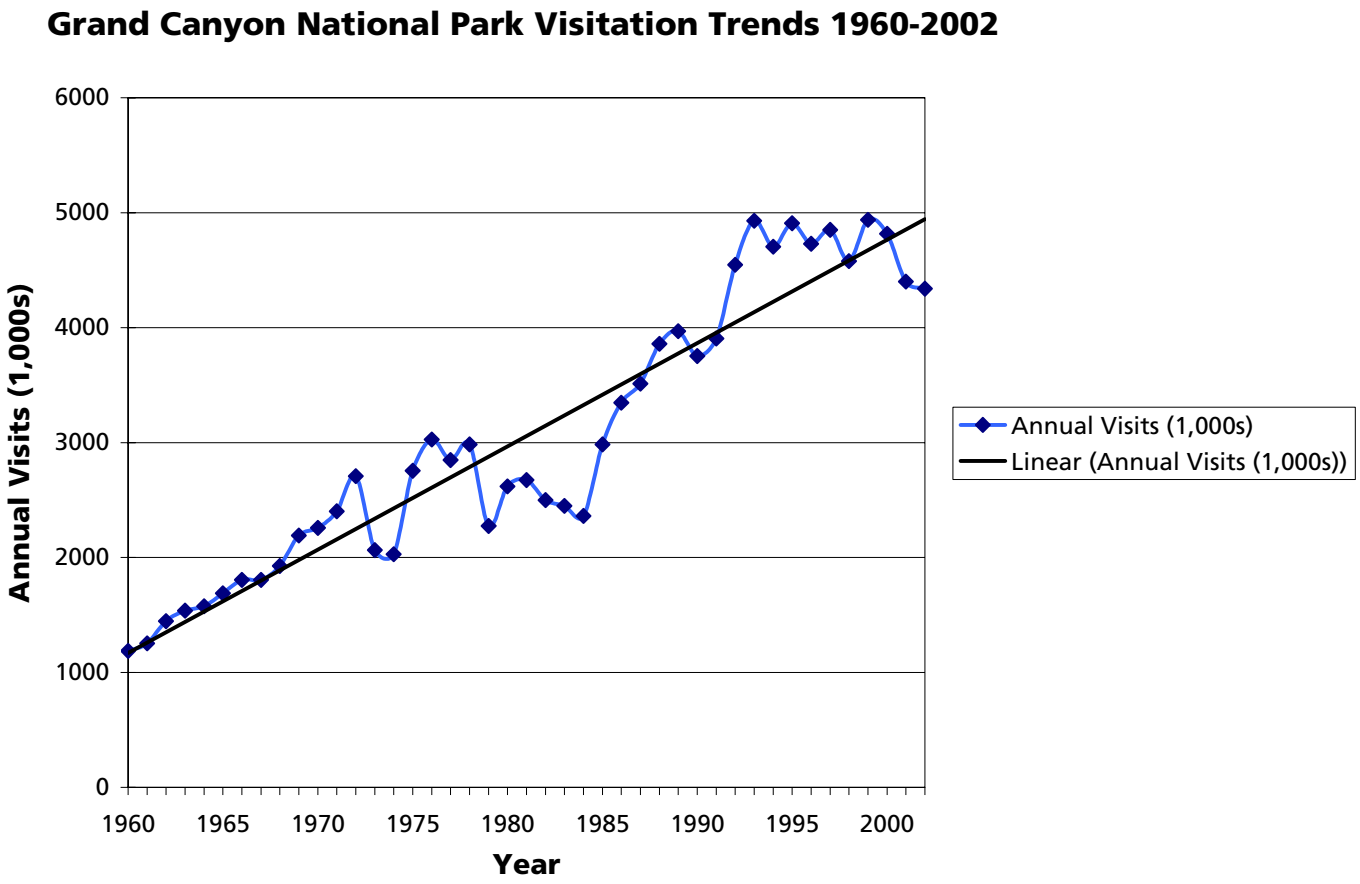
million in recent years, is taking its toll on the experience." *The Arizona Guide, Second edition, 2000, pg. 58*

- "The South Rim also features most of the Canyon's easily accessible viewpoints and trails. It's not surprising, then, that large crowds of visitors, especially in summer, are the main drawback of this part of the Canyon. Park staff have big plans to relieve the congestion by adding a light rail system, more shuttles, bike paths, and foot trails." *Arizona Handbook, Seventh edition, 1999, pg. 44*
- "I'm going to beg of you to please, please, come in the off season if you can." *Arizona for Dummies, First edition, 2001, pg. 358*
- "Yet because the crowding grows ever worse, the experience of visiting the park has been ruined. The situation reached a seemingly hopeless point until, in a plan approved in 1997, the Park Service decided to get rid of cars completely. The system will phase in during 2000 and 2001. Visitors will park at large lots and ride trains into the park. It's long overdue." *Frommer's Family Vacations in the National Parks, First edition, 1999, pg. 191*

While visitation to Grand Canyon has been stagnant, other indicators of the Arizona tourism market show strong growth. The following chart compares visitation to Grand Canyon over several years in the 1990's with visitation to the State of Arizona and to Arizona State Parks over a similar time period. Arizona has been receiving an increasing number of visitors – Grand Canyon National Park has not, perhaps due to visitors' perceptions of crowding and congestion. The 2004 season has shown an upturn in visitation, with recreational visits up 5.19% over the previous year through August.

Visitation Growth in Several Arizona Markets





Visitation forecasts have been prepared for three target years to support planning and financial analysis for transit options at Grand Canyon National Park. The target years are 2006, 2016, and 2026. These target years correspond to conditions near the beginning, middle and end of a potential concession or service contract over a 20-year period. Although years have been associated with visitation levels, historic trends show that it is not possible to predict future visitation with reliability. Due to the uncertainty inherent in predicting future visitation, transportation systems for Grand Canyon must be planned with flexibility and expandability in mind. The evaluation of the transit options considers the extent to which each option can be modified to respond to unexpected changes in visitation, both positive and negative. After the transportation system is implemented, future decisions on expansion and enhancements should be based on thresholds of daily and annual visitation.

In 1992 the Denver Service Center, National Park Service, prepared a forecast of annual visitation to Grand Canyon National Park of 6,850,000 people in 2010. As shown in the figure above, this forecast was prepared near the end of a period of rapid growth in annual visitation.

Since 1993, visitation to Grand Canyon has varied from year to year, but has shown a relatively flat trend. Current visitation is well below the trend line of the 1992 visitation forecast used in the General Management Plan. Although visitation has grown rapidly in the past, it is now unlikely that visitation would reach the level forecast in the General Management Plan by 2010.

New forecasts of visitation have been prepared for the purpose of planning visitor transportation systems. These forecasts anticipate a lower rate of increase in annual visitation than that forecast in the General Management Plan, reflecting more recent trends. Visitation growth is forecast to vary over the 20-year forecast period. The average annual compound rate of growth from 2001 to 2026 is expected to be 1.7% For the purposes of transit system design (not financial analysis), annual visitation to Grand Canyon is projected as follows:

2006 – 5,000,000 annual visitors
2016 – 5,922,000 annual visitors
2026 – 6,800,000 annual visitors

Although these are slower growth forecasts than most of the park's history, we consider them to be reasonable for the design of the transit system in light of the most recent trend. Different, lower, projections were used as sensitivity tests for financial calculations to present a more conservative, lower risk financial analysis. The assumptions used in the financial analysis will be described later.

The General Management Plan estimated the visitation capacity of the South Rim area served by the planned visitor transportation system to be 22,500 visitors at one time and, assuming length of stay remained constant, 45,000 visitors per day. This ultimate capacity is referred to in this report as the Maximum Day visitation projection. The ability to ultimately serve this number of visitors, while accommodating the existing visitor demand cost-effectively is a consideration in evaluation of the visitor transportation system options.

Current daily visitation is well below the estimated capacity of the South Rim area. In 2001, visitation on a typically busy summer day (defined as the day with the 5th highest visitation) was estimated to be about 22,000 people. Visitation trends indicate that visitation during the peak season is growing less rapidly than annual visitation or not at all, while visitation in the shoulder seasons and the winter is growing relatively more rapidly. Daily visitation during the peak season, a key factor in the design of visitor transportation systems is projected as follows:

2006 – 24,800 visitors daily
2016 – 26,800 visitors daily
2026 – 28,400 visitors daily

The options for Grand Canyon's transit system have been planned to meet these daily visitor levels during the summer and lower visitation levels, estimated from historic trends, in other seasons.

D VISITOR COMFORT STANDARDS

Standing Room: The quality of visitors' experiences while visiting the Grand Canyon will be influenced by many factors related to the transportation system. The degree of crowding visitors experience while riding on the transit system and the likelihood of being able to sit while riding the transit service will contribute to their overall impression of the Grand Canyon experience.

Therefore, it would be the National Park Service's preference to have no standees at all. At the same time, planning for lower levels of crowding or higher proportions of seated passengers will require more vehicles to operate, thereby increasing capital, operating and maintenance costs. Visitor comfort standards for the transit service in Grand Canyon were established to provide a reasonable amount of space for each visitor – recognizing that some visitors will have backpacks, strollers, or recreational equipment with them – while controlling the cost of the transit system.

A variety of standards for visitor comfort are in use in the transit industry. Area per standing passenger was selected as an appropriate measure for use in estimating the capacity for standing passengers of the different transit vehicles being considered in this analysis. A floor layout for each vehicle was used to determine the number of seats and the area available for standing passengers. The standard for area per standing passenger was then used to determine how many standees could be accommodated comfortably on the vehicles.

Transit vehicle manufacturers typically express the capacity of their products using a “crush” load and a “normal” load. The crush load is literally the number of people who could crush onto the vehicle. A typical value for area per standing passenger at crush load is 1.5 square feet per passenger. This loading level is appropriate for the structural design of the vehicle and for sizing engines and braking systems, but it is not appropriate for planning. The normal load capacity typically quoted by vehicle manufacturers is based on approximately 2.5 square feet per standing passenger. This loading level results in very crowded conditions, and most planning sources recommend using a higher standard for planning service.

The *Highway Capacity Manual*, Transportation Research Board, presents standards for queuing areas (areas where people gather to wait) that can be applied to the standing area of transit vehicles. The standards are expressed for levels of service ranging from A (best) to F (worst). Level of service D is frequently used to design facilities that experience peaks of use, such as the transit system at Grand Canyon. The *Highway Capacity Manual* establishes a range of 3.0 to 7.0 square feet per standee for level of service D conditions.

The *Transit Capacity and Quality of Service Manual*, Transit Cooperative Research Program, Transportation Research Board, 1999, recommends that a minimum of 4.3 – 5.3 square feet per total passenger be used to plan bus service and a minimum of 3.2 – 5.3 square feet per total person be used to plan rail service. Seated passengers typically occupy about 4.5 square feet, so the standards expressed in this reference are consistent with the middle of the range for level of service D conditions in queuing areas. This reference recognizes that passenger demand will vary between transit trips and that individual trips would be more crowded than that average during a given time period.

The options being considered for the Grand Canyon transportation system have been planned using 3. 5 square feet per standing passenger. This value is somewhat less than that recommended in the *Transit Capacity and Quality of Service Manual*, but it is within the range of level of service D for queuing areas. It is, however, the lower limit for planning the Grand Canyon transit system.

Frequency of Service: Frequency of service is another important criterion for visitor comfort. Waiting too long at a station is inconvenient. On the other hand, having transit vehicles bunching up at the stations can be confusing and frenetic. Therefore, a standard for service frequency has also been established for the Grand Canyon transportation system.

For the "line haul" route (the subject of this report), service no less frequent than ten minutes (during the primary visitation hours) and no more frequent than two minutes is the standard applied (for routes initiating service in Tusayan). In low visitation periods in the winter, the ten-minute standard will reduce the exposure of visitors at the stations to the weather but will require that transit vehicles be operated sometimes when they are mostly empty. In the busy summer months, the two minute standard will permit time for vehicles to offload and load, giving drivers the chance to provide courteous service. There will be occasions in some options, as demand requires that service approaches the two-minute minimum standard, when two vehicles will be in the stations at the same time. The intent of the standard is to minimize this occurrence.

E TRANSIT SERVICE CONCEPTS

The transit system alternatives analyzed in this study are intended to provide the transit service envisioned in the General Management Plan (GMP). Option A accomplishes this through a reduction in visitor day-use traffic in Grand Canyon Village while Options 1-5 seek to eliminate visitor day-use traffic. All options include a line-haul transit connection operating in a loop from a parking/staging area located on National Forest System lands north of Tusayan, to Canyon View Information Plaza near Mather Point, and on to Grand Canyon Village. Supplemental parking in Grand Canyon Village was provided for buses in the GMP. Supplemental parking for automobiles is provided in Option A, but only provided for buses in some of Options1-5. The line-haul transit system would be fully accessible to people with disabilities and would comply with the Americans with Disabilities Act.

It is anticipated that the design of the parking/staging area north of Tusayan will be redesigned from the earlier light rail concept and located north of Tusayan and west of Arizona 64. Costs can be expected to be roughly comparable.

Option A assumes that both day-use and overnight visitor vehicles will park in designated locations within Grand Canyon Village.

Options 1-5 assume *only* overnight visitors in private vehicles and some commercial tour buses would travel to their overnight accommodations in Grand Canyon Village directly, parking nearby and leaving their vehicles parked for the duration of their stay at the South Rim. Overnight visitors and day visitors would be transported to features along the South Rim by a system of shuttle buses and by walking/bicycling trails. The shuttle bus system operating along the rim would be an expanded version of the existing shuttle system. For the purposes of comparing options for the line-haul transit system, it is assumed that the shuttle bus system would be the same for all options. The current shuttle system is a constant cost incorporated into each option. Operating costs for each option include operation of the shuttle bus system. The shuttle bus system would be fully accessible to people with disabilities and would comply with the Americans with Disabilities Act. The shuttle bus system would continue to operate on a

year-round basis in Grand Canyon Village while the line haul system from Tusayan could be seasonally operated.

Overnight visitors and pass-through visitors could bring their cars into the park, but pass-through visitors would only be allowed to travel between the South Rim Entrance and Desert View.

F CURRENT VISITOR TRANSPORTATION (SHUTTLE) SYSTEM

Grand Canyon National Park has operated a free seasonal shuttle bus system for visitors to the South Rim since 1974; year-round service on two of the three routes began March 10, 2000.

The *Village Route* provides year-round service to 13 stops on an 8-mile, 50-minute round trip route for motels, parking areas, Market Plaza (the *general store, post office, bank, etc.*), and other visitor facilities in the South Rim Village, from Yavapai Observation Station and the Canyon View Information Plaza to the Hermits Rest Transfer.

The *Hermits Rest Route* provides March through November service to 9 stops on a 15-mile, 90-minute round-trip route to scenic overlooks and Hermits Rest. Service is not provided during winter months due to steep roads and frequent snow and ice; private vehicles are then allowed on Hermit Road.

The *Kaibab Trail Route* provides year-round service on a 6 mile, 30-minute round trip from the Canyon View Information Plaza to the South Kaibab Trailhead and Yaki Point.

Current Government-Owned Fleet

Qty	Built	Length	Manufacturer/Model	Fuel	Comments
7	1984	25-foot	Chance AMTV RT-50	LNG	Rehab 8/99
3	1987	40-foot	GMC RTS II	Diesel	Rehab 2001
7	1989	40-foot	Carpenter RE 362	Diesel	
9	1998/99/2004	40-foot	New Flyer C40LF CNG	CNG	
10	1973/74	25-foot	Minibus MBST 4068	Trailer	Towed

The fleet is a challenge to maintain, due to the age, variety of fuel types, and different body styles.

The system is operated under a service contract. The 2004 on-site staff includes a project manager, three shift supervisors, five mechanics, forty drivers, and three bus fuelers and

cleaners. The contractor maintains and operates the transit buses, and the National Park Service reimburses the contractor for drivers and mechanics hours and repair parts.

The system provides about 4,250,000 passenger boardings per year at a rate of 7.6 passengers per mile. During peak times of the day, buses are overcrowded, and passengers must often wait at a stop through more than one bus to board.

Requests to the Recreation Fee Demonstration Program have been submitted to purchase 7 forty-foot natural gas buses and 6 sixty-foot articulated natural gas buses. If approved, this project would eliminate all diesel engines from the fleet and significantly improve system convenience for visitors.

G EXISTING INFRASTRUCTURE

The current shuttle system operates on park roads, maintained by the National Park Service. Some are closed to visitor vehicles; others are shared. The park also maintains twenty-six bus stops; nine have shade structures and the others are open air:

9	Hermits Rest Route
14	Village Route
4	Kaibab Trail Route

Under the current service contract, an NPS-owned fenced compound is assigned for exclusive use of the shuttle system contractor. It includes:

- Paved open air parking for shuttle fleet
- Two-bay maintenance garage, with storage, work and office space and restroom, recently made "natural-gas safe"

Fueling is currently provided as follows:

- Diesel is fueled at a tank farm near the maintenance garage, shared with others
- Natural gas (LNG and CNG) is provided at a new fueling facility near the diesel tanks

The NPS provides the mobile and base radio system, including separate access to the park dispatch frequency for emergencies.

III DESCRIPTION OF OPTION A

A PURPOSE

Option A has been developed as an adaptive management approach that provides a lower cost alternative to Options 1-5 and The Grand Canyon Railway (GCR) proposal. It is intended to reduce traffic congestion at the South Rim, but unlike Options 1-5 and the GCR proposal, it does *not* eliminate day-use traffic on the South Rim. Option A offers management flexibility to adjust to changing conditions and to test new concepts. For example, while the GCR proposal is not currently viable, the increased use of GCR as a means of reducing visitor day-use traffic needs further exploration. Option A could serve as an interim to future transit system solutions or it could stand alone, if successful in resolving long term needs.

B BACKGROUND

Arizona State Highway 64 provides access to the South Rim area of Grand Canyon National Park through the South Entrance, near Tusayan, AZ and through the Desert View Entrance west of Cameron, AZ. According to statistics collected by the park, about 77% of the visitors to the South Rim area in the summer enter through the South Entrance and 23% enter at Desert View. On a typically busy summer weekend day more than 6,100 visitor vehicles enter the South Rim; roughly 1,400 enter through the Desert View Entrance and 4,700 come through the South Entrance. Of those coming through the South Entrance, 3,800 vehicles consist of day-use visitors. In addition, about 150 commercial tour buses enter the South Rim on a typically busy day, with more than 2/3 of these carrying day visitors. During the morning peak arrival period, about 540 vehicles per hour come through the South Entrance, resulting in wait times at the South Entrance Station of up to an hour.

Visitors who travel into the park through the South Entrance drive along South Entrance Road, which intersects Center Road and Desert View Drive en-route to the canyon rim (see **Figures 1 and 2**). Visitors have their first opportunity to view the canyon at Mather Point. Canyon View Information Plaza (CVIP) is located within walking distance of Mather Point. This new visitor orientation facility was built without parking, anticipating the construction of a transit system that would bring all day visitors to the site from remote parking areas (as in Options 1-5).

The popular Mather Point area has about 120 parking spaces, far fewer than the number needed to meet the demand. The combination of visitors wanting to have their first view of the canyon and wanting to access the nearby CVIP results in heavy use in the area and safety concerns. Up to 480 parked vehicles were observed at one time at Mather Point and on the adjacent roadsides over the July 4th weekend in 2004. Roadside parking and heavy pedestrian traffic at Mather Point combine to create hazardous conditions on the main access route to Grand Canyon Village.

Visitation to Grand Canyon National Park and the South Rim grew rapidly during the 1980s and early 1990s. Visitation more than doubled from 1984 to 1993, reaching a peak of about 4.9 million. Meanwhile, facilities for visitors remained essentially unchanged, resulting in crowding and congestion. The demand for parking is significantly greater than the supply throughout the South Rim area. Parking demand exceeds the available supply by more than 500 spaces,

resulting in visitor parking in inappropriate and unsafe locations, such as roadsides. Much of the parking overflow occurs near Mather Point early in the day. Later in the day it is estimated that most of the excess parking demand occurs in the Village.

Although the rapid growth in visitation to Grand Canyon did not continue through the 1990s, recent statistics for 2003 and 2004 approximate a high visitation mark achieved in 1999, which suggests that visitation growth can be expected to occur in the future.

Option A proposes a solution to address the traffic problems at Mather Point in addition to reducing day visitor traffic entering the South Entrance and accessing Grand Canyon Village by 15-25%.

1 Introduction

Option A includes two new parking areas, one inside the park near Canyon View Information Plaza (CVIP) and one south (outside of the park) at Long Jim Canyon (LJC); an expansion of the existing bus transit system; a bypass lane at the South Entrance Station for transit; and a new bus operations and maintenance facility. The new facilities combined with the expanded transit service and active traffic management would result in a reduction of day visitor traffic on the South Rim of 15-25% during peak visitation periods.

Near CVIP, a new parking lot for approximately 470 vehicles would primarily serve visitors wanting to access Canyon View Information Plaza and Mather Point. Under this option, the Mather Point area would be closed to vehicular traffic and the roadway and parking areas, including the existing parking lot near Mather Point would be removed and restored. Visitors wanting to access Mather Point would be expected to park at CVIP, or access the area by transit from other locations. A new road alignment would bypass Mather Point, accommodating through traffic to Grand Canyon Village without crossing the pedestrian route between CVIP and Mather Point.

A 450 space parking lot at Long Jim Canyon would serve as a staging area for visitors who prefer to ride the bus transit system into the park. Visitors who park in this lot would also avoid long waits at the South Entrance Station during peak visitation periods.

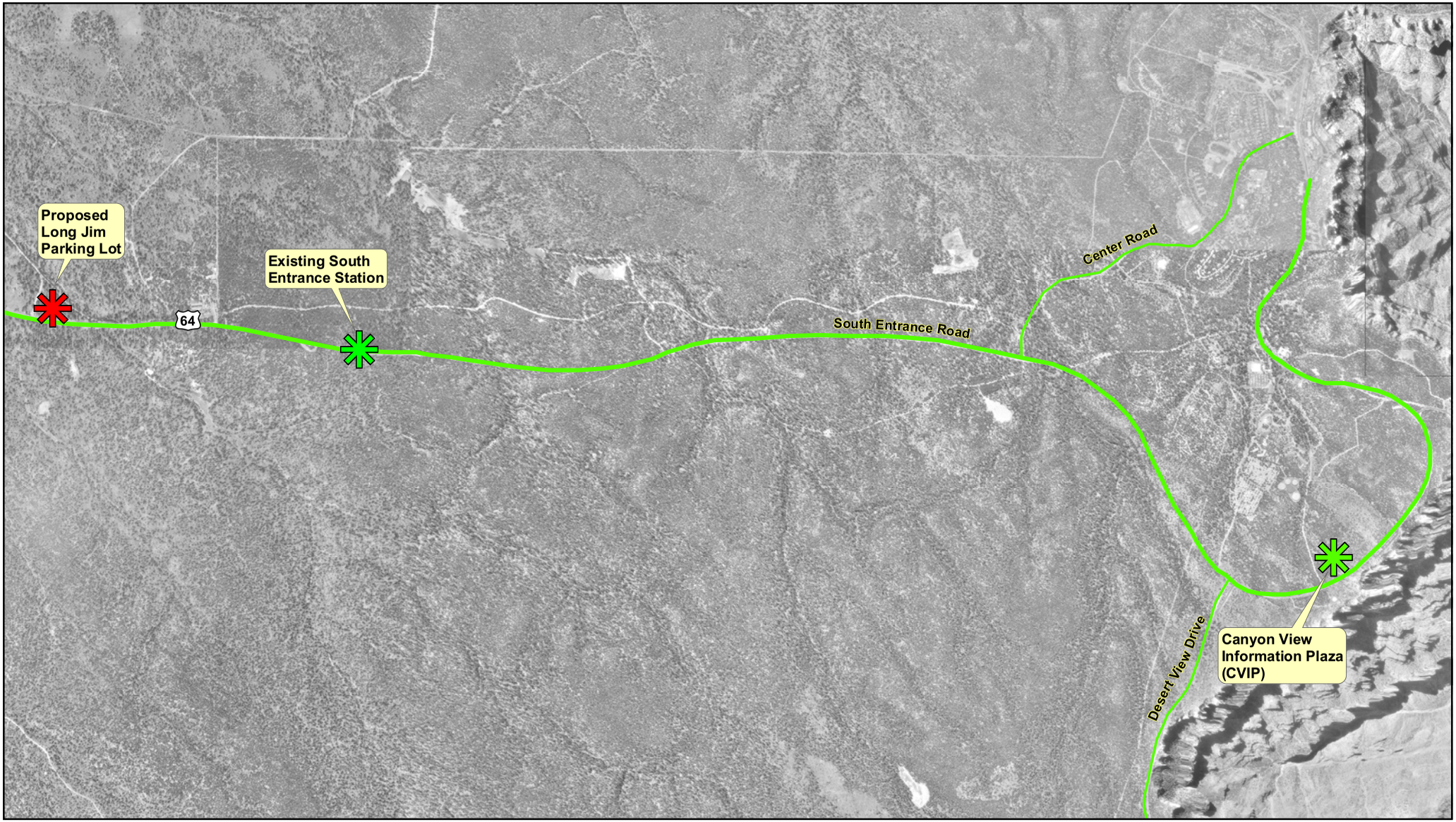
Details follow for each of the elements of this option, along with descriptions of costs and funding strategies.

2 Assumptions

Assumptions - In doing any analysis, basic assumptions are made to model actual conditions and achieve desired results. The original 5 options for transit in this report have assumptions that are substantially different from Option A. There are four important areas where the assumptions differ between the options. The following categorizes and briefly summarizes these.

Congestion Reduction:

- Options 1-5 assume 100% elimination of day-use traffic in Grand Canyon Village.



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Kilometers
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Miles
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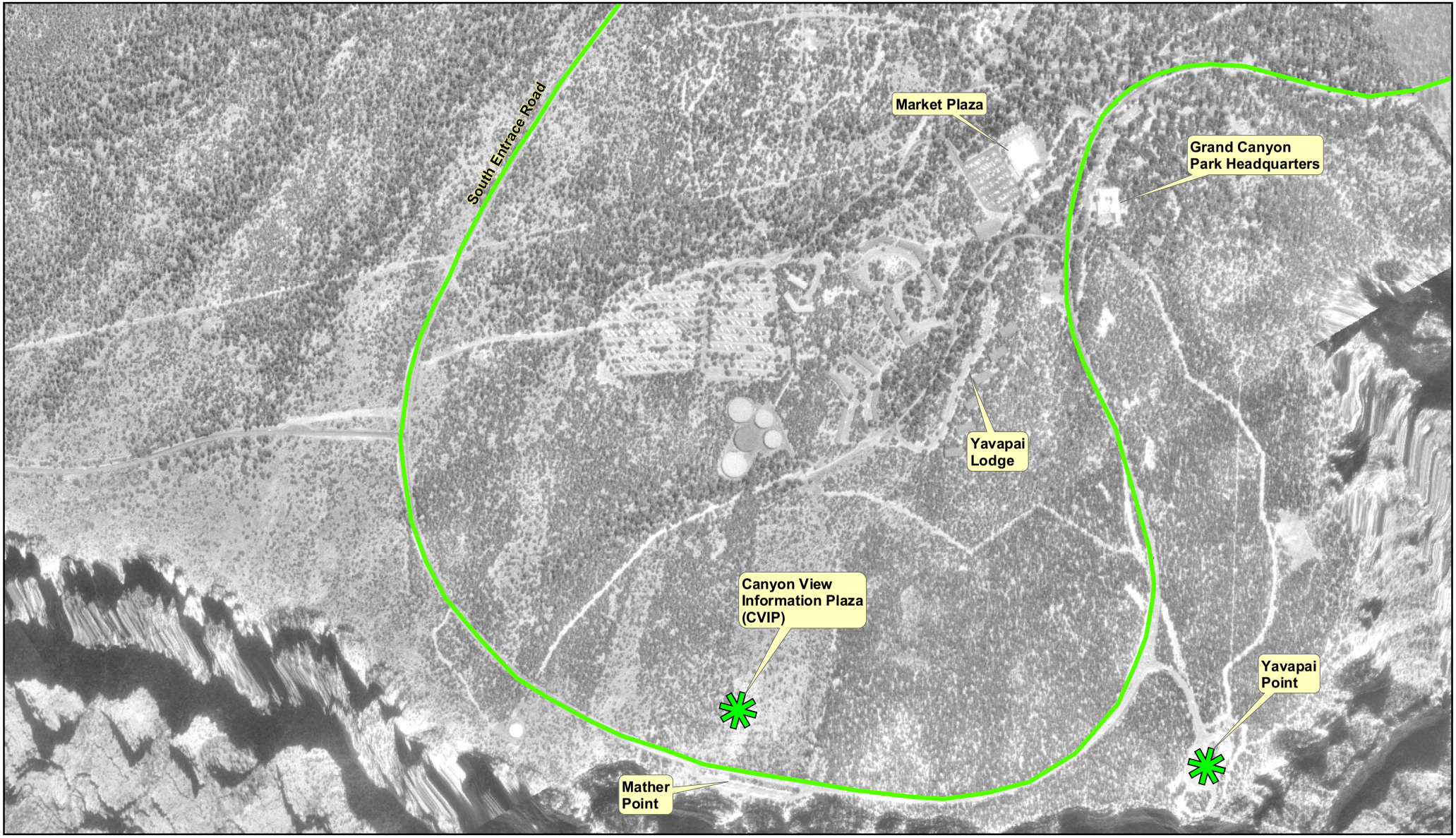
October 2004

Grand Canyon National Park

Project Areas

Figure 1



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N

0 200 400 Meters

0 600 1,200 Feet

October 2004

Grand Canyon National Park

Canyon View Area

Figure 2

- Option A assumes 15-25% reduction in traffic in Grand Canyon Village and targeted improvements at the Mather Point parking area.

Visitor Use Requirement:

- Transit system use under Options 1-5 is mandatory.
- Transit system use under Option A is voluntary.

Capital Costs:

- Under Options 1-5, initial system implementation costs rely primarily on new Congressional appropriations.
- Under Option A, initial implementation will be funded primarily through a combination of existing authorized fund sources (Fee Demo, Federal Lands Highway Program, and Line Item Construction).

Operating Costs:

- Options 1-5 funds operating costs are through 100% user fees. Park pass holders would be charged an additional fee to use the system.
- Option A funds system operations through a base operating subsidy along with a user fee. Park passes are accepted for use of the system with no additional fee required.

Although assumptions have been altered, Option A shares with Options 1-5 the intent of helping achieve the park's basic transit goals: provide a better quality visitor experience; ensure visitor safety; relieve traffic congestion; and utilize Canyon View Information Plaza to its full potential.

3 Levels of Analysis

The levels of analysis used for Options 1-5 vary considerably from the level of analysis used for Option A. The differences, the reasons for them and the impact they have on future implementation actions follow.

Options 1-5 were developed within the context of preparing a prospectus to be used to solicit actual transit services. This requires a high degree of design detail and rigorous analysis. Design development level drawings were prepared for the light rail prospectus in 2000. The design of Grand Canyon Transit Center from that prospectus was used, with variations as appropriate for each of Options 1-5. Option A was prepared without intent to generate procurement documents and therefore the level of analysis was commensurate with a less detailed, planning level document. For example, financial consultants were utilized to prepare the financial analysis of Options 1-5, but were not used for Option A. Because of this difference, cost estimates are likely to have a greater degree of accuracy with Options 1-5 than with Option A.

If NPS determines to move forward with Option A, additional analysis will be required.

C ELEMENTS OF OPTION A

1 Transit Routes and Service

A new transit route would be operated to provide bus transit service from a staging area at Long Jim Canyon (LJC) to Canyon View Information Plaza (CVIP). The route would use a new roadway (or bypass lane) west of Arizona 64, which would be constructed from LJC to an area

about a quarter mile north of the South Entrance Station, where the route would converge with Arizona 64 (South Entrance Road). Buses would proceed to CVIP, unload / load and return to LJC along the same route. (see **Figure 3**)

During peak times buses would depart every 8 to 9 minutes. Initially, this service would need to operate from Memorial Day to Labor Day. The operating season would expand with visitation growth. Transit service has been designed to be expandable to meet expected growth needs. In 2026 the operating season would need to extend from late March through early October.

Existing transit service would be expanded from CVIP to the Village to accommodate all of the riders who would arrive from LJC on buses, plus a share of the visitors who would park at CVIP. During peak times shuttle service along the Village Route would increase, with departures occurring every 6 minutes. (Buses currently operate every 15 minutes). During seasons of low visitation, when the route between LJC and CVIP is not operating, additional service would still be provided, but only to the extent needed to accommodate visitors parking at CVIP and using the Village transit service. An extra one to two trips per hour on the Village shuttle route would be required.

2 Transit Vehicles

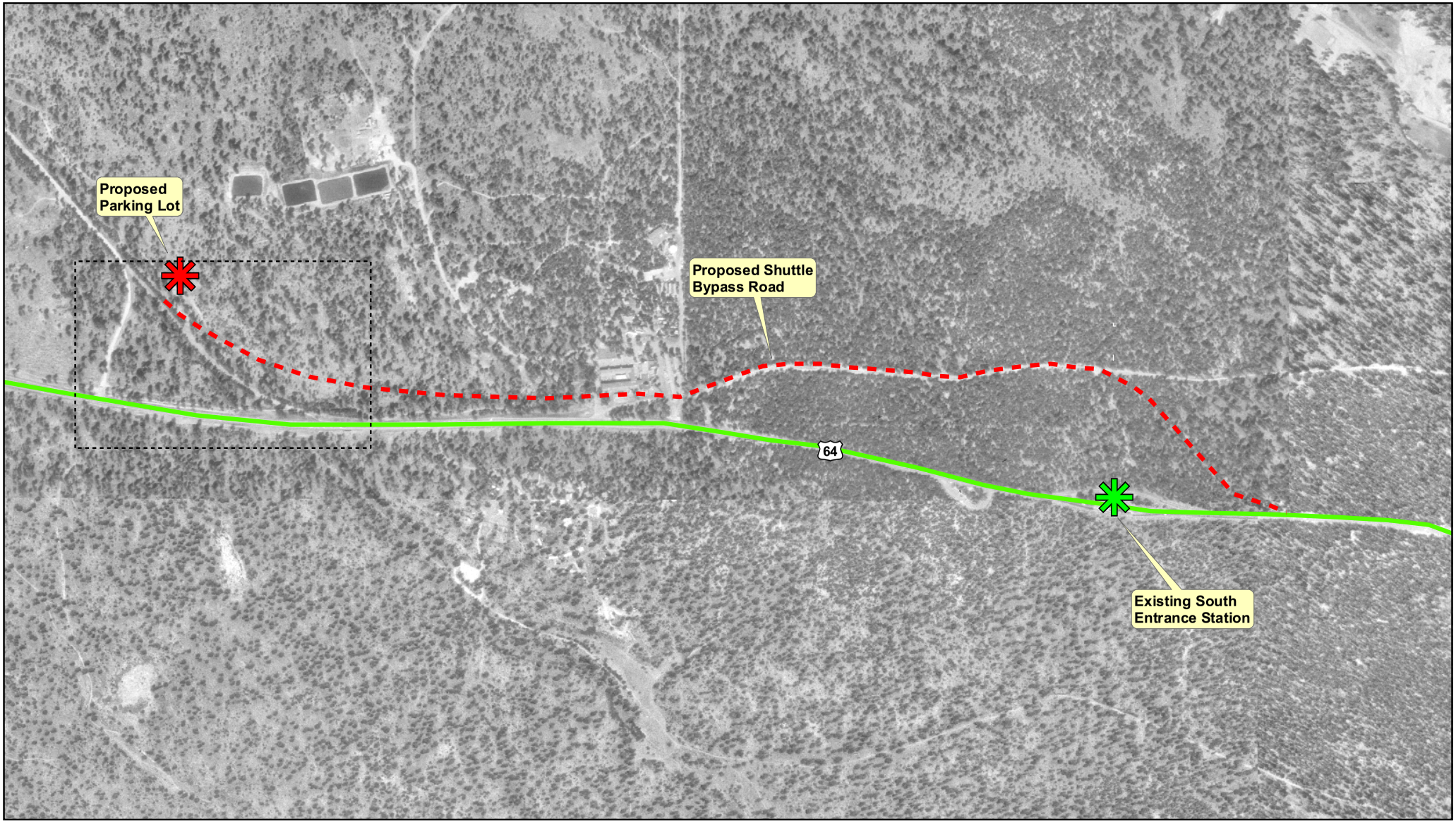
Initially five (5) new 40-foot buses would be required for the LJC to CVIP route and seven (7) new articulated buses would be required for the expanded CVIP to Village route service. All new vehicles would be low-floor (universally accessible), alternatively fueled vehicles. The fleet required would increase with visitation over time. In 2026 the total fleet requirements would be seven (7) 40-foor buses for the LJC to CVIP route and nine (9) articulated buses for the Village route.

3 Parking and Traffic Management

Providing a parking lot at CVIP and eliminating all vehicular traffic at Mather Point would eliminate vehicle / pedestrian conflicts near Mather Point. However, without additional parking (at LJC) and increased transit service, only a very small percentage of traffic would be reduced on the South Rim. Providing parking at both CVIP and LJC with transit service would result in day visitor traffic reductions of 15-25% on South Rim roadways, with the greatest reduction occurring in Grand Canyon Village.

Active traffic management would be required to achieve these traffic reductions and improve visitor experience. Option A improves upon but continues the current system of scattered parking areas for day visitors. For the new facilities to be effective, visitors will need information on how to reach available parking lots. Ideally, visitors would be informed in advance, or in ‘real time’ when individual lots were full, avoiding unnecessary travel and frustration associated with searching for available parking in the scattered lots.

Active traffic management strategies include marketing and internet access, trip planning media, video monitoring of parking lots, variable message signs at key locations, and possibly other



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N

Meters
0 200 400

Feet
0 600 1,200

October 2004

Grand Canyon National Park

Long Jim Canyon Project Area

Figure 3

methods. More study on these strategies is needed to determine the most effective means for the South Rim.

4 Stations / Parking Areas

(a) Long Jim Canyon

A new parking area for approximately 450 vehicles would be developed on Forest Service land near Long Jim Canyon, south of the South Entrance Station. The development would be located on the west side of Long Jim Canyon. The LJC facility would include a shuttle bus access road and bus loading area, a concrete plaza and shade shelters, site amenities, a restroom, a walk-up ranger / entrance station (for fee payment and information), and orientation waysides. This component also includes improvements at the intersection of the parking lot access road with Arizona 64. An area of approximately 8.5 acres would be needed for this development.

(b) Canyon View Information Plaza and Mather Point

A new parking area for approximately 470 vehicles (including 20 tour buses) would be developed near Canyon View Information Plaza (CVIP). Buses from LJC would enter the site at the existing access from the South Entrance Road and would unload / load passengers at the existing transit pavilion. The parking area would include pedestrian walkways, lighting, wayfinding and landscaping. Approximately 7 acres southeast of CVIP would be needed for this development.

The parking lot at Mather Point would be removed, as would portions of the South Entrance Road along either side of Mather Point. Improvements would be made to accommodate pedestrians and small shuttle buses for those unable to walk a quarter mile from CVIP. Site restoration would occur in areas where paving would be removed.

Through traffic would be rerouted on a new connector road that would bypass Mather Point and provide visitor access to CVIP. This new road would connect with the existing South Entrance road some distance east of the Yavapai Point access road.

5 Transit System Operations and Maintenance Facility

A new operations and maintenance facility would be implemented to accommodate administrative facilities, vehicle storage, and routine maintenance activities. The facility would be located on Forest Service land just south of the South Entrance Station and would include administrative offices, driver break and locker rooms, maintenance bays, a vehicle wash and utilities. A storage yard would also be included for staging buses overnight and in the off season. Bus fueling would still occur within the park, at the existing bulk fueling facility.

D IMPLICATIONS OF OPTION A

1 Cost

Cost estimates were developed by NPS and our transportation consultant, David Evans and Associates. The following table presents the estimated initial capital investment, operating expenses and life cycle costs for the system. For comparative purposes to Options 1-5, costs are provided in 2003 dollars and are not inflated or adjusted to year of expenditure. Note that Operation and Maintenance Costs include costs for the *expanded portion* of the bus transit system only; Operation and Maintenance Costs for the existing bus transit system are *not* shown here, as is consistent with other options in this report.

Exhibit 1 - Estimated Initial Investment, Life Cycle Costs, and Operating Expenses (2006 – 2026) in 2003 dollars

Initial Investment 2006 - 2010			Life Cycle Cost 2010 - 2026			O & M Expenses 2006 - 2026	Avg Annual O & M Expense
Real Property	Personal Property	Total	Real Property	Personal Property	Total		
$39,500,000	$6,500,000	$46,000,000	$7,900,000	$10,350,000	$18,250,000	$33,525,000	$1,752,000

Definitions of Terms:
(1)Real Property: land and improvements that are affixed to the land, such as buildings, tracks, and other permanent structures.
(2)Personal Property: assets that are not affixed to the land, such as rolling stock and equipment.
(3)Life Cycle Costs: the ongoing capital costs of a given transit system after initial development, including substantial real property refurbishment and replacement of rolling stock. Please note that this is not the standard definition of life cycle cost that is typically used in the context of analyzing economic investment alternatives.
(4)Operation and Maintenance: day to day system operations, including labor and personnel necessary to maintain and operate the system; also includes fuel and routine maintenance.
(5)*Average Annual Operating Expense*: day to day system operations, as described above, on a yearly basis. Note: Annual Operating Expenses shown here do not include yearly amortized life cycle costs, however, amortized life cycle costs are included in the transit fees, shown below.

2 Performance

Providing 450-space parking lots at both Long Jim Canyon and at CVIP (with 20 additional spaces for tour buses at CVIP), would result in a diversion of about 23% of day visitors to the Village to transit assuming minimal traffic management and visitors' willingness to ride the shuttles. About 18% of day visitors would be diverted to LJC and about 5% of day visitors would be diverted to parking at CVIP. Active traffic management at the LJC lot could increase the diversion to near 30%. With the combined facilities in place, traffic into the Village would not be expected to return to current levels until 2025, or later if more active traffic and parking management was undertaken.

With the addition of the CVIP and LJC parking lots, peak parking demand in the Village would decrease to about 1,260 spaces, compared to an estimated demand of nearly 1,890 spaces today. The estimated supply of parking in the Village in areas appropriate for day visitor use, today, is 1,392 spaces, resulting in a shortage of about 500 spaces. With the implementation of CVIP and LJC lots a severe parking shortfall would be converted to a small parking surplus. Visitation growth is estimated to consume the surplus parking between 2006 and 2009, but the shortfall

would be far less than the existing. If minimal traffic management continued through 2026 and additional facilities or services were implemented, a shortfall of about 360 parking spaces for day visitors would exist in Grand Canyon Village.

3 Park Operations – Staffing

The expanded service would require adding transit operators, maintenance staff and additional supervision to the existing operations. The costs associated with additional transit system staff are included in operations and maintenance costs shown above in Exhibit 1. Additional park staff may be required to manage an expanded system, and depending on the traffic management strategy used, additional park (or transit operator) staff would be needed to coordinate information updates and dissemination and, possibly, to direct visitors to available parking areas. Additional fee staff would be required at LJC and additional interpretive staff would be required at both LJC and CVIP. Four to eight new positions total would be required during peak summer months.

E FINANCIAL ANALYSIS FOR OPTION A

The NPS is proposing a combination of funding sources to support the Option A transit system, as follows:

- NPS "equity" (NPS contributions from the Recreational Fee Demonstration Program [Fee Demo] or other NPS controlled sources)
- Increases to Park Base Funding

A description of each funding alternative is provided below.

1 NPS "Equity" Funds

NPS equity funds are those dollars provided by the National Park Service through discretionary accounts – existing programs such as Recreational Fee Demonstration Program (Fee Demo), Line Item Construction, Federal Lands Highway Program or Transit Fees collected through the entrance fee. The advantages of using these sources include immediate availability (with Fee Demo) and zero cost of capital; disadvantages include fluctuations in revenue, and uncertainty of reauthorization of Fee Demo.

2 Increases to Park Base Funding

A portion of the existing transit system is currently funded out of park base funds. Increases to the park base account could be used to offset additional costs to operate and maintain the expanded transit service proposed under Option A. Funds could also be used to cover salaries of additional NPS staff needed to support the new transit system.

Advantages

- A fixed amount covered through base funds would not be subject to fluctuations in visitation or in numbers of visitors who pay the entrance fee

Disadvantages

- Base funds used for the existing transit system have been assessed to cover budget shortfalls, requiring increasing dependence on gate fees to fund the system.

F TRANSIT FEE PAYMENT

The number of visitors who pay a transit fee is an important factor in this analysis because it represents the population that will bear the cost of the system. Fee payment is not directly linked to transit ridership; all South Rim visitors who currently pay an entrance fee, will pay the transit fee. The larger the number of paying visitors, the lower the per person charge. The fee payment scenario for Option A follows.

Fee Payment Scenario – Option A

• All visitors who currently pay an entrance fee will pay the transit fee. Passes are honoured for transit fees.
• Estimated to be 50 percent of total south rim recreation visitors
  ▪ Park estimates indicate that at least 50 percent of visitors currently use a pass.
  ▪ Minors under the age of 17 do not pay an entry fee at this time. The park does not have an estimate of the number of minors visiting the park. To the extent visitors are under the age of 17, the quantity of fee-paying visitors would be reduced.

Grand Canyon along with other parks will likely raise its entrance fee to $25. If the National Parks Pass continues to be sold for $50, more and more visitors will likely buy passes instead of paying an entrance fee. Under the scenario presented above, our assumption is that the transit fee would be included in the total entrance fee of $25. At some point in the future this transit system fee payment scenario may have to be adapted (such as assessing a separate transit fee to all visitors, regardless of whether or not they have a pass), in order to keep the system fully operational.

G FUNDING SCENARIOS

As shown in *Exhibit 1*, the implementation costs for Option A are $46 million for construction and equipment plus an additional annual operations and maintenance cost of approximately $1.8 million. One of many possible scenarios for funding capital costs is as follows (see Option A Appendix for a detailed cash flow analysis):

- $20 million would be available from park transit and entrance fee revenues FY 06-09;
- $10 million would be made available from deferring currently approved and scheduled Fee Demo projects;
- $16 million (35%) would be come from Federal Lands Highway Program and Line Item Construction appropriations.

The viability of Option A rests upon several critical assumptions:

- That the Fee Demonstration Program will be reauthorized and the current distribution formulas will remain unchanged.
- That the park's visitation will remain relatively constant.
- That an increase in fees will be approved for FY06 resulting in a per vehicle fee of $25 for which $10 will be for transportation (also called "transit fee").
- That the proportion of passes used for park entrance will not significantly increase.
- That all visitors who currently pay an entrance fee will pay the transit fee; pass holders will not be expected to pay a separate transit fee.
- That the park will receive about $16 million adjusted for inflation in Federal Lands Highway Program or Line Item Construction Program funds during the construction period.
- That the park will receive approval to defer about $10 million in previously approved and scheduled Fee Demonstration projects. The park proposes to defer projects such as the relocation of the power substation, rehabilitation of the park's headquarters building, and rehabilitation of roads and pullouts in Mather Campground.
- That the establishment of an equipment replacement fund for transit can be deferred until completion of construction.
- That base increases will be available to defray the increases in operations and maintenance costs that will occur over time.
- That cost estimates provided by the park and David Evans and Associates are reasonably accurate.

The table below provides suggested requirements for construction capital by fiscal year and fund source. For comparative purposes to Options 1-5, costs are provided in 2003 dollars and are not inflated or adjusted to year of expenditure.

	FY05	FY06	FY07	FY08	FY09	Total
Option A Total Costs by Fund Source and Fiscal Year of Expenditure	**1,000,000**	**18,000,000**	**8,000,000**	**12,000,000**	**7,000,000**	**46,000,000**
Funded from fee cash flow - $20 million	0	5,000,000	5,000,000	5,000,000	5,000,000	20,000,000
Funded from deferred projects - $10 million	1,000,000	9,000,000	0	0	0	10,000,000
Funded from FLHP - $11.4 million	0	4,000,000	3,000,000	2,400,000	2,000,000	11,400,000
Funded from LIC - $4.6 mill	0	0	0	4,600,000	0	4,600,000

This table presumes an implementation sequence as follows:
FY05: Planning, compliance, design
FY06: Construction of CVIP parking and bypass road, replace old buses
FY07: Construction of LJC parking and ITS
FY08: Construction of maintenance facility and bus purchase
FY09: Complete bus acquisition

The park estimates that the implementation of Option A will increase annual operational and maintenance costs by approximately $1.8 million.[1] This increase is due to the expansion of

[1] Current annual operational and maintenance costs for the park's existing transportation system are about $3.6 million, which are funded from a combination of base funds ($1.5 million) and transit fees.

transit service, including increased labor and maintenance costs for additional buses, increased fuel costs, and increased labor costs for the active management of visitor circulation and parking. Option A proposes OFS base increases of $500,000 in each of FY06 and FY09, with the balance of operational cost increases being absorbed by the park's transit fees.

As described above, Option A provides for immediate action to relieve the park's most pressing transportation concerns (CVIP and Mather Point parking) using resources now available to the park. Full implementation will require about $16 million in assistance, which we believe is a more realistic figure and significantly less than the support required for Options 1-5. While reducing the amount of money the park has available for other fee demonstration projects by more than half, we anticipate that the park will still be able to proceed with its most critical infrastructure backlog projects, which have been planned for Fee Demonstration funding.

Option A Appendix

Cash Flow Analysis for FY 05-09

Table 1 - Grand Canyon Projected Fee Program for Option A

Revenue	2005	2006	2007	2008	2009
Entrance Fees	9,022,900	7,852,257	7,852,257	7,852,257	7,852,257
NPP	1,923,924	1,923,924	1,923,924	1,923,924	1,923,924
Park Specific Passes	12,058	12,058	12,058	12,058	12,058
Golden Age & Eagle	370,887	370,887	370,887	370,887	370,887
User Fees	2,462,811	2,462,811	2,462,811	2,462,811	2,462,811
Commercial Tour Fees	5,021,624	5,021,624	5,021,624	5,021,624	5,021,624
Transportation Fees	1,446,776	5,234,838	5,234,838	5,234,838	5,234,838
Total	20,260,981	22,878,400	22,878,399	22,878,399	22,878,399
Park Retained Funds (100%)	1,446,776	5,234,838	5,234,838	5,234,838	5,234,838
Park Retained Funds (80%)	13,512,224	12,575,710	12,575,710	12,575,710	12,575,710
Park Retained Funds (70%)	1,346,747	1,346,747	1,346,747	1,346,747	1,346,747
Note -WASO Funds (20%)	0	0	0	0	0
Note -WASO Funds (30%)	0	0	0	0	0
Note -NPF (15%)	0	0	0	0	0
Total Funds Allocated to Park	16,305,748	19,157,295	19,157,294	19,157,294	19,157,294

Required and Fixed Expenses

Annual O&M (existing and expanded system)	3,692,850	5,492,850	5,492,850	5,492,850	5,492,850
Less Base ONPS funds used for O&M	-1,550,000	-2,050,000	-2,050,000	-2,050,000	-2,550,000
Total Transportation Cost	2,142,850	3,442,850	3,442,850	3,442,850	2,942,850
Required Ongoing fee demo projects					
Cost of Collections	2,784,474	2,784,474	2,784,474	2,784,474	2,784,474
Cost Recovery - Backcountry Operations	683,659	683,659	683,659	683,659	683,659
Project management	631,740	631,740	631,740	631,740	631,740
2005 Required expenses - Narrowband radios $4,115,000 Overflights $2,435,500	6,550,500	0	0	0	0
Total Required and Fixed Expenses	12,793,223	7,542,723	7,542,723	7,542,723	7,042,723

	FY05	FY06	FY07	FY08	FY09	Total
Option A in constant 2003 dollars without adjustment by year or inflation	1,000,000	18,000,000	8,000,000	12,000,000	7,000,000	46,000,000
Funded from fee cash flow - $20 million	0	5,000,000	5,000,000	5,000,000	5,000,000	20,000,000
Funded from deferred projects - $10 million	1,000,000	9,000,000	0	0	0	10,000,000
Funded from FLHP - $11.4 million	0	4,000,000	3,000,000	2,400,000	2,000,000	11,400,000
Funded from LIC - $4.6 mill	0	0	0	4,600,000	0	4,600,000
Available for other Fee Demo Projects	3,512,525	6,614,572	6,614,571	6,614,571	7,114,571	30,470,811

Assumptions and notes:

- Fee Demo is only authorized until December 31, 2005.
- Annual Inflation Factors have not been applied - dollars are constant
- For 2005 the Transportation Fee will be $3.25 and Entrance Fee $16.75
- For 2006 - 2009 the fees will be increase to Transportation fee $10.00 and Entrance fee $15.00
- Current annual O&M costs are $3,692,850 are assumed to increase by 1.8 million for the expanded system
- Base ONPS funds will continue to be used for O&M.

IV DESCRIPTIONS OF OPTIONS 1-5

A INTRODUCTION

Five basic options for line-haul transit service between Grand Canyon Transit Center (Tusayan), Canyon View Information Plaza and Grand Canyon Village, were analyzed in this Report. Three of the basic options use buses to transport visitors along the route. One option uses rail transit, the same technology proposed in the prospectus for a concession contract to provide a transit system at the South Rim and one option assumes a phased development beginning with buses and transitioning to light rail transit as visitation and the demand on the system increases. Each of the basic options assumes a route for the transit service and a traffic management policy for day visitor vehicles traveling into the South Rim area. A range of energy sources is considered in the options, including overhead electric lines. Using electric power for the transit system would require the construction of a new electric transmission line to the park (please see a discussion of on-site power generation options in Appendix E). The following table summarizes the general characteristics of the transit system options.

Option	Transit Route	Traffic Management	Vehicle Type	Energy Source
Option 1	Uses existing roads	Commercial tour buses and shuttles from Tusayan drive into park	Articulated transit buses	Compressed natural gas, diesel, or diesel/CNG electric hybrid
Option 2	Uses new route parallel to AZ 64, existing roads from CVIP to Village, and a new road from Maswik to Market Plaza	Commercial tour buses and shuttles from Tusayan drive into park	Civis advanced design buses	Compressed natural gas, diesel, or diesel/CNG electric hybrid
Option 3	Uses new route following proposed rail transit line	All day visitors board transit line at Grand Canyon Transit Center	GLT advanced design buses	Overhead electric lines
Option 4	Phase 1 same as Option 1, except new road from Maswik to Market Plaza Drive; Phase 2 route along proposed rail transit line	Phase 1: Commercial tour buses and private vehicles enter park up to capacity of defined parking areas; Phase 2: Same as Option 5	Phase 1: articulated transit buses; Phase 2: rail transit	Compressed natural gas (if available), diesel, or diesel/CNG electric hybrid (both buses and rail vehicles)
Option 5	Uses proposed rail transit route	All day visitors board transit line at Grand Canyon Transit Center	Two considered: A) Internal combustion or hybrid electric B) Electric light rail vehicles	A) diesel (or alternative) B) overhead electric lines

The following section provides a more detailed description of the options and diagrams of the routes and stations for each option.

B OPTIONS

Five primary options were analyzed in this study. This section describes the distinguishing features of the options. The options have been designed to meet projected visitor demand in the year 2026. Some options have the capacity to serve greater numbers of visitors and others do not (see chapter IV IMPLICATIONS OF OPTIONS, section B PERFORMANCE for details on capacity).

The line-haul transit system is intended to carry large numbers of day visitors into and out of Grand Canyon Village and to transport visitors between two stations inside the park. The local routes would distribute day visitors and overnight visitors to scattered features along the canyon rim. Several shuttle bus routes would be operated, with transfers provided among the shuttle routes and the line-haul transit service at Canyon View Information Plaza and in the village. All of the options also include construction of a parking facility and transit center north of Tusayan. This facility is called Grand Canyon Transit Center. The size of the parking lots would vary among the options along with the types of vehicles that would use the lot.

Each of the options has been defined to provide attractive and convenient transit service to and from the South Rim. Transit vehicles would leave each of the stations in the system every 10 minutes or more frequently during the primary visitation hours (mid morning to after sunset). Service would be provided every 30 minutes or more frequently in the early morning and late evening. Special service would be provided for trail users starting hikes into the canyon prior to sunrise.

All of the options assume that the transit system would operate on a year-round basis. The transit service would be adjusted during the year to serve lower numbers of visitors in the spring, fall, and winter. Seasonal variations are possible and are discussed at the end of this section.

Maps illustrating the Overall Site Plan and site plans for Canyon View Information Plaza, the Village, and the Grand Canyon Transit Center near Tusayan follow each option description.

OPTION 1 – BUS SERVICE ON EXISTING ROADS

a Transit Routes and Service

Two transit routes would be operated in this option.

One route would travel from the Grand Canyon National Park Airport, through Tusayan and on to the Canyon View Information Plaza (CVIP) using existing roads.

The second route would start at Grand Canyon Transit Center, north of Tusayan. Buses would travel northwest along Long Jim Canyon for a short distance before entering Arizona 64 at a new roundabout intersection.

Buses would depart CVIP and travel through the Yavapai Lodge area and would proceed along South Village Loop Road to a station near a proposed interpretive facility in the Powerhouse. Buses would proceed from the Powerhouse station to the Backcountry

Information Center, where they would stop before turning back to the east. Buses would travel along the South Village Loop Road to Center Road. The buses would use Center Road to travel to Arizona 64, where they would turn south and return to Tusayan.

Transit buses would arrive at CVIP, the Powerhouse and Backcountry Information Center every two to three minutes during busy times. The service provided from Grand Canyon Transit Center would be much more frequent than the service from Tusayan and the airport.

b Transit Vehicles

Articulated buses with internal combustion engines would be used to provide the transit service on the line-haul transit system. A fleet of 25 buses would be needed to serve the projected demand in 2025.

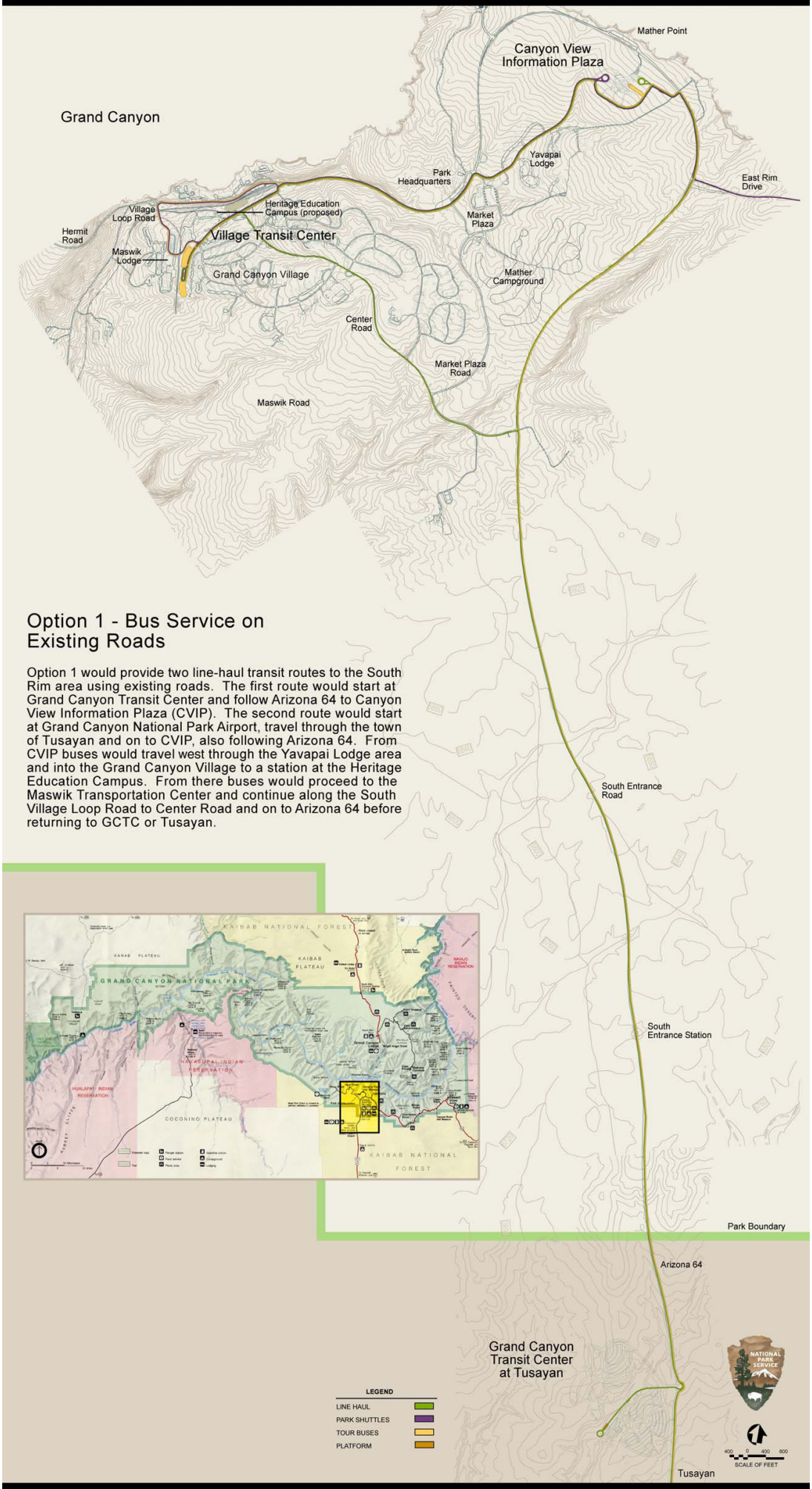
c Parking and Traffic Management

Commercial tour buses carrying day visitors would enter the park at the South Entrance or the East Entrance and continue into the South Rim area in this option. The tour buses would use the parking that has recently been constructed at CVIP and other existing parking areas at scattered sites in the South Rim area. A reservation system or other traffic management techniques would be implemented if needed to prevent tour bus congestion and overflow parking. Day visitors traveling in private vehicles, including visitors who spend the night at accommodations in and near Tusayan, would park in lots in Tusayan or at Grand Canyon Transit Center. Approximately 500 parking spaces are assumed to be available in Tusayan and at the airport. About 2,235 parking spaces for private vehicles, including RVs, would be provided at Grand Canyon Transit Center.

d Stations

(1) Grand Canyon Transit Center

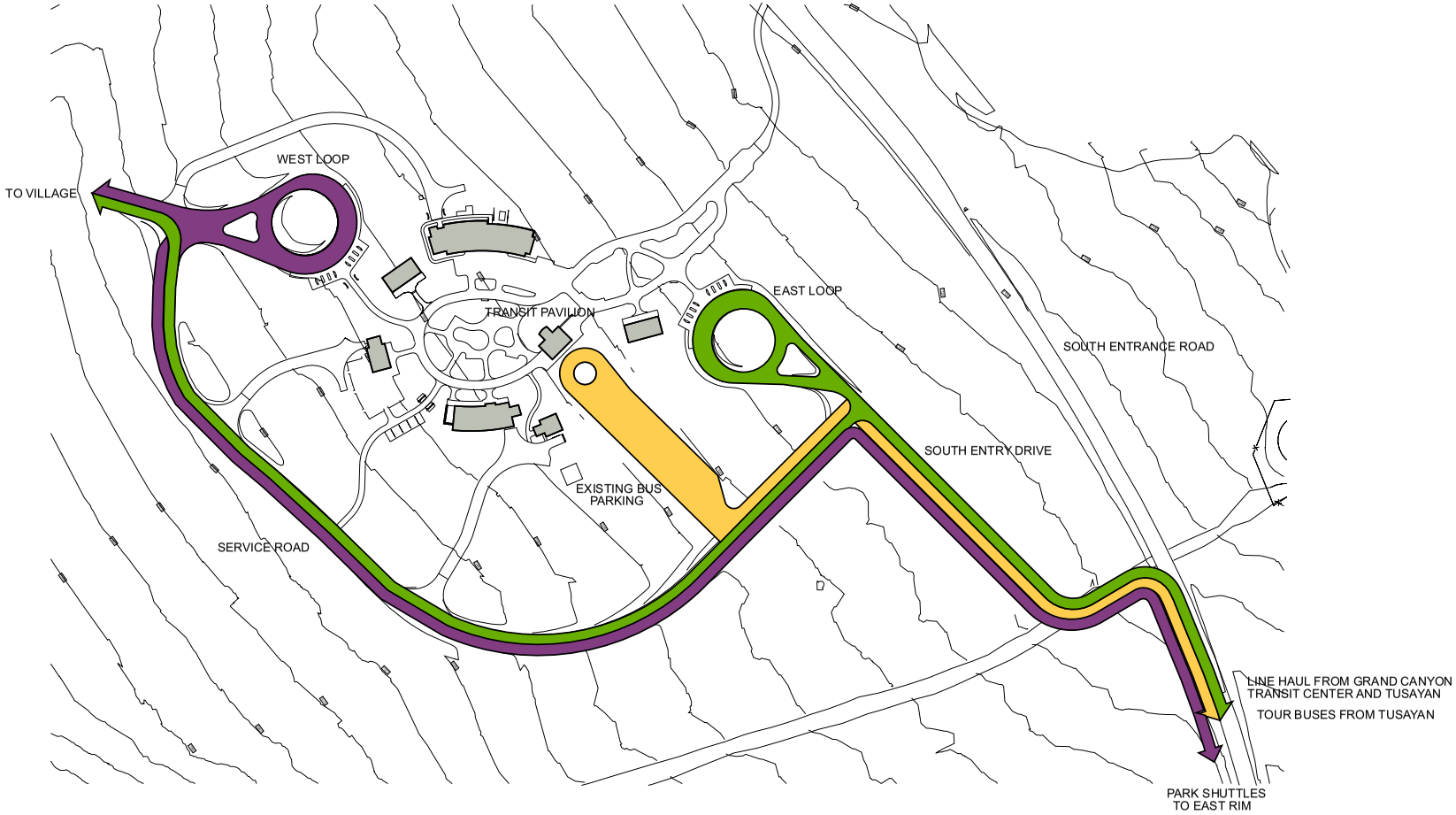
Line-haul buses would enter the Grand Canyon Transit Center at a new roundabout intersection on Arizona 64 and would follow the alignment of an existing road that leads into Long Jim Canyon to the new station. The buses would unload at the western platform and then turn around the loop and proceed to the eastern platform to load. Bus drivers would wait for their scheduled departure time, if necessary, in the turnaround loop. Day use car and RV parking would be located on both the east and west sides of Long Jim Canyon while tour buses would bypass the Transit Center and enter the park.



Option 1 - Bus Service on Existing Roads

Option 1 would provide two line-haul transit routes to the South Rim area using existing roads. The first route would start at Grand Canyon Transit Center and follow Arizona 64 to Canyon View Information Plaza (CVIP). The second route would start at Grand Canyon National Park Airport, travel through the town of Tusayan and on to CVIP, also following Arizona 64. From CVIP buses would travel west through the Yavapai Lodge area and into the Grand Canyon Village to a station at the Heritage Education Campus. From there buses would proceed to the Maswik Transportation Center and continue along the South Village Loop Road to Center Road and on to Arizona 64 before returning to GCTC or Tusayan.

Grand Canyon National Park
Transportation Alternatives



LEGEND

LINE HAUL	
PARK SHUTTLES	
TOUR BUSES	
PLATFORM	

DESIGNED:	SUB SHEET NO.	TITLE OF SHEET	DRAWING NO.
OVERLAND CADD OVERLAND	C1	CVIP OPTION 1	PKG. NO. GRCA DS 96A
TECH. REVIEW:		GRAND CANYON NATIONAL PARK BUS AND LIGHT RAIL TRANSIT SYSTEM	SHEET OF
DATE: 6/1/01			

LEGEND

- LINE HAUL
- PARK SHUTTLES
- TOUR BUSES
- PLATFORM
- OVERNIGHT GUEST PARKING

DESIGNED:	SUB SHEET NO.	TITLE OF SHEET	DRAWING NO.
OVERLAND CADD OVERLAND	V1	VILLAGE OPTION 1	PKG. NO. GRCA DS 96A
TECH. REVIEW:		GRAND CANYON NATIONAL PARK BUS AND LIGHT RAIL TRANSIT SYSTEM	SHEET ____ OF ____
DATE: 6/1/01			

LEGEND

- LINE HAUL (GCTC)
- LINE HAUL (TUSAYAN)
- TOUR BUSES
- PLATFORM

DESIGNED:	SUB SHEET NO.	TITLE OF SHEET	DRAWING NO.
OVERLAND GADD	T1	GRAND CANYON TRANSIT CENTER AT TUSAYAN OPTION 1 GRAND CANYON NATIONAL PARK BUS AND LIGHT RAIL TRANSIT SYSTEM	PKG. NO. GRCA DS 96A SHEET ___ OF ___
OVERLAND TECH. REVIEW:			
DATE: 6/1/01			

(2) Canyon View Information Plaza

Line-haul buses would enter the CVIP station at the existing access from the South Entrance Road and would unload and load passengers at the existing east shuttle loop. The buses would leave the CVIP station on the service road, connect to the existing road through Yavapai Lodge and proceed to the Powerhouse station in the village. Commercial tour buses would also enter the CVIP area at the existing access from the South Entrance Road. They would park in the existing bus parking lot located near the existing transit pavilion. All park shuttle buses would load and unload at the existing west shuttle loop.

(3) Village

Line-haul buses would enter the Village area from the east on the existing South Village Loop road. Bus unloading and loading would occur at a new transit plaza located near the Powerhouse, between the mule and horse barns. This plaza would serve the amenities on the rim accessed by a proposed bridge over the Bright Angel Wash and the railroad tracks. The buses would proceed to the Backcountry Information Center, where they would begin the return trip to Tusayan or Grand Canyon Transit Center. The park shuttle would continue to operate on the existing North and South Village Loop Road system.

OPTION 2 - BUS SERVICE ON PARALLEL ROAD

a Transit Routes and Service

Like Option 1, Option 2 would provide two line-haul transit routes to the South Rim area. One route would travel from the Tusayan airport, through the town of Tusayan and on to the Grand Canyon Transit Center (GCTC) using existing roads. In the vicinity of GCTC the buses would enter a dedicated bus lane created by widening the existing South Entrance Road from Long Jim Canyon to CVIP. This new road would be dedicated for the exclusive use of line-haul transit buses. Buses would depart CVIP using the road through Yavapai Lodge and would proceed to a station on the South Village Loop Road near the Powerhouse. Buses would proceed from the Powerhouse station to the Backcountry Information Center, where they would stop before proceeding south on a new road that would link Backcountry Information Center with the intersection of Market Plaza Road and Center Road. Line-haul transit buses would share this road with commercial tour buses, administrative traffic, and overnight visitors leaving the South Rim area. From the Market Plaza Road intersection, the buses would travel a short distance east on Center Road before turning south onto the new dedicated bus lane to return to Tusayan. The second bus route would start at Grand Canyon Transit Center. Buses would travel along Long Jim Canyon to join the new dedicated bus lane and would follow the previously described bus route. Buses would arrive at CVIP, the Powerhouse, and Backcountry Information Center every two to three minutes during busy times. The service provided from Grand Canyon Transit Center would be much more frequent than the service from Tusayan.

b Transit Vehicles

CIVIS single-articulated, advanced-design buses with internal combustion engines and hybrid-electric power, if available, would provide the service on the Grand Canyon Transit Center to Canyon View Information Plaza line-haul route in this option. The same articulated buses with internal combustion engines as proposed in Option 1 would be used for the Tusayan to CVIP route. A fleet of six articulated buses (Tusayan to CVIP) and 17 CIVIS buses (GCTC to CVIP) would be required to meet the projected demand in 2025.

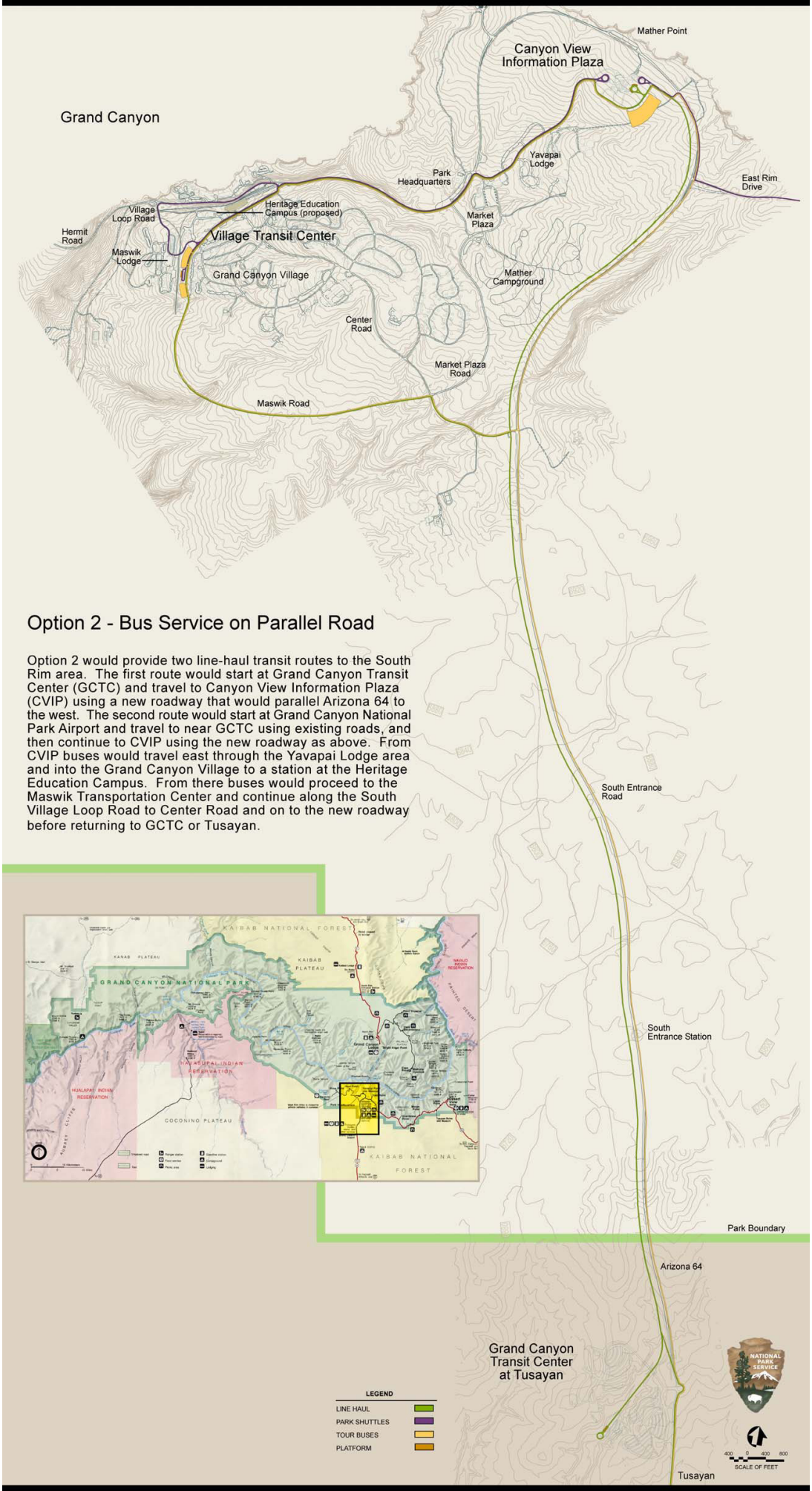
c Parking and Traffic Management

Commercial tour buses carrying day visitors would enter the park at the South Entrance or the East Entrance and continue into the South Rim area in this option. The tour buses would use a new parking area near CVIP that would be designed to accommodate the expected number of tour buses. Tour buses also would park at the Backcountry Information Center and at Bright Angel Lodge if necessary. Day visitors traveling in private vehicles, including visitors who spend the night at accommodations in and near Tusayan, would park in lots in Tusayan or at Grand Canyon Transit Center. Approximately 500 parking spaces are assumed to be available in Tusayan and at the airport. About 2,235 parking spaces for private vehicles, including RVs, would be provided at Grand Canyon Transit Center.

d Stations

(1) Grand Canyon Transit Center

Line-haul buses would enter the Grand Canyon Transit Center from the north on a dedicated bus lane created by widening Arizona 64. This dedicated bus lane would drop into Long Jim Canyon near the canyon's crossing of Arizona 64 to access the new station. The buses would unload at the western platform and then turn around the loop and proceed to the eastern platform to load. Buses would wait for their scheduled departure time, if necessary, in the turnaround loop. Day use car and RV parking would be located on the east and west sides of Long Jim Canyon while tour buses would bypass the Transit Center and enter the park on Arizona 64.



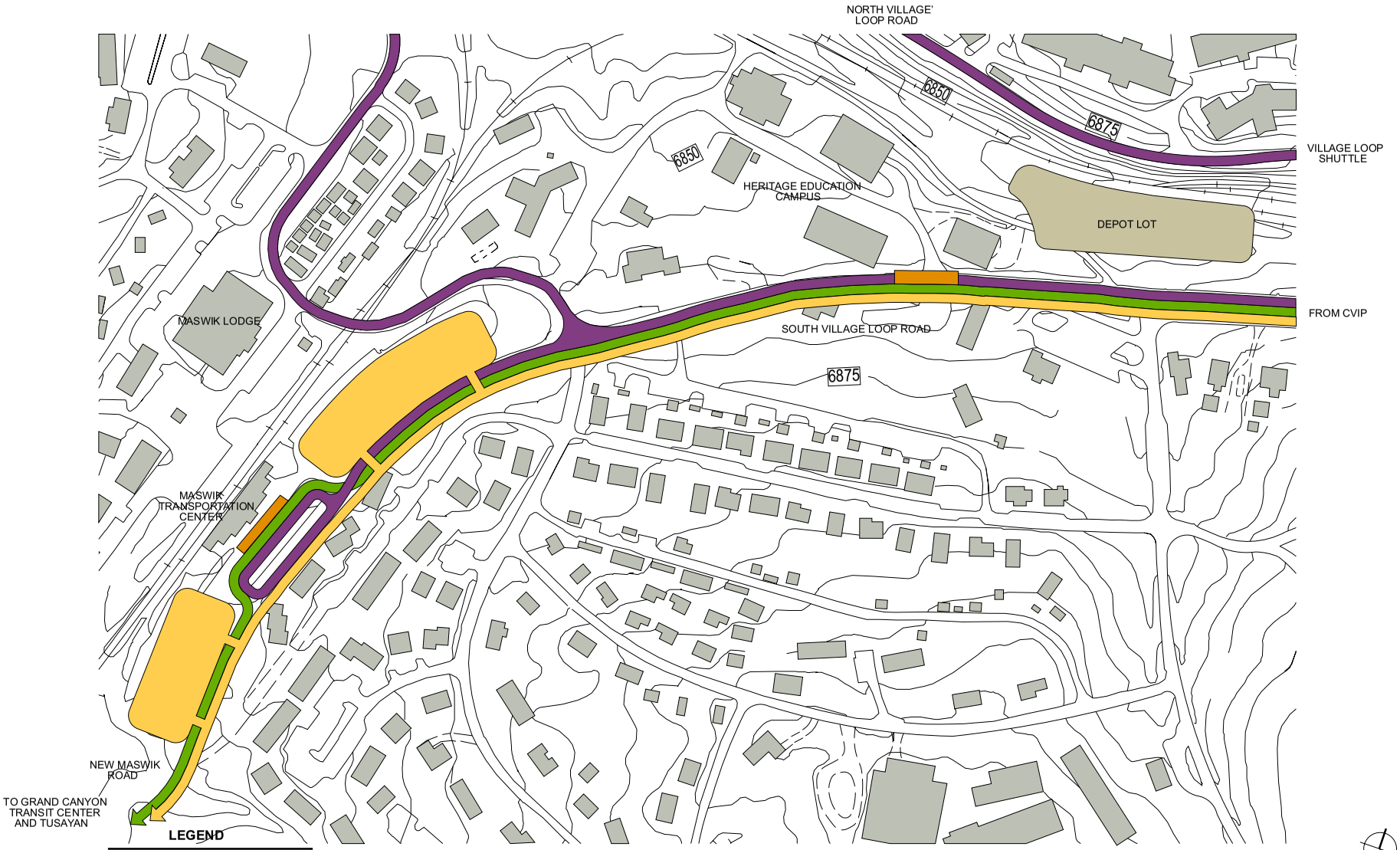
Option 2 - Bus Service on Parallel Road

Option 2 would provide two line-haul transit routes to the South Rim area. The first route would start at Grand Canyon Transit Center (GCTC) and travel to Canyon View Information Plaza (CVIP) using a new roadway that would parallel Arizona 64 to the west. The second route would start at Grand Canyon National Park Airport and travel to near GCTC using existing roads, and then continue to CVIP using the new roadway as above. From CVIP buses would travel east through the Yavapai Lodge area and into the Grand Canyon Village to a station at the Heritage Education Campus. From there buses would proceed to the Maswik Transportation Center and continue along the South Village Loop Road to Center Road and on to the new roadway before returning to GCTC or Tusayan.

LEGEND

- LINE HAUL
- PARK SHUTTLES
- TOUR BUSES
- PLATFORM

DESIGNED:	SUB SHEET NO.	TITLE OF SHEET	DRAWING NO.
OVERLAND CADD OVERLAND TECH. REVIEW: DATE: 6/1/01	C2	CVIP OPTION 2A & 2B GRAND CANYON NATIONAL PARK BUS AND LIGHT RAIL TRANSIT SYSTEM	PKG. NO. GRCA DS 96A SHEET ___ OF ___



LEGEND

- LINE HAUL
- PARK SHUTTLES
- TOUR BUSES
- PLATFORM
- OVERNIGHT GUEST PARKING

DESIGNED:	SUB SHEET NO.	TITLE OF SHEET	DRAWING NO.
OVERLAND	V2	VILLAGE OPTION 2	
CADD OVERLAND			PKG. NO. GRCA DS 96A
TECH. REVIEW:		GRAND CANYON NATIONAL PARK BUS AND LIGHT RAIL TRANSIT SYSTEM	SHEET ___ OF ___
DATE: 6/1/01			

LEGEND

- LINE HAUL (GCTC)
- LINE HAUL (TUSAYAN)
- TOUR BUSES
- PLATFORM

DESIGNED:	SUB SHEET NO.	TITLE OF SHEET	DRAWING NO.
OVERLAND CADD OVERLAND TECH. REVIEW: DATE: 6/1/01	T2	GRAND CANYON TRANSIT CENTER AT TUSAYAN OPTION 2A & 2B GRAND CANYON NATIONAL PARK BUS AND LIGHT RAIL TRANSIT SYSTEM	PKG. NO. GRCA DS 96A SHEET ___ OF ___

(2) Canyon View Information Plaza

Line-haul buses would enter the CVIP station at the existing access from the South Entrance Road and unload and load passengers at platforms located on a new bus loop adjacent to the existing transit pavilion. The buses would exit the new loop and use the service road to connect to the existing road through the Yavapai Lodge area and would then proceed to the Village. Commercial tour buses would enter the CVIP station at the existing access from the South Entrance Road and would park in a new bus lot to the southeast of the station. Tour groups would unload and enter CVIP along a new pathway from the lot to the existing transit pavilion. The park shuttle would continue to operate as they do currently – with the eastbound shuttles using the east loop and the westbound shuttles using the west loop.

(3) Village

Line-haul buses would enter the Village area from the east on the existing South Village Loop Road. Bus unloading and loading would occur at a new transit plaza located near the Powerhouse, between the mule and horse barns. This plaza would serve amenities on the rim via a proposed pedestrian bridge over the Bright Angel Wash and the railroad tracks. The buses would proceed to the Backcountry Information Center on the South Village Loop Road. From the Backcountry Information Center the buses would proceed south and east on the proposed Maswik Road. The park shuttle (local routes) would continue to operate on the existing North Village Loop Road and South Village Loop Road.

OPTION 3 - *ADVANCED BUS* (GLT) SERVICE ON RAIL ALIGNMENT

a Transit Routes and Service

A single transit route would be operated to provide line-haul transit service in this option. The route would use a new roadway dedicated for the exclusive use of line-haul transit vehicles. The new roadway would generally follow the light rail route proposed in the LRT prospectus. This route follows the old South Entrance Road alignment to the west of Arizona 64 from GCTC to CVIP. The roadway would cross over or under Center Road. A second dedicated transit road would diverge from the first roadway near the intersection of Center Road and Market Plaza Road. This transit road would be located to the south and west of Center Road and the residential area south of Maswik Lodge. It would enter the village area between Maswik Lodge and the Backcountry Information Center and proceed to a station north of the Powerhouse. Line-haul buses would travel from GCTC to CVIP on the first transit roadway. Buses would then backtrack to the Center Road area and use the second transit road to reach the Powerhouse station. Buses would retrace their route on the second transit road to reach the first road and return to GCTC. Buses would arrive at each station every three to four minutes during busy times. Independent private-sector operators may choose to provide shuttle service from the Tusayan airport and other locations in Tusayan for a fee. Any shuttles of this type would enter GCTC and transfer their passengers to the line-haul transit service.

b Transit Vehicles

GLT advanced design buses would be used in Option 3. These articulated transit buses would be powered by electric motors, with the energy being supplied to the vehicles by overhead wires. A fleet of 21 GLT vehicles would be needed to serve the projected demand in 2026. Because there is insufficient electric power for operation of a transit system at the South Rim, a new electric transmission line would need to be built from Williams to the Grand Canyon. In Appendix E, you will see a report done by EPRI Solutions on various on-site power generation options. None are recommended as stand-alone solutions and would require the extension of transmission lines as described.

TransLohr advanced design buses were also considered for this alignment. These buses are powered by electric motors, with the energy distributed to the buses using overhead wires. The buses can be quad-articulated and guided by a rail embedded in the roadway. These buses could not be used on routes off the exclusive bus roadway because of their size and the need for electric power and guidance. The buses could be driven from either end, eliminating the need for turnaround loops at the stations. The TransLohr buses, however, are not sufficiently far enough along in development to be a realistic option for the Grand Canyon system and therefore were not evaluated.

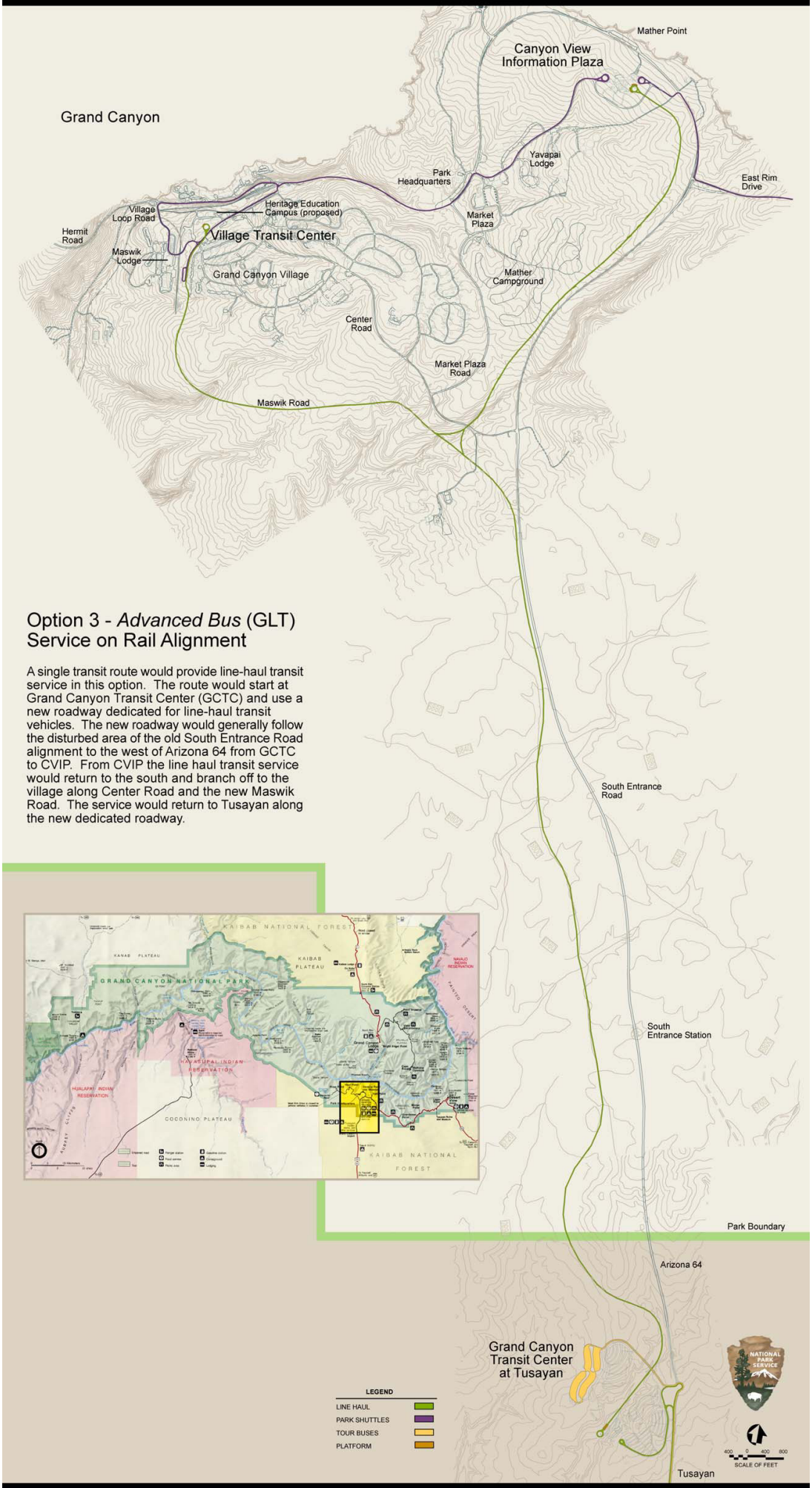
c Parking and Traffic Management

All vehicles carrying day visitors into the South Rim area, including commercial tour buses, would park at Grand Canyon Transit Center. All day visitors would ride the line-haul transit system into the park and would return to Grand Canyon Transit Center on the system. Approximately 2,735 parking spaces would be provided for private vehicles, including RVs. Commercial tour buses would use 120 parking spaces at Grand Canyon Transit Center.

d Stations

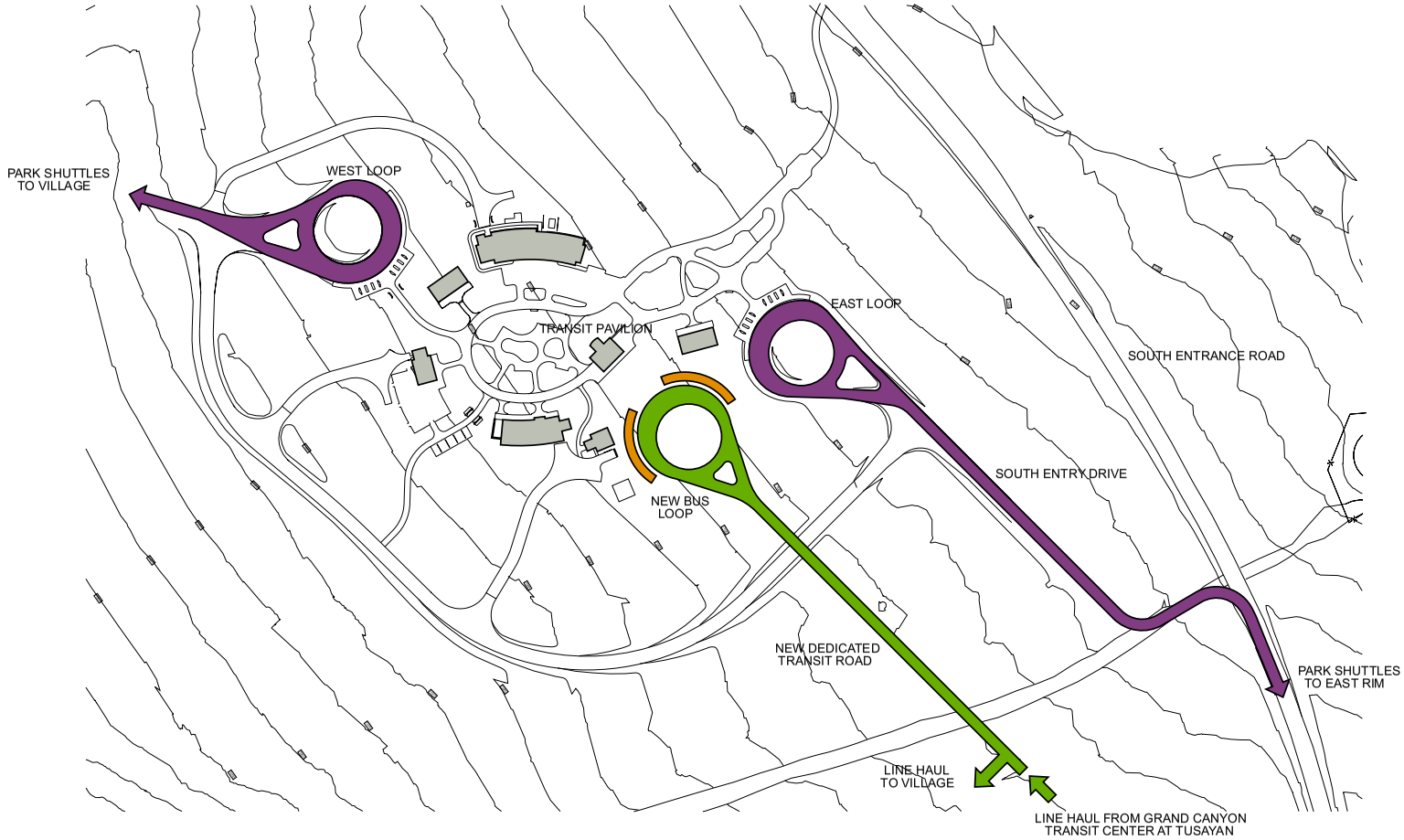
(1) Grand Canyon Transit Center

The line-haul buses would enter the Grand Canyon Transit Center from the north on a dedicated roadway along the light rail alignment and drop into Long Jim Canyon to access the new station. The buses would pull up to the platforms to unload, utilize a turnaround loop to the south of the station platforms, load passengers on the opposite platform, and then pull out of the station in the opposite direction. Commercial tour buses carrying day visitors would enter the Grand Canyon Transit Center at a new roundabout intersection on Arizona 64 and would park in the dedicated bus lot on the west side of the station. Shuttles from Tusayan (operated by others) would enter at the roundabout and unload at the east side of the station to the south of the ticketing area.



Option 3 - *Advanced Bus* (GLT) Service on Rail Alignment

A single transit route would provide line-haul transit service in this option. The route would start at Grand Canyon Transit Center (GCTC) and use a new roadway dedicated for line-haul transit vehicles. The new roadway would generally follow the disturbed area of the old South Entrance Road alignment to the west of Arizona 64 from GCTC to CVIP. From CVIP the line haul transit service would return to the south and branch off to the village along Center Road and the new Maswik Road. The service would return to Tusayan along the new dedicated roadway.



LEGEND

LINE HAUL	
PARK SHUTTLES	
TOUR BUSES	
PLATFORM	

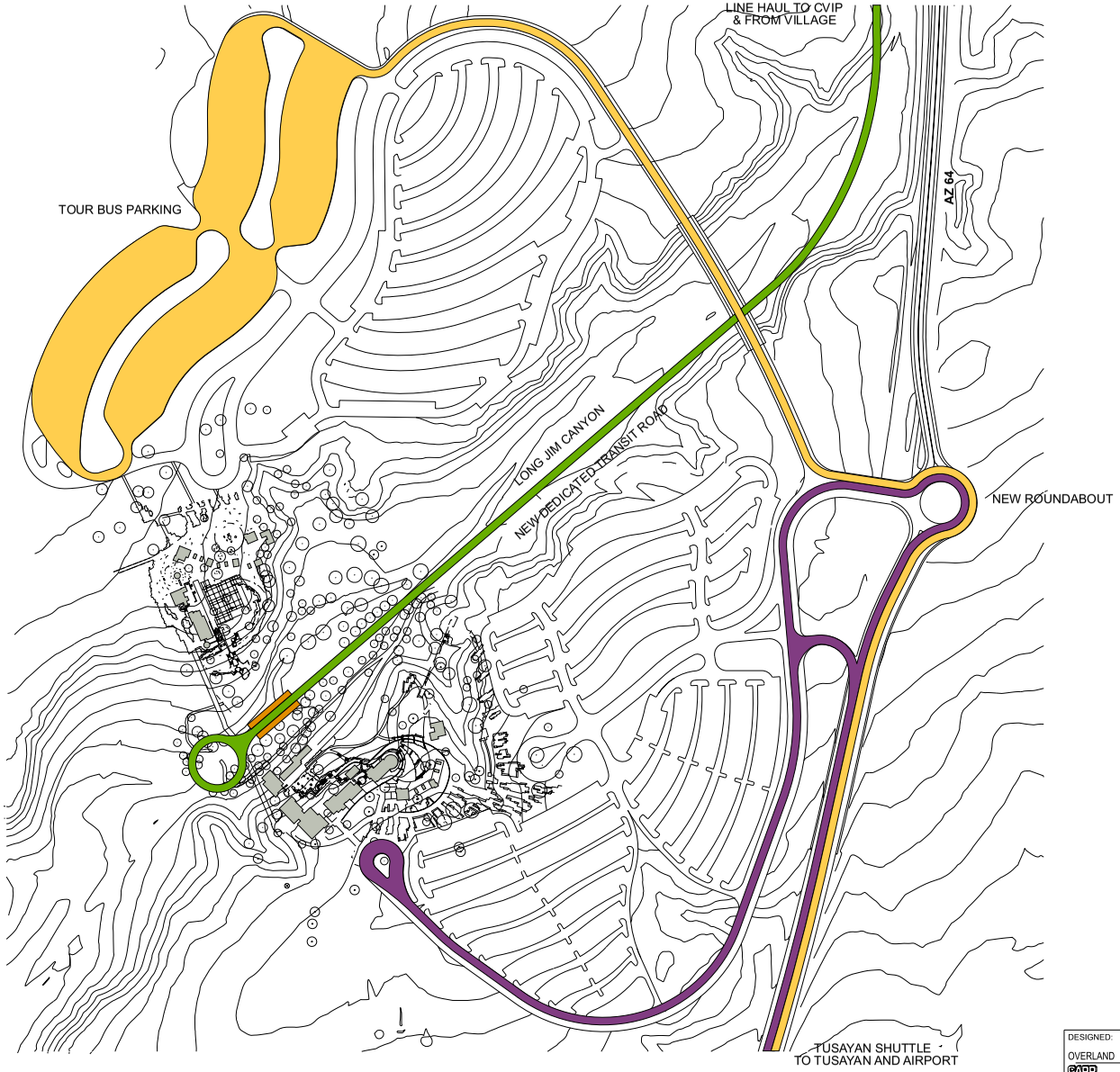
(TOUR BUSES STOP @ TUSAYAN)

DESIGNED:	SUB SHEET NO.	TITLE OF SHEET	DRAWING NO.
OVERLAND CADD OVERLAND TECH. REVIEW: DATE: 6/1/01	C3B	CVIP OPTION 3B GRAND CANYON NATIONAL PARK BUS AND LIGHT RAIL TRANSIT SYSTEM	PKG. NO. GRCA DS 96A SHEET ___ OF ___

LEGEND

- LINE HAUL
- PARK SHUTTLES
- TOUR BUSES
- PLATFORM
- OVERNIGHT GUEST PARKING

DESIGNED:	SUB SHEET NO.	TITLE OF SHEET	DRAWING NO.
OVERLAND	V3B	VILLAGE OPTION 3B	
CADD OVERLAND		GRAND CANYON NATIONAL PARK BUS AND LIGHT RAIL TRANSIT SYSTEM	PKG. NO. GRCA DS 96A
TECH. REVIEW:			SHEET ___ OF ___
DATE: 6/1/01			



LEGEND

- LINE HAUL
- TUSAYAN SHUTTLE (BY OTHERS)
- TOUR BUSES
- PLATFORM

DESIGNED:	SUB SHEET NO.	TITLE OF SHEET	DRAWING NO.
OVERLAND	T3B	GRAND CANYON TRANSIT CENTER AT TUSAYAN OPTION 3B GRAND CANYON NATIONAL PARK BUS AND LIGHT RAIL TRANSIT SYSTEM	
OVERLAND TECH. REVIEW:			PKG. NO. GRCA DS 96A
DATE: 6/1/01			SHEET ___ OF ___

(2) Canyon View Information Plaza

The line-haul buses would enter CVIP on a new dedicated roadway located to the west and south of the South Entrance road. The buses would pull up to the station in a loop located near the existing transit pavilion to unload and load passengers and then pull out in the opposite direction to proceed to the Village on a dedicated road as described above. The park shuttle would continue to operate with the eastbound shuttles on the east loop and the westbound shuttles on the west loop.

(3) Village

The line-haul buses would enter the Village area on a dedicated roadway from the west paralleling the storage tracks of the Grand Canyon Railway. As the road approached Backcountry Information Center it would turn slightly east to allow the buses to travel through the transit loop at the transportation center and connect to the South Village Loop Road. Buses would proceed to a station near the Powerhouse. The buses would unload and load at a new transit plaza adjacent to the mule barn at the site of the existing mule corral. The buses would use the loop to turn around and head back to GCTC following the South Village Loop Road and the dedicated transit road. The transit plaza would have access to the amenities on the rim via a proposed pedestrian bridge over Bright Angel Wash and the railroad tracks. The Village shuttle would continue to operate on the existing North and South Village Loop Roads.

OPTION 4 PHASED: BUS SERVICE ON EXISTING ROAD LEADING TO LIGHT RAIL

Option 4 provides for phased implementation of transit improvements at Grand Canyon, starting with bus service primarily using existing roads and transitioning to light rail transit when higher levels of visitation occur. It is expected that visitation would exceed the capacity of the bus system provided in Phase 1 sometime between 2016 and 2026. A peak season visitation threshold would be defined to indicate when design and procurement activities should begin for the implementation of Phase 2 of the transit system.

Phase I:

a Transit Routes and Service

In Phase 1 of Option 4 a shuttle bus route would provide transit service from Tusayan to Grand Canyon Transit Center. In addition, a line-haul transit bus route would provide service between the transit center and locations in Grand Canyon National Park. The Tusayan shuttle would operate every 12 to 15 minutes during busy periods along a route from Tusayan Airport to Grand Canyon Transit Center, primarily following Arizona 64. The line-haul transit route would utilize Arizona 64 from Grand Canyon Transit Center to Canyon View Information Plaza (CVIP). Buses would travel from CVIP to a station near the Powerhouse using existing roads. Buses would then proceed west to the Backcountry Information Center and stop before proceeding south on a new road connecting

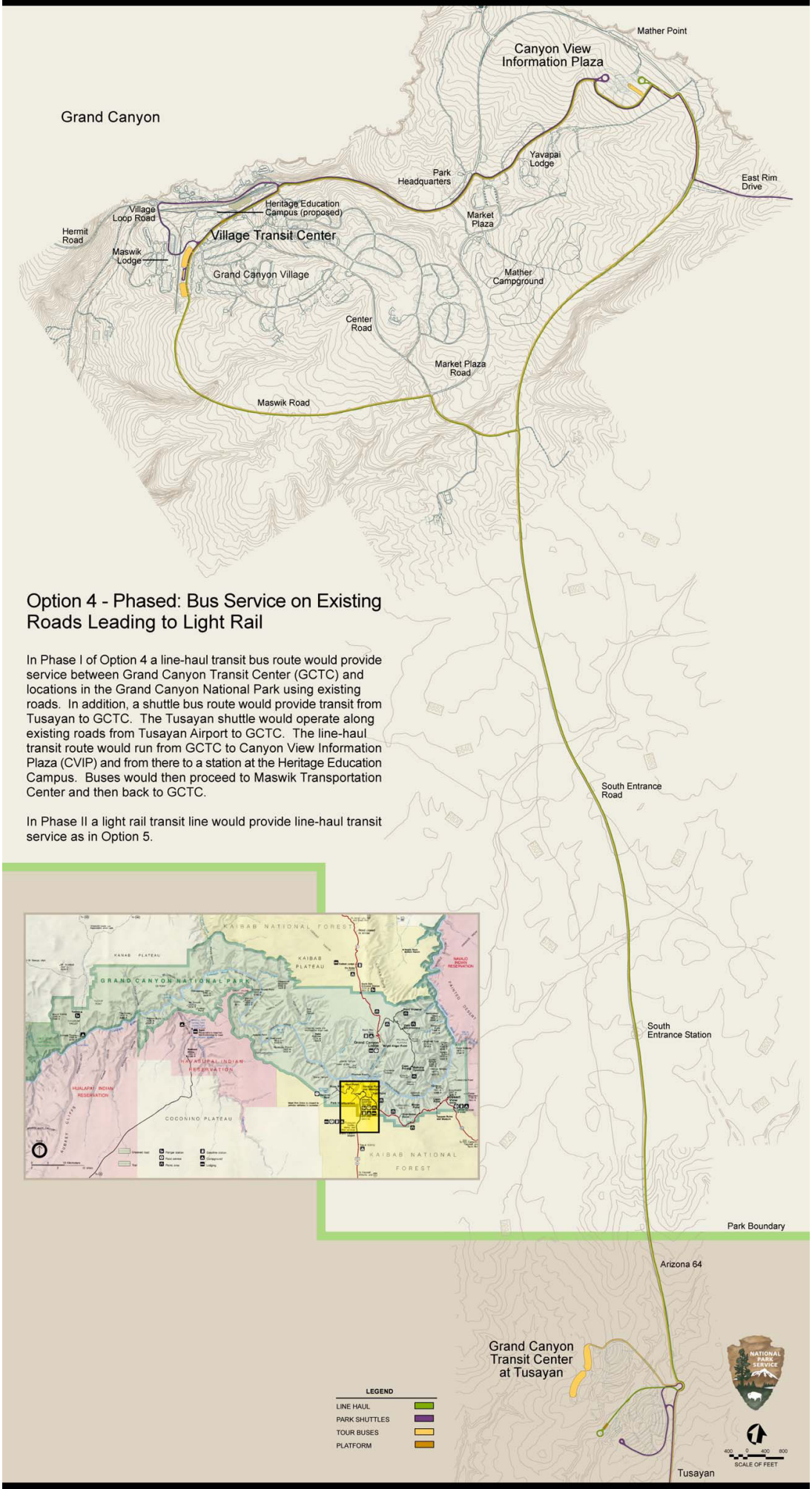
Backcountry Information Center with the intersection of Market Plaza Road and Center Road. Line-haul transit vehicles would share this road with tour buses, administrative traffic, and overnight visitors leaving the South Rim area. Buses would travel a short distance along Center Road to reach Arizona 64 for the return trip to Grand Canyon Transit Center. Buses would operate every two to three minutes along the line-haul transit route. Phase 2 of this option would be implemented when bus service frequency reached two minutes. Phase I is the same as Option 1, except Option 1 doesn't include a new road connecting the Backcountry Information Center with the intersection of Market Plaza Road and Center Road.

b Transit Vehicles

Articulated transit buses with internal combustion engines would provide transit service on the Tusayan shuttle and line-haul transit routes.

c Parking and Traffic Management

Commercial tour buses carrying day visitors into the south rim area would be allowed to enter the park up to the capacity of existing parking areas. A reservation or other management systems would be used to allocate access to parking spaces inside the park that would be designated for tour buses. Those tour bus parking areas would be served by the park shuttle bus system. It is estimated that about 30 to 40 % of the commercial tour buses carrying day visitors could be appropriately accommodated in existing parking areas; the other 60-70% of tour buses would be directed to and accommodated at the Grand Canyon Transit Center. Visitors in private vehicles, including RVs, would be directed to park at Grand Canyon Transit Center. Initially, there would be about 2,530 private vehicle parking spaces, with the number increasing to about 2,735 by the year 2026. Parking spaces for commercial buses would increase from an initial number of 62 to about 85 in 2026. During peak visitation in the year 2026, it's assumed that up to 194 tour buses per day would arrive at the park. Parking spaces (both in the park and at Grand Canyon Transit Center) would accommodate up to 70% of that total at one time.



Option 4 - Phased: Bus Service on Existing Roads Leading to Light Rail

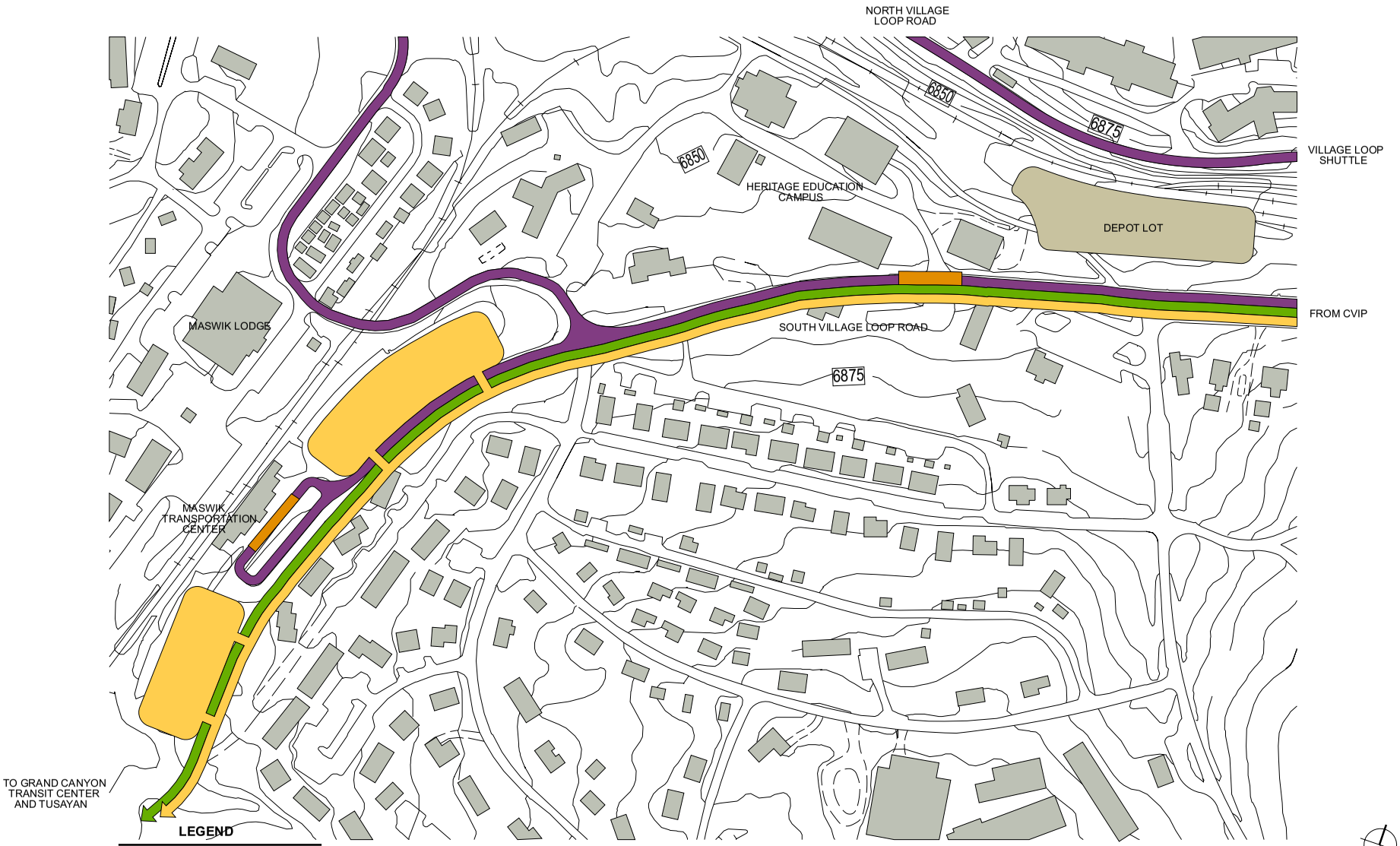
In Phase I of Option 4 a line-haul transit bus route would provide service between Grand Canyon Transit Center (GCTC) and locations in the Grand Canyon National Park using existing roads. In addition, a shuttle bus route would provide transit from Tusayan to GCTC. The Tusayan shuttle would operate along existing roads from Tusayan Airport to GCTC. The line-haul transit route would run from GCTC to Canyon View Information Plaza (CVIP) and from there to a station at the Heritage Education Campus. Buses would then proceed to Maswik Transportation Center and then back to GCTC.

In Phase II a light rail transit line would provide line-haul transit service as in Option 5.

LEGEND

LINE HAUL	
PARK SHUTTLES	
TOUR BUSES	
PLATFORM	

DESIGNED:	SUB SHEET NO.	TITLE OF SHEET	DRAWING NO.
OVERLAND GADD OVERLAND	C4	CVIP OPTION 4 PHASE 1	
TECH. REVIEW:		GRAND CANYON NATIONAL PARK BUS AND LIGHT RAIL TRANSIT SYSTEM	PKG. NO. GRCA DS 96A
DATE: 6/1/01			SHEET OF



LEGEND

- LINE HAUL
- PARK SHUTTLES
- TOUR BUSES
- PLATFORM
- OVERNIGHT GUEST PARKING

DESIGNED:	SUB SHEET NO.	TITLE OF SHEET	DRAWING NO.
OVERLAND CADD	V4	VILLAGE OPTION 4 PHASE 1 GRAND CANYON NATIONAL PARK BUS AND LIGHT RAIL TRANSIT SYSTEM	PKG. NO. GRCA DS 96A SHEET ___ OF ___
OVERLAND TECH. REVIEW:			
DATE: 6/1/01			

LEGEND

- LINE HAUL
- TUSAYAN SHUTTLE
- TOUR BUSES
- PLATFORM

DESIGNED:	SUB SHEET NO.	TITLE OF SHEET	DRAWING NO.
OVERLAND AOP OVERLAND	T4	GRAND CANYON TRANSIT CENTER AT TUSAYAN OPTION 4 PHASE 1 GRAND CANYON NATIONAL PARK BUS AND LIGHT RAIL TRANSIT SYSTEM	PKG. NO. GRCA DS 96A SHEET ___ OF ___
TECH. REVIEW:			
DATE: 6/1/01			

d Stations

(1) Grand Canyon Transit Center

The line-haul buses would enter the Grand Canyon Transit Center at a new roundabout located on Arizona 64. The buses would enter Long Jim Canyon to access the new station. The buses would unload at the western platform and then turn around the loop and proceed to the eastern platform to load. Buses could wait for their scheduled departure time in the turnaround loop if necessary. Tour buses that could not proceed into the park would enter the Grand Canyon Transit Center at the new roundabout intersection on Arizona 64 and would park in the bus parking lot on the west side of the station. The Tusayan shuttle would enter at the roundabout and unload at the east side of the station to the south of the ticketing area above Long Jim Canyon.

(2) Canyon View Information Plaza

Line-haul buses would enter the CVIP station at the existing access from the South Entrance Road and would unload and load passengers at the existing east shuttle loop. The buses would leave the CVIP station on the service road, connect to the existing road through the Yavapai Lodge area and proceed to the Powerhouse station. A limited number of tour buses would be allowed into the park by reservation and would also enter at the existing access from the South Entrance Road and park in the existing bus parking lot located near the transit pavilion. All park shuttle buses would load and unload at the existing west shuttle loop.

(3) Village

Line-haul buses would drive from the CVIP station and enter the Village area from the east on the existing South Village Loop Road. Bus unloading and loading would occur at a new transit plaza located near the Powerhouse between the mule and horse barns. This plaza would serve amenities on the rim via a proposed pedestrian bridge over Bright Angel Wash and the railroad tracks. The buses would proceed to the Backcountry Information Center on the South Village Loop Road and exit the village area on the new Maswik Road. Tour buses would park in a new lot at the Backcountry Information Center and then exit on the new Maswik Road. The park shuttle would continue to operate on the existing North and South Village Loop Roads.

Phase II:

a Transit Routes and Service

A light rail transit line would provide line-haul transit service in Phase II of Option 4. Service would be provided along a new set of light rail tracks, as proposed in the

concession prospectus. The route would be the same as the route described for Option 3.

b Transit Vehicles

This option assumes light rail transit vehicles would be used to provide the transit service. Light rail vehicles would be operated as single units or in trains of up to three cars, depending on the demand. The cost estimates for this option assume that internal combustion engines would power the vehicles. Currently available vehicles of this type are powered only by diesel engines. These vehicles are also known as diesel multiple units, or DMUs. Other types of fuel or hybrid electric propulsion would be used if available and cost-effective. A fleet of 14 light rail vehicles, including spares, would be needed to provide the transit service in this option.

c Parking and Traffic Management

Parking and traffic management for this Phase II of Option 4 would be the same as that described for Option 3. All vehicles carrying day visitors would park at Grand Canyon Transit Center, with about 2,735 private vehicle parking spaces and 120 commercial tour bus spaces being provided for the expected demand in 2026.

d Stations

(1) Grand Canyon Transit Center

The rail cars would enter the Grand Canyon Transit Center from the north along an alignment following the historic entrance road and drop into Long Jim Canyon to access the new station. The cars would pull up to the platforms to unload and then load passengers and then pull out of the station in the opposite direction. Commercial tour buses carrying day visitors would enter the Grand Canyon Transit Center at a new roundabout intersection on Arizona 64 and would park in the dedicated bus lot on the west side of the station. Shuttles from Tusayan (operated by others) would enter at the roundabout and unload at the east side of the station to the south of the ticketing area.

(2) Canyon View Information Plaza

The rail cars would enter CVIP on an alignment to the west and south of the South Entrance road. The cars would pull up to the existing transit pavilion to unload and load passengers and then pull out in the opposite direction to proceed to the Village on an alignment described for Option 3. The park shuttle would continue to operate with the eastbound shuttles on the east loop and the westbound shuttles on the west loop.

(3) Village

The rail cars would enter the Village on an alignment from the west between Maswik Lodge and the Backcountry Information Center. The cars would pull up to a new station north of the existing Powerhouse to unload and load passengers. Trains would pull out in the opposite direction to return to the Grand Canyon Transit Center at Tusayan. This station will have direct access to the amenities on the rim via the proposed pedestrian bridge over Bright Angel Wash and the railroad tracks. The Village loop shuttle will continue to operate on the existing North and South Village Loop Roads.

OPTION 5 - LIGHT RAIL

a Transit Routes and Service

This option includes the same transit service as that described for Option 4, Phase 2. Light rail transit vehicles would operate along the route proposed in the concession prospectus and described in Option 3. A fleet of 14 light rail vehicles would be needed.

b Transit Vehicles

Light rail vehicles either with internal combustion engines or powered by electric motors would provide the transit service in this option. The vehicles would operate as single units or in trains of up to three cars, depending on visitation. To power the electric vehicles a new transmission line, similar to that proposed for Option 3 would provide overhead electric power for the system.

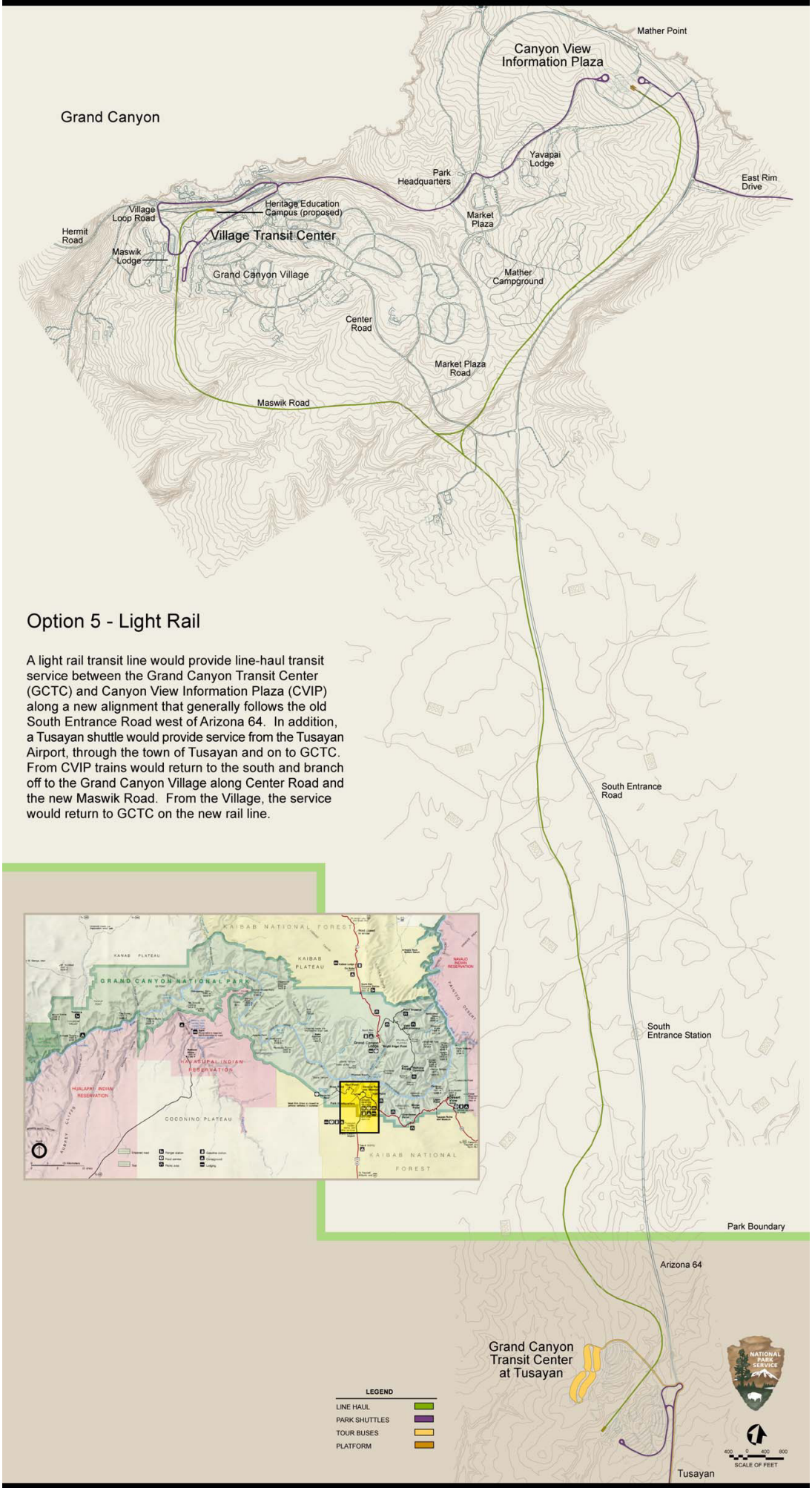
c Parking and Traffic Management

Parking and traffic management would be the same as that described for Option 3 and Option 4, Phase II. All vehicles carrying day visitors would park at Grand Canyon Transit Center.

d Stations

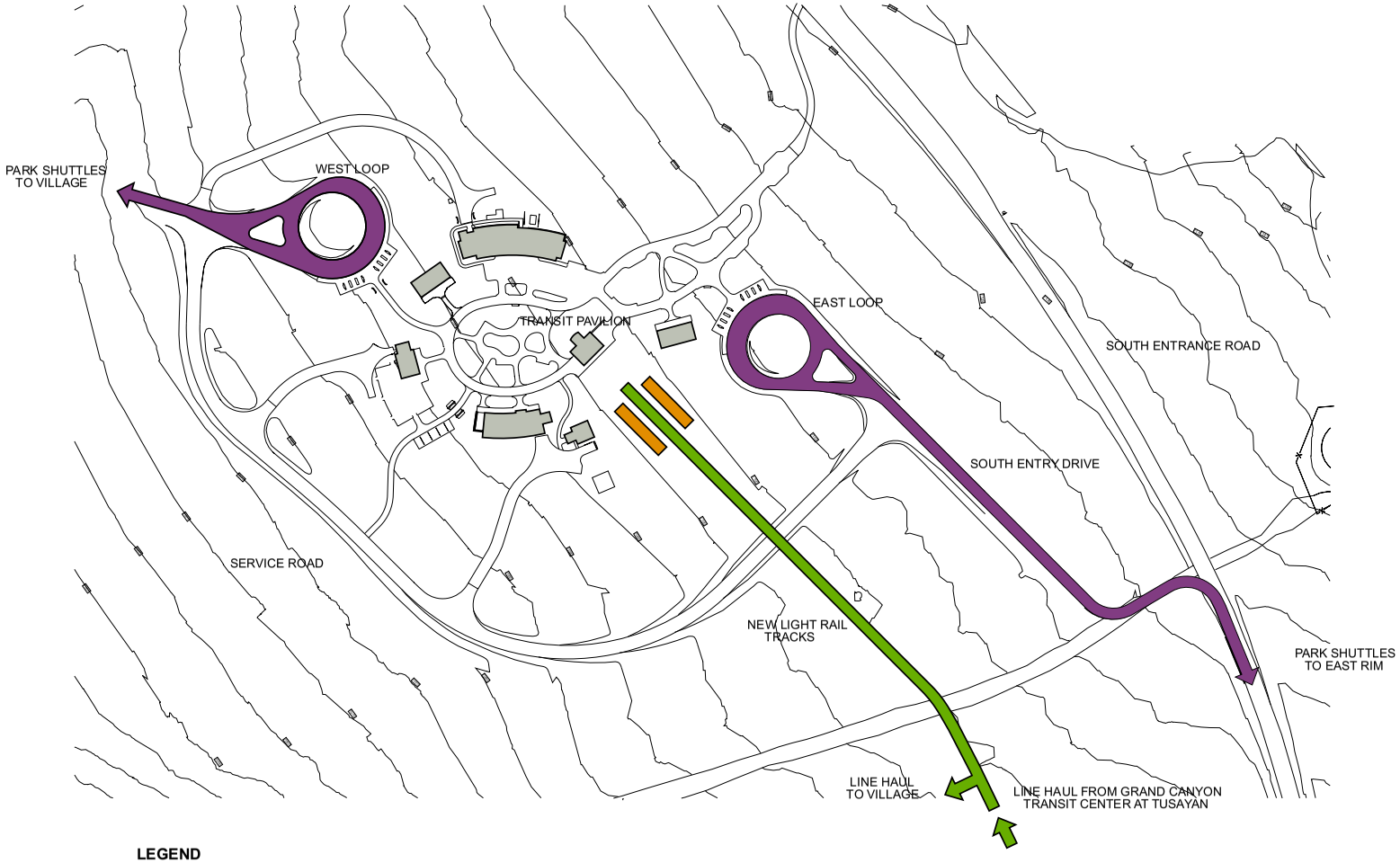
(1) Grand Canyon Transit Center

The station in this option is the same as the station described in Option 4, Phase II.



Option 5 - Light Rail

A light rail transit line would provide line-haul transit service between the Grand Canyon Transit Center (GCTC) and Canyon View Information Plaza (CVIP) along a new alignment that generally follows the old South Entrance Road west of Arizona 64. In addition, a Tusayan shuttle would provide service from the Tusayan Airport, through the town of Tusayan and on to GCTC. From CVIP trains would return to the south and branch off to the Grand Canyon Village along Center Road and the new Maswik Road. From the Village, the service would return to GCTC on the new rail line.

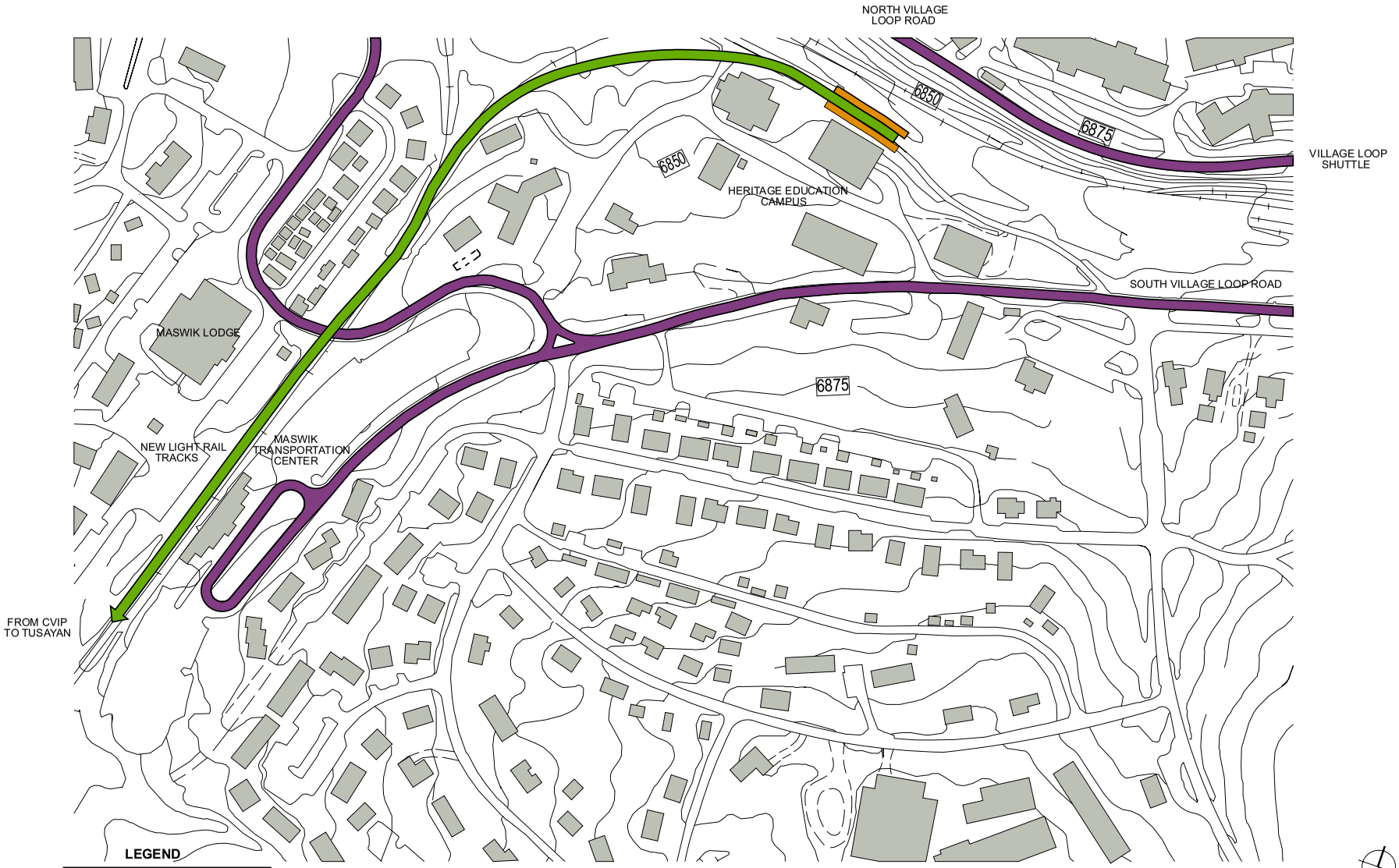


LEGEND

- LINE HAUL
- PARK SHUTTLES
- TOUR BUSES
- PLATFORM

(TOUR BUSES STOP @ TUSAYAN)

DESIGNED:	SUB SHEET NO.	TITLE OF SHEET	DRAWING NO.
OVERLAND OADD OVERLAND TECH. REVIEW: DATE: 6/1/01	C5	CVIP OPTIONS 4 PHASE 2, 5A & 5B GRAND CANYON NATIONAL PARK BUS AND LIGHT RAIL TRANSIT SYSTEM	PKG. NO. GRCA DS 96A SHEET ___ OF ___

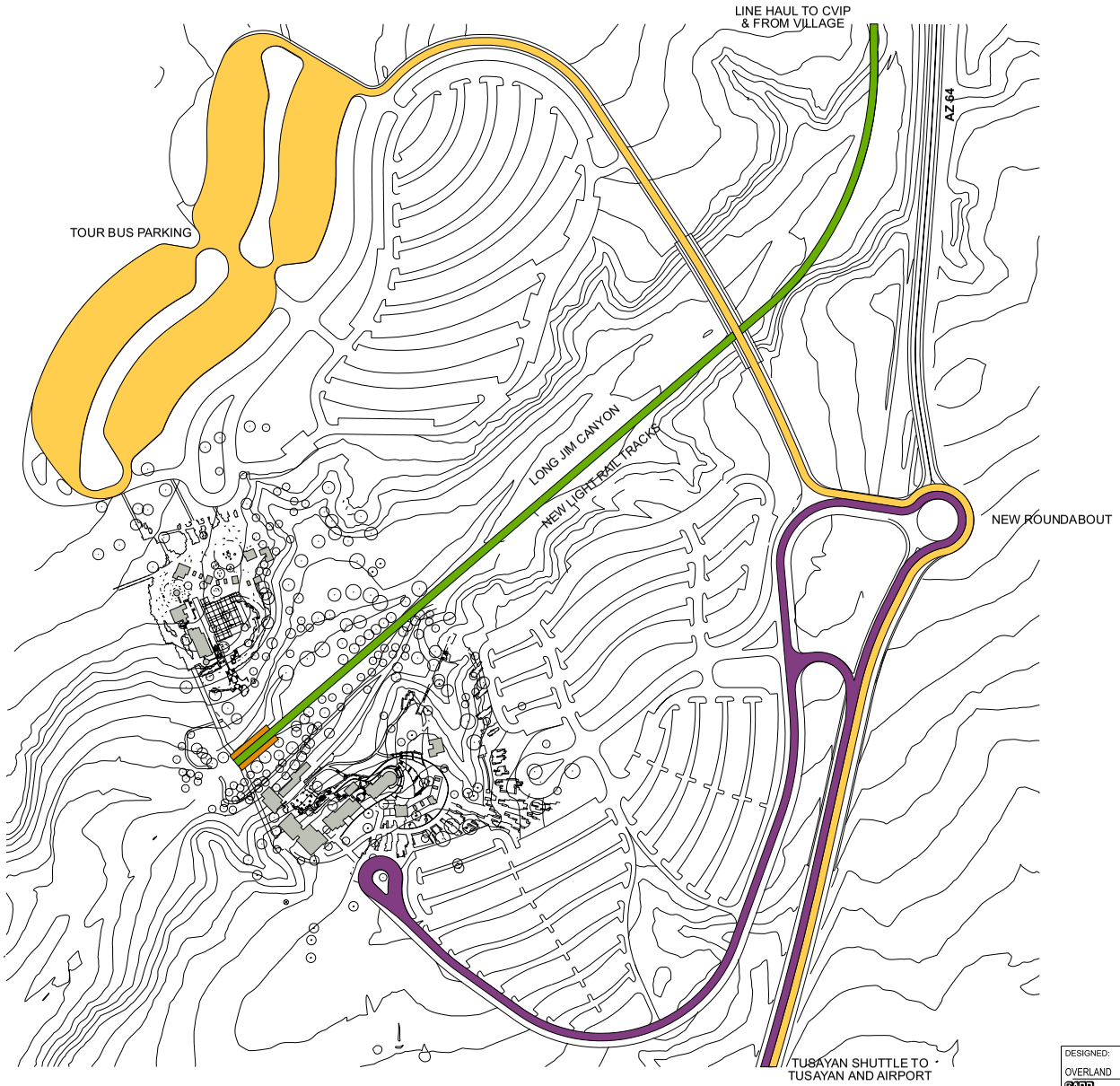


LEGEND

- LINE HAUL
- PARK SHUTTLES
- TOUR BUSES
- PLATFORM

(TOUR BUSES STAY IN TUSAYAN)

DESIGNED: OVERLAND	SUB SHEET NO.	TITLE OF SHEET	DRAWING NO. 113
CADD OVERLAND	V5	VILLAGE OPTIONS 4 PHASE 2, 5A & 5B GRAND CANYON NATIONAL PARK BUS AND LIGHT RAIL TRANSIT SYSTEM	41206
TECH. REVIEW:			PKG. NO. GRCA DS 96A / SHEET ___ OF ___
DATE: 6/1/01			



LEGEND

- LINE HAUL
- TUSAYAN SHUTTLE (BY OTHERS)
- TOUR BUSES
- PLATFORM

DESIGNED: OVERLAND	SUB SHEET NO.	TITLE OF SHEET	DRAWING NO.
OVERLAND TECH. REVIEW:	T5	GRAND CANYON TRANSIT CENTER AT TUSAYAN OPTIONS 4 PHASE 2, 5A, 5B GRAND CANYON NATIONAL PARK BUS AND LIGHT RAIL TRANSIT SYSTEM	PKG. NO. GRCA DS 96A / SHEET ___ OF ___
DATE: 6/1/01			

(2) Canyon View Information Plaza

The station in this option is the same as the station described in Option 4, Phase II.

(3) Village

The station in this option is the same as the station described in Option 4, Phase II.

C SEASONAL OPERATIONS

There are two possible scenarios for seasonal operations: 1) operate the system seasonally and shut it down in the slower season and, 2) operate the system all year but make it optional with financial incentives for use during the slower season.

The first scenario requires that the park be willing and able to deal with occasionally very busy winter days when summer-like numbers of visitors and cars arrive. Conditions in Grand Canyon Village on those days would be very similar to those experienced on busy summer days in recent years – something the park is attempting to improve upon.

However, if the system were to cease operation December through February, existing parking lots in the park could be used to accommodate winter day-use. The shuttle routes in Grand Canyon Village would continue to operate as they do now to transport visitors to the Canyon View Information Plaza and otherwise help with visitor circulation.

The second scenario retains an overflow capability for managing visitation on the busy winter days. It could also create a source of operating funds for the transit system if a surcharge were collected from visitors permitted to drive into the park during the winter season.

Both scenarios require that the park manage two means of visitor access – one for cars in the winter, one for transit the rest of the year. This would compromise the intent of the GMP by prohibiting the removal of some parking lots and it would increase the complexity and cost of visitor information systems and services.

As part of this Report, a survey of transportation systems and companies across the west was conducted to determine whether buses could be shared between the Grand Canyon (summer peak demand) and other places with a winter peak demand. The results of this survey can be found in Appendix A. They indicate very limited opportunity for sharing.

D IMPLICATIONS OF OPTIONS

1 Cost

For each transit option cost estimates were developed by our transportation consultant David Evans and Associates. The following table presents the estimated initial capital investment,

operating expenses and life cycle costs for each system. Costs are provided in 2003 dollars and are not inflated or adjusted to year of expenditure.

It should be noted that the table below indicates that Option 4 is not applicable under a no-growth visitation assumption. The premise behind Option 4 is to provide bus service initially and implement light rail after visitation grows to the point that the bus service is unable to meet demand. Without growth, the bus service will be able to meet demand indefinitely. Therefore expansion of the system from buses to light rail would not be required and the additional cost would not be justified. Without expansion to light rail, Option 4 is very similar to Option 1 with some slight roadway modifications.

Exhibit 1 - Estimated Initial Investment, Rehabilitation/Replacement Costs, and Operating Expenses (2004 – 2026) in Constant 2003 US Dollars without Expansion (No-Growth Scenario)

	Initial Investment			Life Cycle Costs		Operation and Maintenance	
Option	Real Property	Personal Property	Total Initial Investment	Real Property	Personal Property	Total 2008-2026	Average Annual
1	$74,646,318	$27,043,500	$101,689,818	$14,929,264	$42,128,400	$252,435,588	$13,286,084
2	$104,219,673	$35,348,500	$139,568,173	$20,843,935	$32,960,900	$272,904,277	$14,363,383
3	$160,620,722	$48,763,000	$209,383,722	$32,124,144	$24,000,800	$286,619,294	$15,085,226
4	**Under "No-Growth" Visitation Scenario, Option 4 is Not Viable**						
5A	$153,531,351	$48,323,000	$201,854,351	$30,706,270	$20,440,800	$277,559,866	$14,608,414
5B	$195,454,381	$44,363,000	$239,817,381	$39,090,876	$20,836,800	$294,213,458	$15,484,919

Source – David Evans and Associates, PricewaterhouseCoopers LLP

Initial Investment in Real Property includes the estimated cost of real property improvements plus design and engineering fees and project management costs. Initial Investment in Personal Property is generally rolling stock.

Life-Cycle Costs are the ongoing capital costs of a given transit system that occur after the initial implementation of the system. This includes substantial real property refurbishment and major overhauls and replacement of rolling stock. Please note that this is not the standard definition of life cycle cost that is typically used in the context of analyzing economic investment alternatives.

Operation and Maintenance expenses are day to day system operations, including labor and personnel necessary to maintain and operate the system. This category also includes fuel and other consumable materials and routine maintenance.

Seasonal operation of the line-haul system (shutting down December through February) would save approximately 10-15% of annual operating costs. However, the same period accounts for approximately 10-15% of annual visitation to the South Rim. If no transit fee were charged to visitors for the line haul system during these months, the financial effect of seasonal operation is expected to be inconsequential. No savings from capital costs are expected from seasonal operations.

Transit System Expansion

In the event that South Rim recreation visitation is assumed to grow, visitation levels will eventually justify expansion of the systems. Under each scenario, there are expansions that will occur based on estimated demand derived from visitation forecasts (roughly when ridership achieves 4 million and again at 4.4 million). Although the exact timing of when expansion would be required is uncertain, the assumed years for expansion are 2013 and 2019 (expansions would be completed and operational by these target years). The most significant expansion will occur under Option 4. Option 4 includes a conversion from buses to light rail and the light rail system is assumed to be operational by 2017. It was assumed that the planning and development of any system expansion would begin (and costs would begin to be incurred) four years before estimated expansions would be operational**.**

Exhibit 2 - Estimated cost of system expansion, in unadjusted 2003 dollars

Option	Initial Investment			Expansion		Total Investment	Life Cycle Costs		Operation and Maintenance	
	Real Property	Personal Property	Total Initial Investment	Real Property	Personal Property	Initial + Expansion	Real Property	Personal Property	Total 2008-2026	Average Annual
1	$75,756,410	$29,667,000	$105,423,410		$10,307,000	$115,730,410	$15,151,282	$42,026,550	$291,154,300	$15,323,911
2	$105,329,765	$37,394,500	$142,724,265		$13,002,000	$155,726,265	$21,065,953	$30,729,300	$304,612,100	$16,032,216
3	$162,111,022	$50,963,000	$213,074,022		$10,494,000	$223,568,022	$32,422,204	$23,826,800	$334,445,800	$17,602,411
4	$81,128,234	$26,999,500	$108,127,734	$95,190,392	$48,911,500	$252,229,626	$14,603,082	$18,309,438	$311,385,200	$16,388,695
5A	$155,019,809	$54,483,000	$209,502,809		$3,894,000	$213,396,809	$31,003,962	$19,962,800	$315,995,800	$16,631,358
5B	$196,942,839	$49,863,000	$246,805,839		$3,894,000	$250,699,839	$39,388,568	$20,424,800	$334,955,548	$17,629,239

(1) Values are presented in unadjusted 2003 dollar amounts. Inflation adjustments are dependent upon visitation forecasts.
(2) Initial Investments for Option 4 represent Phase I and Expansion figures represent Phase II.
(3) For options 1-3 and 5, Initial Investments under the Expansion scenario are slightly greater than those shown in the No-Growth scenario, because with a growth scenario, growth that occurs during the initial years of planning and construction results in increased demand of parking spaces (real property) and additional vehicles (personal property).

2 Performance

The following table shows the useful life of each option. Maximum Day demand is defined as the South Rim carrying capacity of 22,500 people at one time and 45,000 visitors per day on the South Rim established in the park's GMP. The date when this visitation demand will occur is unknown and is beyond the 20 year planning horizon for the anticipated concession contract.

Headway is the time between vehicles in the system. A 2-minute headway is the standard the NPS has chosen for minimum frequency. Headways of less than 2 minutes would require that buses bunch up at loading/unloading areas. Note that the figures in bold do not meet this standard.

Exhibit 3 – Performance relative to frequency standard by option

Transit Service Requirements by Option						
Option	**Buses**		**Peak Hour Headway @ CVIP & Village (minutes)**			
	Tusayan Shuttle	**GCTC Shuttle**	**2006**	**2016**	**2026**	**Max Day**
1	New Flyer 40', New Flyer 60' in 2025	New Flyer 60'	2.5	2.2	2.3	**1.4**
2	New Flyer 40', New Flyer 60' in 2025	CIVIS	2.4	2.1	2.2	**1.3**
3	N/A	GLT	2.1	**1.9**	**1.7**	**1.0**
4	N/A	New Flyer 60' Light Rail for 2026 and Max Day	2.5	2.2	8.6	5.0
5A	N/A	Light Rail (diesel)	10	8.6	8.6	5.0
5B	N/A	Light Rail (electric)	10	8.6	8.6	5.0

The years for which the analysis was performed correlate to base case visitation projections, which are on the low side of historical trends but are reasonable for system design purposes, considering the most recent decade.

It should be noted that in Options 1 and 2, commercial tour buses would continue to carry their passengers into the park and these visitors are not included in the transit system demand. However, finding parking for 120 tour buses near the various places tours visit, particularly in an historic district, could have significant impacts on park resources. In Options 3, 4, 5A, and 5B, commercial tour buses would park at the Grand Canyon Transit Center near Tusayan and board the line haul transit system.

All of the options would be able to serve the transportation needs of visitors in 2006 while meeting the defined standards. Option 3 would fail to meet the minimum headway standards after about 5 years of operation. The other bus options (1 and 2) would be able to meet the transportation demand anticipated through the contract term, but they would violate the minimum headway standard for the maximum day. These options would require an upgrade to rail transit technology or the implementation of reservation systems or other visitor use management methods at some time in the future.

If NPS is directed to conduct a NEPA environmental analysis, it will be the planning vehicle that will be used to understand the implications of each option and to present the choices available to the public in a clear and concise manner. Many features beyond the cost, financial, and capacity factors presented in this report will be considered in the selection of the best transportation option for Grand Canyon National Park.

E FINANCIAL ANALYSIS FOR OPTIONS 1-5

1 Financing Tools

A combination of financing tools is critical to achieving the most favorable estimated per person fee that would need to be levied to support each of the proposed transit systems. An analysis of financing options was produced in 1998. Since that time, several legislative changes have occurred and additional financing tools have been identified that were not originally evaluated. The following financing alternatives were analyzed by PricewaterhouseCoopers LLP in an effort to identify the optimal mix of financing options for providing the lowest reasonable cost to each fee-paying visitor.

- Concession contract
- Transportation Infrastructure Finance and Innovation Act ("TIFIA") direct loan
- Congressionally appropriated funds ("APF")
- NPS "equity" (NPS contributions from Fee Demo or other NPS controlled sources)
- Non-appropriated Fund Instrumentality ("NAFI")
- Federal revenue bonds
- Working capital fund

Each alternative listed above was analyzed for its suitability for financing the proposed transit systems. A description of each alternative is provided below.

In each description, an estimation of the appropriate cost of capital is provided. This estimate was developed using a Weighted Average Cost of Capital ("WACC") as the appropriate measure of risk and return. WACC is a method of looking at various levels of debt and equity within a financing structure and assigning the appropriate rate of return to each portion of debt and/or equity. For instance, a concessioner is likely to use both commercial debt and firm equity to finance its obligations under a concession contract for the types of systems contemplated in this analysis. Debt is generally less costly than equity and therefore the WACC for a concessioner will increase as debt is replaced by equity. A higher WACC indicates a higher financing costs and results in higher transit fees. The ultimate cost of capital for any transaction is highly dependent upon the mix of debt and equity used as well as the individual expected rates of return associated with each component of the financing mix.

1 Concession contract

The NPS has used concession contracts for decades to provide "necessary and appropriate visitor services" within units of the National Park Service. Currently, concession contracts are governed by laws, regulations, and policies including Public Law 105-391 and 36 CFR 51. Concessioners are private entities that provide authorized visitor services, typically collect a fee, and provide a return to the government in the form of franchise fees or other consideration authorized by the Secretary.

Under a concession contract, the concessioner would provide an investment into the system and operate the system under a contract going forward. As the operator, the

concessioner would be responsible for the day-to-day operation of the system and its ongoing maintenance and repair. The NPS would be responsible for contract oversight.

The standard length for a concession contract is ten years. However, contracts may be granted for a term up to 20 years. Given the levels of investment required for development of any of the proposed transit options at the park, it is likely that the necessary term would be 15 to 20 years. For the purposes of this analysis, the term of any concession contract was assumed to be 20 years.

Investments made by a concessioner in new construction and real property improvements would provide them with a compensable interest known as Leasehold Surrender Interest (LSI). This interest is essentially the terminal value of the concessioner's investment at the end of the contract at which time the concessioner would be paid the value of the LSI by the next concessioner or the government. LSI is calculated as the initial investment value, increased or decreased annually by the change in the Consumer Price Index, decreased by physical depreciation. For the purposes of this analysis, it was assumed that any investment made by a concessioner would be eligible for LSI and that a maintenance reserve account would be used to offset physical depreciation such that it is zero. This is the most conservative assumption and any actual depreciation incurred would lower the overall cost of the system.

The WACC for a concession contract was estimated to be 15 percent. This level of WACC is estimated to be a reasonable return for a concessioner in consideration of project risks (as currently designed). This is only an estimate and additional analysis of the risks associated with the final transit option, its operation, construction risks, and other sources of financing would need to be completed before a final, more thorough calculation can be developed.

Advantages

- No additional authorization is needed.
- Several companies have expressed interest in bidding on a concession contract for the transit system.
- Allows a private entity to design and construct the system, thereby reducing the additional costs that can be associated with government construction.

Disadvantages

- Concessioner cost of capital is higher than many other sources. As a result, the cost to the visitor increases as additional concessioner investment is used.
- Prospectus development for a contract of this size would require one to two years of work and preparation, although some work is already done.

2 Transportation Infrastructure Finance and Innovation Act ("TIFIA") direct loan

The TIFIA program provides a variety of financial support options including credit enhancement, direct loans, and standby lines of credit. A TIFIA direct loan was utilized in this analysis.

TIFIA direct loans are defined by the following criteria:

- Projects must have national or regional significance
- Project values typically exceed $100 Million
- TIFIA contribution is limited to 33 percent of project cost
- Investment grade rating required, as determined by one of the major credit rating agencies
- Revenues must be dedicated for repayment
- Subsidy cost is the estimated long-term cost to the Government of providing the credit assistance
- Risk profile, as calculated by investment rating, determines the subsidy cost
- Project must be incorporated into state transportation plan (currently in process)
- Congress appropriated approximately $1.8 Billion for the TIFIA program in 2003.

The estimated cost of capital for a TIFIA loan is 5.2 percent based on transactions completed through the program during the period 2000 – 2002. However, the actual terms of the loan itself vary based upon the project. The rate will very based on the rating received from one of the major credit rating agencies and other terms and conditions are set project by project. It was assumed that debt service would not be required on the loan until the system was open to the public and generating income. However, it was also assumed that interest on the loan would begin accruing upon the disbursement of funds and that only one loan would be taken out with a staggered disbursement schedule.

Advantages

- The cost of capital is lower than many other sources.
- Substantial project oversight and support is provided by the Federal Transit Administration.
- The use of a TIFIA loan will serve as an inducement to attract private investment.
- Initial repayment may be deferred during construction period.

Disadvantages

- Requires creation of special authority or partnering with local governments and/or private firms. (Concession contract may qualify as an acceptable private partnership. It was assumed that a TIFIA loan would not be granted without the use of a concession contract.) The special authority would be responsible for making payments on the loan.
- Projects must compete for TIFIA funds. Though the park may be competitive, funding is not guaranteed.
- The TIFIA program has been successful in the past but has not yet been renewed by Congress beyond FY 2003.

The competitive nature of the TIFIA program should not be underestimated. The program is highly competitive and the current economic climate has increased the need for funds at state and local levels. The park will be required to compete against numerous other projects for TIFIA funding before a final financing package can be constructed.

3 Congressionally appropriated funds ("APF")

APF refers to funds appropriated by Congress for the express purpose of building the transit system at the Grand Canyon. These funds may be provided over a period of several years and could be used for construction of real property improvements and/or procurement of rolling stock.

Advantages

- APF have the lowest cost of capital
- Use of APF reduces the cost to the visitor

Disadvantages

- Federal Acquisition Regulations apply to the expenditure of APF, thereby potentially increasing the overall cost of the project.
- Multi-year funding may be problematic
- Availability is subject to prevailing political priorities

The cost of capital for appropriated funds was set to zero because there is no return expectation associated with them. Though there may be an opportunity cost associated with appropriated funds, the opportunity cost would have to be calculated across the entire spectrum of opportunities available to the federal government. The opportunity cost of appropriated funds, if any, is immaterial in relation to the size of the transit project at the park. An additional potential cost that should be considered is the time value of money. Congressionally appropriated funds do not earn interest during the construction period. Therefore, any delays in construction or project development may lead to increased costs, for which additional monies must be appropriated or alternate funding sources found.

4 NPS "equity" funds

NPS equity funds are those dollars provided by the National Park Service through discretionary accounts – existing programs such as line item construction, alternative transportation, fee demo or transportation fees. The advantages, disadvantages and costs of capital are the same as those for appropriated funds, though the opportunity cost for the NPS may be easier to calculate because the pool of possible investments is much smaller than that of the entire federal government. The demonstration status of the fee demo program could also be a disadvantage.

5 Non-appropriated Fund Instrumentality ("NAFI")

A Non-appropriated Fund Instrumentality is an organizational entity that performs an essential government function. It acts in its own name to provide or to assist other organizations in providing programs in support of an agency's mission.

A NAFI maintains custody and control over its non-appropriated funds and is responsible for the exercise of reasonable care to prudently administer, safeguard, preserve and maintain those appropriated fund resources made available to carry out its function. A NAFI is not incorporated under the laws of any State or the District of Columbia and enjoys the legal status of an instrumentality of the United States.

Non-appropriated Funds (NAFs) are cash and other assets received by NAF Instrumentalities from sources other than monies appropriated by the Congress of the United States. NAFs are Government funds; are used for the collective benefit of the agency and its constituents.

In the case of the NPS, NAFs are those funds generated by activities such as concessions, entry fees, and other user fees such as campgrounds or transit fees.

Among the key distinctions of a NAFI is the authority to utilize debt in a similar fashion to private sector businesses. In the case of the transit system at the Grand Canyon, a NAFI could be used to borrow from commercial banks, or perhaps the Treasury, based upon anticipated system revenues. The use of debt is common in the private sector and has worked well for agencies that utilize NAFIs including the Department of Defense and United States Department of Agriculture – Graduate School.

NAFIs also carry a high degree of credibility and accountability because they require rigorous accounting and budgeting procedures that utilize industry standard Generally Accepted Accounting Procedures.

Though NAFIs are an effective method of managing non-appropriated funds, the NPS does not currently have the authority to implement a NAFI. To effectively establish a NAFI within the NPS, the support of agency leadership would be necessary to acquire the needed authorization(s) and develop the institutional support structure required for successful implementation.

The estimated cost of capital for a NAFI is 7.2 percent based upon recent NAFI transactions completed by the Department of Defense.

Advantages

- Access to debt for project financing
- Low cost of capital
- Separate contracting authority
- Improved accountabilityDisadvantages
- Requires special authority
- Oversight and structure are not in place
- Requires time and expertise to develop
- Rules and regulations must be formulated

6 Federal Revenue Bonds

Revenue bonds are debt instruments backed by the pledge of anticipated cash flows from underlying assets and operations. They typically mature over a defined time period and pay investors a pre-determined rate of return. Revenue bonds are used by both private and public sector entities to finance large scale projects. In the case of public sector agencies, revenue bonds are most often issued by local or state municipalities to finance large public works projects. The NPS does not currently have the authority to issue revenue bonds and would have to rely on local governments to do so. Past efforts to authorize the Grand Canyon to issue revenue bonds have been unsuccessful.

The lack of authority to issue federal bonds and the historically unsuccessful attempts to provide the NPS with the authority to do so led to the determination that revenue bonds are not a viable funding source for the transit system at the Grand Canyon.

Revenue bonds could also be issued through a partnership with a local or regional transit authority. However, partnering local or regional municipality for the purpose of issuing bonds was deemed to be unacceptable to the NPS because the NPS would not have control over the bonding agency. Rather, control would rest with non-federal entities outside of the park.

7 Working Capital Fund

The key purpose of a working capital fund is to plan for long-term capital investments and accumulate the required funds over several fiscal years. Working capital funds are generally eligible to accept funds from appropriated and and/or reimbursable agreements and are managed at the agency level.

Advantages

- Funds are “no-year” funds
- WCF may accept contributions from appropriated and non-appropriated sourcesDisadvantages
- Requires special authority and legislation
- Requires start up capital
- Not suited to GRCA transit because of large start up costs
- Federal Acquisition Regulations (FAR) apply

Working capital funds (WCF) are not a viable option for financing the transit system at the park for two reasons. First, WCFs are not designed to fund large-scale projects in which major costs occur in the initial period. Instead, they are designed to build up funds over time to provide capital throughout a project’s life cycle. A typical use of WCFs is to provide for vehicle fleet replacement over time.

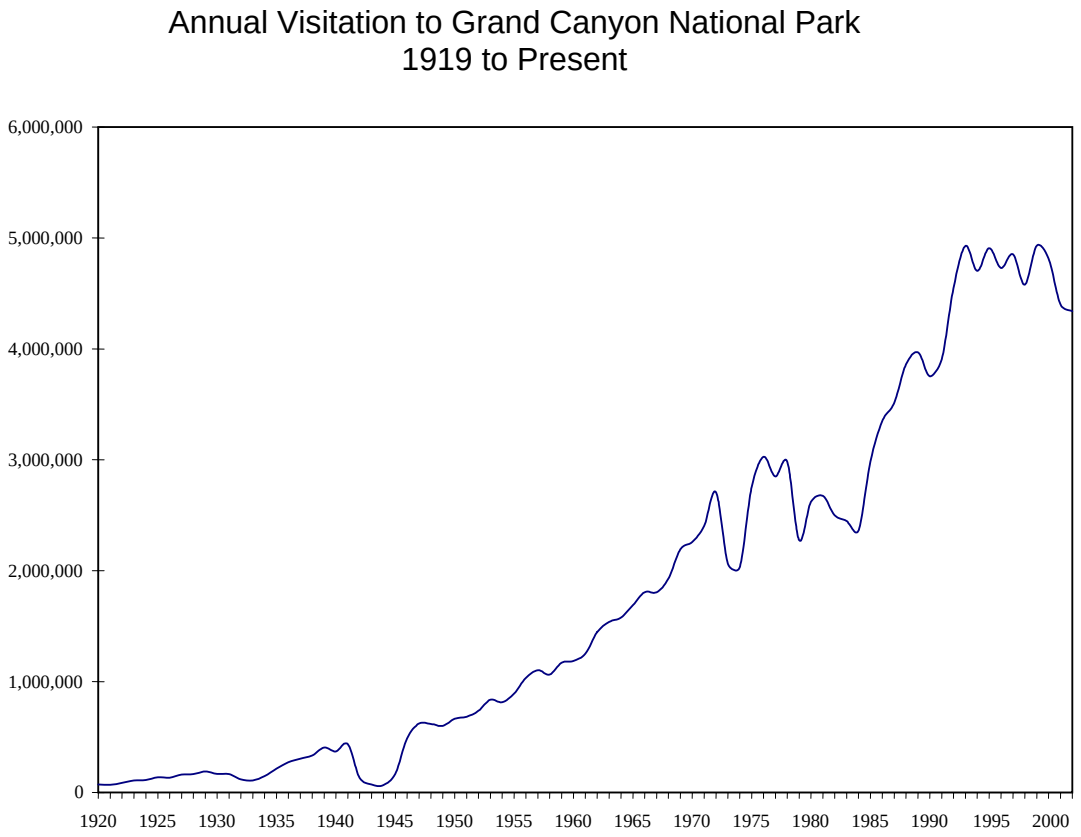
Second, WCFs would require special authorization from Congress that would take time and, in our opinion, is unlikely to be authorized. For these reasons, WCFs were determined to unsuitable for use in developing the transit system at the Grand Canyon.

Selected financing tools
The list of financing tools described in this report was narrowed based on significant criteria including legislative/regulatory constraints, financial viability, and applicability to the proposed transit system. The most workable alternatives were determined to be a **concession contract**, **TIFIA direct loan**, **appropriated funds**, and **NPS equity**. These financing tools have been used throughout the balance of this analysis.

2 Visitation and Ridership

1 Visitation

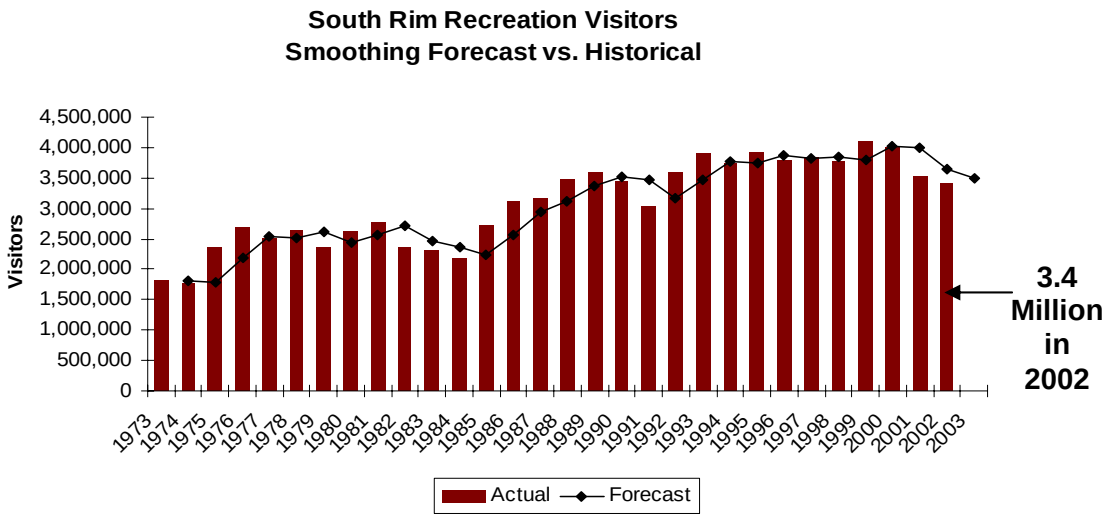
Visitation and ridership are integrally linked and are the fundamental factors affecting the financial viability of the proposed transit systems at the park. Following is a graph showing annual visitation to Grand Canyon National Park since its creation in 1919.



The initial development of transit options began when visitation to the South Rim was estimated to exceed four million visitors by the early part of the 21st century. Though visitation was on track to reach these levels, it has declined in recent years. As shown in the chart below, South Rim visitation only reached approximately 3.4 million recreation visitors in 2002. The chart depicts the relationship between actual visitation (red bars) and a smoothed trend line that indicates what might have been forecasted using historical data. The smoothed forecast is relatively close to actual visitation and indicates a

downward trend over the last few years. The Compound Annual Growth Rate (CAGR) for the entire period is 2.2 percent.

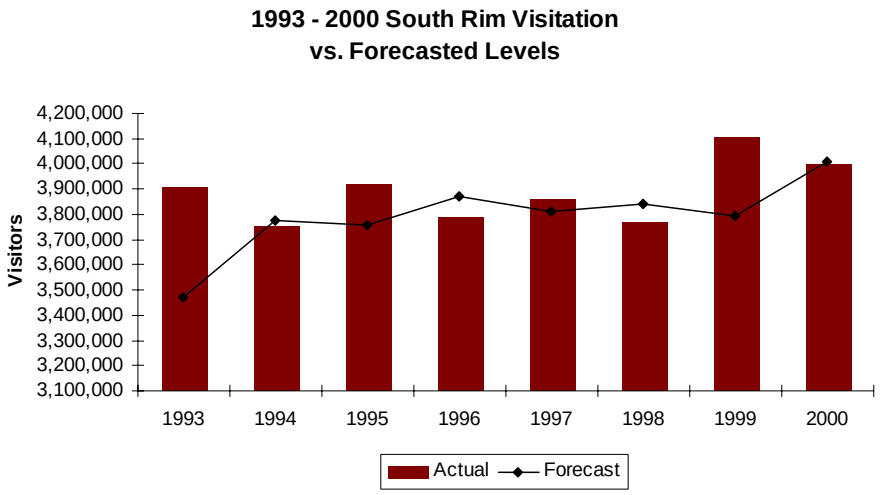
Exhibit 4 - Historical South Rim Recreation Visitation



Source – National Park Service

Though the CAGR was 2.2 percent for the last 30 years, this rate may be overly aggressive for forecasting future visitation. An analysis of the period between 1993 and 2000 presents a more current picture of visitation. During this period, the CAGR was zero percent. This presents the most conservative assumption for financial analysis. The following exhibit presents actual visitation from 1993 – 2000.

Exhibit 5 - 1993 – 2000 South Rim Recreation Visitation



Source – National Park Service

2001 and 2002 were not included in the long-term projection due the unique events of September 11, 2001 and the resulting downturn in tourism. However, the base year for creating projections will be 2002, thereby establishing an initial visitation level that accounts for the recent visitation downturn.

Multiple visitation scenarios were used to estimate future ridership and fee-paying visitor levels.

- Negative growth. Based on the Compound Annual Growth Rate (CAGR) from 1993 - 1998 (-0.7%)
- No growth, which is equal to the near term CAGR (0%)
- Growth. Based on the long term CAGR from 1973 – 2002 (+2.2%)

2 Ridership

Ridership is a key factor in the analysis because it impacts operational and capital costs. More riders lead to a higher operational cost and, under several scenarios, the system will expand when ridership reaches certain predefined levels. The design analysis assumes that a percentage of South Rim visitors will ride the transit system from the Grand Canyon Transit Center into the park and connect to the shuttle system from there. Ridership and payment of transit fees are not directly linked.

3 Transit Fee Payment

The number of visitors who pay a transit fee is the most important factor in the analysis because it represents the population that will bear the cost of the system. The larger the number of paying visitors, the lower the per person charge. Two scenarios were analyzed:

Fee Payment Scenario I.	Fee Payment Scenario II.

• All visitors will pay a transit fee. Passes are not honored for transit fees.
• The fee charged will be valid for entry for a seven-day period. Re-entries within that time period will not be charged an additional fee.
• It was estimated that 13 percent of visitors counted as recreation visitors entering the South Rim were re-entries. Therefore projections assume that 87 percent of total visitors would pay a fee for the transit system. The balance would not pay a fee as visitors who are re-entering within the allowed seven-day period.
	• All visitors who currently pay an entrance fee will pay the transit fee. Passes are honored for transit fees.
	• Estimated to be 50 percent of total south rim recreation visitors
	  ▪ Park estimates indicate that at least 50 percent of visitors currently use a pass.
	  ▪ Minors under the age of 17 do not pay an entry fee at this time. The park does not have an estimate of the number of minors visiting the park. To the extent visitors are under the age of 17, the quantity of fee-paying visitors would be reduced.

3 Financing Scenarios

The range of transit options, financing tools, visitation estimates, and fee-paying visitor scenarios yields a large number of potential outcomes. To simplify the analysis, the following predefined financing scenarios were developed by Pricewaterhouse Coopers, in consultation with Grand Canyon National Park. In each scenario, it was assumed that all ongoing operational and life cycle requirements would be funded through transit fees charged at the entrance station. Funds provided by a concessioner, through the TIFIA loan program, or by Congress are for capital investment costs only (including expansion). Each financing option can be classified as government equity, government debt, or private debt. The scenarios presented in this analysis are:

Exhibit 6 - Financing Scenarios Used in Analysis

Scenario	Govt. Equity Appropriated Funds	Govt. Debt TIFIA Loan	Private Debt Concession Contract
A	100%	0%	0%
B	66	0	34
C	33	33	34
D	50	33	17

Source - PricewaterhouseCoopers

4 Sensitivities

The final fee needed to support the transit system is dependent upon the mixture of variables identified in the preceding pages. The combination of transit option, visitation projection, fee-

paying visitor scenario, and financing packages yields an enormous number of possible outcomes. Here is a scorecard of the variables:

Variable	***Description***
Transit option	1, 2, 3, 4, 5A, 5B as described earlier
Estimated visitation	Negative Growth (-0.7%), No Growth (0%), Growth (+2.2%)
Fee-payment scenario	Scenario I – all South Rim visitors pay the transit fee (including pass-holders) Scenario II – an estimated 50% of South Rim visitors pay the transit fee as part of the entrance fee (the rest hold passes or are otherwise admitted free)
Financing package	Scenarios A, B, C, and D as shown in Exhibit 6 above

The financing scenarios described in Exhibit 6 were used to develop estimated prices per fee-paying visitor for each transit option and for each "fee payment " scenario. The table below presents the estimated transit fee for each transit option based on fee payment **Scenario I** and a **zero-growth** future visitation estimate.

Exhibit 7 - Estimated Transit Fees by Transit Option and Financing Mix:
Fee Payment Scenario I (all visitors entering for the first time within a seven day period pay transit fees), Visitation = Zero Growth

	Transit Fee by Financing Mix			
Transit Option	**A**	**B**	**C**	**D**
1	$5.70	$8.20	$9.00	$7.80
2	6.00	9.10	10.50	8.90
3	6.50	11.20	13.10	10.80
4	**Option 4 Is Not Applicable Under No Growth**			
5A	6.20	10.70	12.60	10.40
5B	6.60	12.00	14.20	11.60

NOTE – estimated transit fees are reported in unadjusted 2002 dollars. It was assumed that fees would increase at an annual rate of 2.5% going forward.

Source - PricewaterhouseCoopers

Clearly, the mix of financing tools has a significant impact upon the cost to the visitor who pays a transit fee. Under financing mix Scenario A, appropriated funds are used for construction and capital costs. In this case, the transit fees range from approximately $5.70 to $6.60 per fee-paying visitor. However, under Scenario B, when a concession contract is used for 1/3 of the capital cost, the fees for the same system increase an average of 61 percent.

Under fee payment Scenario II, the estimated transit fees increase substantially. The table below provides the estimated transit fees per fee-paying visitor under fee payment **Scenario II** assuming **zero growth** in visitation.

Exhibit 8 - Estimated Transit Fees by Transit Option and Financing Mix:
Fee Payment Scenario II (half of visitors pay transit fee), Visitation = Zero Growth

	Transit Fee by Financing Mix			
Transit Option	**A**	**B**	**C**	**D**
1	$12.00	$17.20	$9.00	$7.80
2	12.30	18.70	21.50	18.30
3	13.00	22.40	26.20	21.60
4	**Option 4 Is Not Applicable Under No Growth**			
5A	12.50	21.50	25.30	20.90
5B	12.90	23.40	27.70	22.60

NOTE – estimated transit fees are reported in unadjusted 2002 dollars. It was assumed that fees would increase at an annual rate of 2.5% going forward.

Source - PricewaterhouseCoopers

The transit fees charged to fee-paying visitors increase by approximately 100 percent for each transit option and financing scenario (versus the data presented in Exhibit 7). This change would have a very damaging impact on the financial viability of all of the proposed transit systems.

For instance, today, a family of four riding in the same vehicle can enter the park for an entry/transit fee of $20 ($5 per person) or buy a National Parks pass for $50.

Under the scenario described in Exhibit 7, the same family of four would pay between $48 and $90 in individual transit fees. Any entrance fees levied would increase this family's overall cost. Therefore, the option of purchasing a National Parks Pass for $50 (that would be honored for the transit and entrance fees) is the lower cost option for them. As a result, the number of passes sold would likely increase, thereby further reducing the number of fee-paying visitors, and increasing the per person cost. This is a vicious cycle that would ultimately bankrupt the system. Therefore, Fee payment Scenario II was eliminated from consideration. <u>To make the system financially possible, passes cannot be honored for transit fees.</u>

In addition to financing mix, transit option, and fee payment scenarios, estimated transit fees are sensitive to visitation estimates. Three visitation scenarios were considered in this analysis:

- Negative growth – based on the Compound Annual Growth Rate (CAGR) from 1993 - 1998 (-0.7%)
- No growth – equal to the near term CAGR (0%)
- Growth – based on the long term CAGR from 1973 – 2002 (+2.2%)

The following table illustrates the sensitivity of transit system option 5A to changes in visitation growth assumptions under each financing scenario. Option 5A was selected for illustrative purposes only it does not represent or imply a preference for option 5A.

Exhibit 9 - Sensitivity of Transit Fees to Changes in Visitation Growth Assumption

Visitation	Transit Fee by Financing Mix			
	A	B	C	D
Growth	$5.40	$8.80	$10.50	$8.60
Negative Growth	$6.80	$11.60	$13.70	$11.20
Zero Growth	$6.20	$10.90	$12.50	$10.30

Source – PricewaterhouseCoopers

5 Financial Conclusions for Options 1-5

1. Taxpayer support is likely necessary to construct a transit system at the Grand Canyon. The system does not appear to be economically viable without significant financial support from Congress. Ultimately, the dollar amount of support required depends upon the transit option selected and the financing package developed to support the system.
2. Regardless of financing package, the ongoing operating costs can and should be covered from system revenues (transit fees). In addition, the life cycle costs must be carefully forecasted to ensure that enough money is set aside in reserve to fund system repairs and maintenance in the future. Transit fees shown in this document include revenues for life cycle costs.

   In the event that ongoing and lifecycle costs are not paid for by system revenues (transit fees) there will be a requirement for substantial and ongoing appropriations. If appropriations are used, the establishment of a Working Capital Fund should be considered to pay for necessary system investments in the future. Additionally, the need for an operator would remain and the NPS should utilize a service contract or similar agreement to find and manage a qualified operator. Note: The Office of Budget objects to the proposal of using appropriations and believes that transit fees should be used to pay for lifecycle costs over time.
3. Visitor needs and preferences should be carefully considered before implementing a new transit system. At this time, an analysis of the price elasticity of demand has not been conducted. For instance, the effect on visitation of increasing the individual cost of a park visit is not known. If increased costs to the visitor substantially reduce park visitation, the costs per fee-paying visitor will have to further increase to continue to cover system expenses.
4. The relationship between increased transit fees and entrance fees should be further developed. If higher transit fees reduce the park's ability to collect entrance fees (that are currently retained under fee demonstration), the park's ability to meet other operational needs may be impaired.

   A substantial facility improvement program is funded through entry fees. As stated earlier, the transit fee portion of the entrance fee is currently equal to 15 percent of $20, or about $3 per vehicle. In the event that a transit system is constructed and fees of $5 - $11 or more are levied on each visitor, the ability of visitors to continue paying entrance fees may be severely reduced. The net result could be a substantial reduction in the amount of entrance fee revenue available to the park.

Appendix A
Supporting Report: An Analysis of Bus Sharing and Other Opportunities for Grand Canyon National Park

An Analysis of Bus Sharing and Other Opportunities for Grand Canyon National Park

Prepared For:
The Arizona Department of Transportation
206 S. 17th Avenue, 330B
Phoenix, AZ 85007-3213
April 20, 2001

ADOT Project T01-48-00032

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EXECUTIVE SUMMARY

The purpose of the study is to evaluate the feasibility of using leased, shared and/or jointly owned transit coaches to serve visitors at Grand Canyon National Park during the peak season. Towards this end, the following options have been identified for obtaining fleet without the full cost of coaches being borne by the Park:

- Joint purchase;
- Leasing;
- Purchase; and
- Non-Transit Coaches.

Data was collected through telephone interviews with representatives of several public and private entities. The types of entities contacted included:

- School Bus Providers;
- Transit Agencies;
- Manufacturers; and
- Contractors.

Table 1 lists the various entities contacted and whether or not that entity is able to meet the type of procurement identified, has fleet available, and is consistent with the established goals of this report. Information is provided only for those entities that provided substantive response to the inquiries of the study team. The table also divides fleet availability and goal consistency into long-term and short-term time periods.

School Buses

The option of using school buses to serve the GCNP was investigated since school buses typically are not operated when school is out of session. Therefore, a shared use of school buses was considered. Significant constraints were identified with this option early in the study process, and therefore this option is not recommended for short or long-term solutions. Constraints include:

- Length of school year overlap the peak season needs at GCNP:
- Seating configuration in school buses is not conducive to loads of adults with standees and would require modification prior to and following service at GCNP; and
- The peak-season for GCNP, being a portion of the off-season for school buses, is a time typically used for maintenance and repair.

Table 1

ENTITY	Method of Procurement			Fleet Availability		Consistency with Goals	
	Joint Purchase	Purchase	Lease	Short-Term	Long-Term	Short-Term	Long-Term
School Bus Providers							
Auto Safety House							
Agencies							
Denver, CO RTD		•		•		•	
Orange County, CA		•		•		•	
Phoenix, AZ		•		•		•	
Roaring Fork, CO	•		•	•	•	•	
Salt Lake, UT		•		•		•	
Summit County, CO							
Manufacturers							
Arizona Bus Sales		•	•	•	•		•
MCI		•	•		•		•
NABI		•			•		•
New Flyer		•			•		•
Contractors							
Paul Revere			•	•	•	•	

Manufacturers
Four manufacturers and one distributor were contacted. All but one of the manufacturers provided information. Manufacturers were identified as a possibility to lease and or purchase coaches. Manufacturers have little or no interest in the possibility of leasing transit coaches for the short or long term.

- Buses are typically built to the specifications of the end uses; and
- Manufacturers have provided some specialty vehicles through distributors who in turn have provided leases primarily to the private sector.

Transit Agencies
A total of 9 transit agencies were contacted, with responses being received from 7. Transit agencies were identified as a possibility for the GCNP to share the use, lease, or jointly purchase coaches. Options identified related to transit agencies also included the option to purchase or lease retiring fleet. Agencies provide alternatives for the short term, but not necessarily for the long-term:

- With the exception of Roaring Fork Transit Agency in Aspen, CO, agencies have little to no peak-season fluctuation in service or fleet needs;
- Agencies do not want to have a continuing commitment for buses which they intend to retire due to continuing needs for administration and maintenance;

- Agencies would be glad to negotiate the sale of a retiring fleet at nominal cost; and
- Aspen, CO has an interest in sharing and jointly purchasing future fleet due to the seasonal demand they experience with the ski resort industry.

Contractors
Detailed input was only received from one contractor. Contractors have an interest in acquiring new or used fleet for a contract operation of service. However, this may not be the best solution for GCNP because:

- Contractors will amortize lease rates based on the length of the operating contract. Lease rates would tend to be high due to the limited ability to lease the vehicles to others during the period of the year when they would be out of service at GCNP ; and
- Ordering new fleet for service at GCNP on a short-term contract would be difficult due to the uncertainty of the limited interest in vehicles of GCNP's specifications elsewhere.

Best Opportunities
Based on the information collected, the best opportunities for GCNP to address fleet needs over the short- and long-term, include the following:

- Short-term
  - Acquire at nominal cost retiring fleet from a transit agency, such as Salt Lake, which could provide a fleet of buses in good operating condition and of the same manufacture;
    - or -
  - Lease spare fleet from Aspen, CO which is parked during the summer months, understanding that while the fleet is currently all of the same manufacture (Neoplan), replacement fleet in the near future will result in a possible mix of available fleet during the summer months.

- Long-term:
  - Pursue joint purchase of both standard 40-foot and articulated 60-foot coaches with Aspen, CO;
    - or -
  - Pursue acquisition of a fleet dedicated to GCNP.

With each of these alternatives there are inherent advantages and disadvantages. These are further discussed in the *Overview of Investigation.*

INTRODUCTION

This study has been prepared by S. R. Beard & Associates for the Arizona Department of Transportation (ADOT). The report is organized into the following eight sections:

- Study Purpose
- Goals
- Methodology
- Overview of Investigations
- Summary
- Additional Considerations
- Contacts

STUDY PURPOSE

The purpose of the study is to evaluate the feasibility of using leased, shared and/or jointly owned transit coaches to serve visitors at Grand Canyon National Park during the peak season. This service will be in addition to that which is currently provided at the Park year round. For the purposes of the Grand Canyon, the peak season is defined as from Memorial Day through Labor Day. More specifically, this study is intended to identify options to acquire coaches in one of the manners listed above due to the fact that the operation of the expanded fleet at the Park will be on a peak season basis, and therefore not in operation for a period of 6 or more months of the year. Furthermore, the study is intended to evaluate the ability to use such non-traditional methods for obtaining fleet not only during the short term, defined as over the next five years, but for the long-term as well.

Towards this end, the following options have been identified for obtaining fleet without the full cost of coaches being borne by the Park:

- **Joint purchase**: the purchase of new or used coaches by the Park and one or more other entities which would have the use of the fleet for the months of the year when they are not in operation at the Park;
- **Leasing**: the leasing of new or used coaches from either a transit property or manufacturer or other organization from which the vehicles will be available during the peak season;
- **Purchase**: the purchase of new or used equipment for the sole use of the Park; and
- **Non-Transit Coaches**: the use of school buses as an alternative to the use of standard transit coaches.

GOALS

For this study, several goals have been outlined based on discussion with ADOT, GCNP, and FTA staff. These goals are categorized for both the short- and the long-term:

Short-Term Goals:

- Provide interim service with a mix of fleet that could be shared, leased, and or purchased.
- Provide reliable transit coaches for service to the visitors to the Park;
- Minimize impacts to system operations and maintenance that could occur with the introduction of a mix of fleet; and
- To the extent practicable, identify short-term fleet that serves the long-term goals of the Park for its transit fleet.

Long-Term Goals

- Provide ADA accessible low-floor, alternatively fueled coaches that are air conditioned;
- Maintain a reliable, modern fleet which provides a positive experience for Park visitors. and
- Determine the ability to use either shared, leased, or jointly purchased fleet.

METHODOLOGY

The methodology for this study is, in effect, three-fold. First, data was collected from a variety of sources regarding the availability of fleet and the relative interest in the methods that might be employed to make such fleet available for GCNP. The entities contacted are listed below. While each of these entities was contacted, not all provided responses and/or the same level of detail in their respective responses. This was particularly evident with the transit agencies, therefore a spreadsheet summarizing their comments is attached for reference as Table 2. The entities contacted include the following:

- School Bus Providers
  - Auto Safety House
  - Flagstaff Unified School District
  - Paradise Valley Unified School District

- Transit Agencies
  - Aspen, CO/Roaring Fork Transit Agency
  - Denver, CO/Regional Transit District
  - Las Vegas, NV/Regional Transportation Commission
  - Orange County, CA/Orange County Transportation Authority
  - Phoenix, AZ/Valley Metro
  - Salt Lake, UT/Utah Transit Authority
  - Summit County, CO/Summit Stage
  - San Diego, CA/Metropolitan Transit Development Board
  - Eagle County, CO/ECO Transit

- Manufacturers
  - Arizona Bus Sales (distributor)
  - Blue Bird
  - MCI
  - NABI
  - New Flyer

- Contractors
  - Paul Revere Transportation

OVERVIEW OF INVESTIGATION

The following section provides a summary of the conversations with those entities contacted that provided substantive input to the issues related to their respective area of expertise.

School Bus Providers

There are three major impediments to the use of school buses for peak season at the Park. First, the typical school year in Arizona, as elsewhere in the southwest, does not begin and end near the Memorial Day and Labor Day holidays. Many Arizona districts begin their school year during mid-August, and end their year in mid-May. With the passage of the Governor's education reform package last year, many districts will be increasing the length of their academic year over the next several years, further diminishing the window of time during which the vehicles are not in operation.

Second, is the fact that the seating configuration within a school bus is based on a much smaller area per passenger, resulting in seated capacity for 60 or more persons, versus 40-45 in a standard 40-foot coach. In order to carry loads of adults, as opposed to children, the seating configuration of the school buses would need to be modified at the beginning and end of each peak season. This would require several weeks at the beginning and end of the seasons.

Finally, the buses are all single door. This is a concern due to the fact that with the heavy loads experienced at GCNP during the peak periods, dwell times for boarding and alighting passengers would significantly increase, thus slowing overall operations.

Transit Agencies

From the transit agencies contacted, the following information was collected:

- Retirement plans for the next five years for currently operating transit coaches;
- Vehicle characteristics including fuel type, floor height, ADA accessibility, air conditioning, overall condition, and currently proposed retirement date; and
- Standard method of disposal for retired fleet.

In addition, inquiries were made of each of these agencies about the ability each might have to reduce fleet needs during the summer months if, in fact, ridership and/or levels of service, decline.

The following summarizes the information collected from each of the transit agencies contacted:

- Aspen, CO/Roaring Fork Transit Agency. While no buses are being retired at this time, RFTA does have fleet available for seasonal lease. Approximately 20 1983-84 Neoplans are available during the summer months because of the seasonal demand the agency experiences with the local ski resorts. All the buses are 40ft and are ADA accessible. RFTA also has an interest in sharing or jointly purchasing future fleet to increase its utilization.

- Denver, CO/Regional Transit District (RTD). RTD is currently replacing most of its 40ft fleet, with over 200 transit coaches being replaced in 2001 alone. Types of buses being retired include 1981 GMC's, 1983 MAN's, 1986-87 Neoplans, and 1989 RTS's. All are expected to have a service life remaining of at least 5 years and most are ADA accessible with air conditioning. A limited number of 1992 Gilligs are scheduled to be available in 2004, although the exact numbers are not known at this time. RTD uses a private auction house in Denver to sell their buses.

- Orange County, CA/Orange County Transportation Authority (OCTA). OCTA is currently replacing a large portion of its 40ft fleet with 60ft articulated coaches. During 2001-2002, OCTA will be retiring nearly 200 buses, including1987-88 Gilligs and 1990 New Flyers. Exact numbers by bus type are not known at this time. All buses include air conditioning and are ADA accessible. OCTA uses a private auction house in Torrence to sell its buses.

- Phoenix, AZ/Valley Metro. Valley Metro is in the midst of major expansion as the result of Phoenix' passage of Transit 2000 in March, 2000. There are, however, its several planned retirements of older fleet which will occur over the next few years. Included are 26 1981-82 GMCs and 25 MAN articulated buses which will be retired by 2003. An additional 63 1988-90 TMCs will be retired between 2003 and 2005. All are air conditioned and ADA accessible. Phoenix has suggested that the negotiated sale of all or a portion of the retiring fleet to GCNP would be greatly preferred over any lease arrangement.

- Salt Lake, UT/Utah Transit Authority (UTA). In order to meet demand for the 2002 Winter Olympics, UTA will be putting back into service dozens of buses that had been previously retired. Major rehabilitation efforts on these buses is being undertaken. Following the games in Salt Lake, UTA expects to re-retire approximately 100 buses, most of which are 1983-84 GM Classics but also some 1983-84 and 1987 Gilligs. None of the buses have air conditioning and they are not ADA accessible. Most are in decent condition with a service life left of at

least 5 years. UTA is unsure how they will dispose of the buses, with selling them privately being the most likely option.

- San Diego, CA/Metropolitan Transit Development Board. MTDB coordinates transit services in the San Diego metropolitan area and estimates that nearly 100 buses will be retired in 2001 from San Diego Transit, National City Transit, and County Transit System. Types of buses include 1983-84 Gilligs, 1985 Orions, 1989 Icarus, and 1990 Flexibles. All have air conditioning and are ADA accessible, although the condition of the lifts may vary. MTDB does not know what may be available after 2001, but is willing to negotiate the purchase of the current available fleet for a nominal cost.

- Summit County, CO/Summit Stage. Summit Stage has just recently started operating all of their routes year round. They operate routes which connect the communities of Silverthorne, Frisco, and Dillon with the resorts and related employment in Breckenridge, Keystone, and Copper Mountain. As a result, they do not have any seasonal surplus fleet, nor do they have any fleet which they intend to retire soon. Summit Stage is, in fact, short on fleet.

In summary, the transit agencies have a variety of fleet that will be available during the next several years that could provide the capacity necessary to meet GCNP's needs. However, the following issues were identified:

- Condition. The vehicles to be retired have exceeded their minimum useful life, as defined by the FTA. While this does not mean that they are necessarily no longer useful, it does mean that they are in excess of 12 years in age, and in many cases upwards of 20 years in age. Older equipment, due its years of service typically is less reliable, requires more frequent maintenance, and would be only a short-term solution;

- Reliability. Some of the vehicles to be retired are, in fact, newer than other coaches, which agencies have chosen to maintain in their fleets due to their reliability. In other words, agencies are disposing of 15-year old unreliable coaches, while keeping 20-year old coaches with better reliability;

- Emissions: Due to the age of retiring fleet, it is likely that diesel emissions will be higher than that of new buses. This is due not only to the normal wear and tear that the vehicles have experienced, but also due to the advancements in emission controls which taken place in recent years;

- Disposal. Many of the agencies either auction the retiring fleet, selling to the highest bidder, or turn fleet over to an auction house. Prior to disposal, many of the components which are in good repair and necessary for the maintenance of vehicles remaining in an agency's fleet, are removed and replaced with less reliable parts; and

- Sale. Due to the desire to eliminate retiring vehicles from fleets due to continuing maintenance needs, administrative hassles, and storage capacity, most indicated that they would not have an interest in leasing vehicles for which they have no remaining use.

Manufacturers
Manufacturers have not historically made a business practice of leasing their equipment, particularly to public agencies. They acknowledge that the predominant market for transit coaches is in the manufacture to the specifications of the agency who is acquiring the vehicle. This allows the manufacturers to provide a coach at a competitive cost while eliminating the need to have an inventory for sale. The drawback is the fact that few agencies have the same specification for their fleet. Therefore, if a coach were manufactured for lease, particularly on the short-term, the manufacturer would have a limited market for that coach at the time that the lease term ended. This would affect the residual value used in determining the lease rate.

Manufacturers have, on a limited basis, leased vehicles for which the manufacturer knows that there is a market beyond that of public transit. Over the road coaches, for example, have been leased to public agencies for use in express bus operations. However, these coaches, whether new or used, are marketable to the private sector, as well, so the risk to the manufacturer is less than it would be for a transit coach.

Manufacturers did note that they have distributors contact them regarding purchase for lease vehicles. However, these tend to be specialty vehicles leased to private entities, such as tour operators, rental car companies and resorts.

Contractors
Contractors have provided vehicles to entities for which they operate service on a contractual basis. This has primarily been accomplished through the use of older rehabilitated fleet. In some circumstances, the contractors have acquired new fleet for such service, but the lease rate or cost passed through to the agency, has been reflective of the need to amortize the 12 or more year life of the asset over a shorter timeframe. In the case of GCNP, the lease of a vehicle for use over a period of only several months would most likely result in a lease rate still based on 12-months use.

The incentive for the contractors to acquire fleet for GCNP would be a longer term operating contract. In this manner, the cost of the vehicles could be more easily amortized over the life of the contract. Regardless, the cost of leasing over a longer period is still going to be comparable with the cost of purchase.

SUMMARY
There are opportunities to be pursued for fleet for GCNP which may help address both short- and long-term needs.

Short-Term

For the short-term, the most realistic options appear to be either acquiring retiring fleet at nominal cost or leasing spare fleet. For the purchase option, the fleet which will be retired following the Olympics in Salt Lake City appears to provide the most realistic option for the following reasons:

- Buses have received significant service and repair to ensure their successful service during the Olympics and are estimated to have up to five years of remaining life as a result of the work performed;
- A fleet of more than 25 Gilligs will be available, reducing the need to store parts and train staff on the maintenance needs for buses of varying manufacture; and
- Once acquired, the buses may be painted or otherwise modified to serve the need of GCNP without compromise to the needs of another agency.

The drawbacks to the acquisition of this fleet are primarily related to maintenance and storage, and accessibility. Due to the age of the fleet, it must be assumed that maintenance needs will be greater than they would be with newer fleet. Of equal concern, is the fact that the facilities at GCNP are not yet suitable for the annual storage and maintenance of a larger fleet. Once acquired, storage and maintenance throughout the year would be the responsibility of GCNP. In addition, the Slat Lake buses are not ADA accessible, which is inconsistent with the goal of GCNP to provide an accessible fleet.

The option of leasing from Roaring Fork Transit Agency in Aspen, CO would provide GCNP with several benefits:

- Buses are available from approximately early May through late October;
- The buses have proven operation and reliability at high altitude;
- The buses would be not have to be stored and maintained at GCNP during the winter months; and
- GCNP would pay a lease rate based only on the time of the year that they would have the fleet in their possession.

As with the acquisition of buses, the leasing of buses would have several drawbacks:

- The available fleet is only 20 buses; and
- The buses, due to their having ski racks for winter use, are only 96 inches in width, as compared to the standard width of 102 inches, thus having less interior room for standees.

Roaring Fork Transit Agency is eager to put these buses in operation during the off-season for ski resorts due to the fact that they have difficulty obtaining federal funds for new fleet because FTA penalizes them on their spare ratios for the majority of the year when this fleet is not in operation.

Long-Term

There two realistic long-term alternatives. The first would include the acquisition of a dedicated fleet for GCNP. The benefits of this option are:

- Buses would be of a specification preferred by GCNP;
- Fleet would adhere to all goals of GCNP for its service, including the use of alternatively fueled buses which are low floor; and
- GCNP would have complete control over the maintenance and operation of the vehicles.

The drawbacks would include the fact that GCNP would have to provide year round storage and maintenance of the fleet.

The other long-term alternative would be the joint purchase of vehicles with Roaring Fork Transit Agency. The agency is interested in methods to expand its fleet through leveraging additional federal monies, and is interested in adding more articulated buses to its fleet. For GCNP, the benefits would be:

- Reduced capital outlay;
- Reduced responsibility for off-season storage and maintenance; and
- The ability to provide substantive input to the bid specifications for the fleet.

The drawbacks are issues GCNP would have to negotiate with Roaring Fork:

- Fuel type – Roaring Fork does not use natural gas and would prefer to use clean diesel, or possibly diesel hybrids;
- Floor height – Roaring Fork has operated only high-floor, but would consider low-floor; and
- Interior appointments – Roaring Fork provides a higher than standard level of interior appointments due to the fact that many of their riders are making trips of 45-60 minutes one-way.

These are both alternatives which could serve GCNP well.

OTHER CONSIDERATIONS

Given the summary outlined above, there are two issues which GCNP should keep in mind as any of these alternatives are pursued. First, is the issue of altitude. There are some older buses which have had difficulty with operation at higher altitudes. If GCNP were to consider the use of older fleet from low altitude locations such as San Diego, Salt Lake, or elsewhere, attention would need to be given to the ability of the fleet to operate reliably at the higher elevation.

Second is the issue of maintenance. Whether for the short- or long-term, GCNP might want to consider off-site locations for increased maintenance needs during the off-season. Auto Safety House in Phoenix has a large maintenance base with both preventative and heavy maintenance capabilities which is used for its school bus fleet.

The low demand season for this facility is the winter months when the school buses are in peak-season. This might provide an alterative for GCNP to have off-season maintenance, particularly heavy, performed by others.

CONTACTS

The following contacts provided the substantive input summarized in this report.

- School Bus Providers
  - Auto Safety House
    Dan Mahoney, (480) 596-1400

- Transit Agencies
  - Aspen, CO/Roaring Fork Transit Agency
    Ken Osier, (970) 920-1905 x209
  - Denver, CO/Regional Transit District
    Dean Shaklle, (303) 299-6922
  - Orange County, CA/Orange County Transportation Authority
    Dale Withers, (714) 560-5926
  - Phoenix, AZ/Valley Metro
    Al Villeverde, (602) 262-7242
  - Salt Lake, UT/Utah Transit Authority
    Dale Woodbury, (801) 287-4674
  - San Diego, CA/Metropolitan Transit Development Board
    Tim Price, (619) 231-1466
  - Summit County, CO/Summit Stage
    Jim Smith, (970) 668-0999

- Manufacturers
  - Arizona Bus Sales
    Paul Miller, (800) 862-5478
  - MCI
    Jay Daabs, (800) 743-3624
  - NABI
    Devon Ikenberry, (805) 529-5080
  - New Flyer
    Rick Brandenburg, (719) 395-9284

- Contractors
  - Paul Revere Transportation
    Richard Brown/Jane Daly, (617) 523-3131

Table 2
Buses Available by Provider

	Phoenix – Valley Metro Al Villaverde (602) 262-7242	Denver – RTD Dean Shaklle (303) 299-6922	Salt Lake City – UTA Dale Woodbury (801) 287-4674	Orange County – OCTA Dale Withers, Fleet Engineer (714) 560-5926	San Diego – MTDB Elliot Horwitz (619) 557-4502	Aspen – RFTA Ken Osier (970) 920-1905 x209
Are any buses being retired or available for lease during the next 5 years?	Retired buses only. No spare fleet available for lease.	Retired buses only. No spare fleet available for lease.	Retired buses only. No spare fleet available for lease.	Retired buses only. No spare fleet available for lease.	Retired buses only. No spare fleet available for lease.	Buses available for seasonal lease. No retired buses available.
What type and year of bus?	1981-82 GMCs 20 available 2001, 6 available '02 1985 MANs 21 available 2001 1990,'92 BIAs (Orion II) 8 available 2002 1988-90 TMCs 35 available 2003, 3 available '04, 25 available '05	1981 GMCs 20-30 available 2001 1983 MANs 40 available 2001 1986-87 Neoplans 150 available 2001 1989 RTSs 5 available 2001 Methenol engines originally; converted to diesal. 1992 Gillig Phantoms 20 available 2004-05	1983-84 GM Classics 40-50 available 2002 45 seats, 2 doors, fiberglass seats Need new tires. Engine: CV92 Transmission: B730 1983-84 Gilligs # unknown; available 2002 (post Olympics). Better condition than '87 Gilligs. 1987 Gilligs 25 available 2002 (post Olympics) Engine: CV92 Transmission: HTB748	1987 Gilligs # unknown; available 2001 1988 Gilligs 60 available late 2001 1990 New Flyer # unknown; available 2001-02 Note: OCTA plans to replace most of its aging 40ft fleet with articulated coaches.	*From County Transit System:* 1985 Orions 9 available late 2001 1983 Gilligs 5 available 2001 *From National City Transit:* 1983 Gilligs 6 available 2001 1990 Flexibles 8 available 2001 *From San Diego Transit:* 1989 Icarus 25 available 2001 1983-84 Gilligs 43 available 2001	1983-84 Neoplans 20 available for seasonal lease during summer months (25% of total fleet).
40ft or 60ft?	All 40ft	All 40ft EXCEPT for '83 MANs which are 60ft articulated coaches	All 40ft	All 40ft	All 35-40ft	All 40ft
Floor height?	All high floor	All high floor	All high floor	All high floor	All high floor	All high floor
ADA accessible?		Yes for all. '89 RTS have rear door lift.	No for all	Yes for all	Yes for all, although the condition of the lifts vary.	Yes
Air conditioned?	Yes for all	Yes for all EXCEPT '81 GMCs which have swamp coolers.	No for all '87 Gilligs have swamp coolers	Yes for all	Yes for all	
What is the condition of the buses? Do they have a service life of at least 4 years left?	Poor to Good. All are being retired but have a service life left of at least 5 years.	Poor to Good. All are being retired but have a service life left of at least 5 years.	Decent. GM Classics and '83-84 Gilligs have been retired but are being put back into service for the 2002 Winter Olympics. All have a service life left of at least 5 years.	Decent. Noted that '87 Gilligs corrode easily.	Poor to Good. All are considered to have a service life left of at least 5 years with the exception of the 1989 Icarus.	Decent. Buses being used during the winter months around Aspen.
What is the procedure for obtaining buses? Sell, auction, lease, etc?	Buses are traditionally auctioned. For another agency Phoenix would discuss a negotiated sale at a nominal cost.	Auction. Mr. C's Auto Auction (800) 559-7357	UTA has not sold buses to public agencies in the past. They sell privately rather than using an auction house.	Auction. Ken Porter Auction House (805) 966-0017	Private sale or auction. MTBD would be willing to sell at a nominal cost. MTDB auctions buses through the Quarterly San Diego County Auction.	Lease. RFTA interested in seasonal lease of buses during the summer months.

Appendix B
Supporting Report: Grand Canyon National Park Pavement Assessment Study

Final Report

Grand Canyon National Park Pavement Assessment Study

ADOT Contract T01-49-H0001
ADOT Project TPD01-48-00026

April 2001

PREPARED FOR

Arizona Department of Transportation
and National Park Service, Grand Canyon National Park

Kimley-Horn and Associates, Inc.

FINAL REPORT
GRAND CANYON NATIONAL PARK PAVEMENT ASSESSMENT STUDY

ADOT Contract T01-49-H0001
ADOT Project TPD01-48-00026

Introduction

A market analysis conducted by the National Park Service (NPS) indicates that annual visitation to the South Rim Grand Canyon National Park will increase to 5.8 million people in 2010. In response to projected increases in annual tourism, the NPS is developing plans for improving access to and from the Park. The NPS is investigating the feasibility of providing transit shuttle service between the Grand Canyon Transit Center (GCTC) in Tusayan, Arizona and designated shuttle stops located within the Park. Transit service, internal to the Park will transport Park users between shuttle stops and tourist destinations and attractions throughout the Park.

NPS has requested assistance from the Arizona Department of Transportation (ADOT) in evaluating transit shuttle service between Tusayan and the Park. ADOT assistance is to focus on a field assessment of existing pavement surface conditions on NPS roadways that will serve as the GCTC-to-Park shuttle route. The assessment will also analyze the structural capacity of the existing pavement design to meet anticipated 2010 traffic projections, by volume and type of vehicle. For roadways that warrant short-term pavement preservation and/or longer-term improvement to meet 2010 traffic loads, recommendations and cost estimates will be developed for upgrading the pavement surface.

Scope of the Study

Kimley-Horn and Associates, under contract to ADOT conducted an assessment of pavement surface conditions on transit shuttle routes within the Park and developed recommendations and construction cost estimates for pavement improvements. The study included the following activities.

1. Initial Field Review

On March 5, 2001, a meeting was conducted with ADOT and NPS personnel to finalize the scope of the study and conduct an initial review of roadways to be assessed during the study. It was determined that existing pavement conditions were to be surveyed and pavement design concepts for 2010 developed for approximately 9.5 miles of roads within the South Rim Grand Canyon National Park. The roads to be included in the assessment include those Park roadways on which transit shuttle service is to be provided between GCTC and the Park. This shuttle transit route is defined later in this report.

2. Data and Construction Documents Review

Information provided by the NPS included construction documents, unit construction costs for roadway construction projects within the Park, 2000 visitor and traffic volumes, and traffic projections for 2005, 2015, and 2025. A summary of relevant information from these sources of information is provided later in this report.

3. Pavement Assessment Standards and Criteria Development

Following the initial field review and the review of NPS-provided information, a technical memorandum was developed to guide the pavement condition assessment. Draft Technical Memorandum Number 1 entitled *Pavement Assessment Criteria For Grand Canyon National Park Pavement Assessment Study* presented the criteria and procedures proposed for use in the assessment of pavement conditions. ADOT and NPS reviewed the draft memorandum and excerpts from the revised memorandum are integrated in this report.

4. Pavement Condition Survey

A visual condition survey was performed at Grand Canyon National Park on March 23, 2001. The survey consisted of walking and driving the entire 9.5-mile transit shuttle route to observe, document, and photograph pavement distresses. Field examination resulted in a determination of cause of pavement distress including load-related causes, climate-related causes, or other causes such as exposure to oil or fuel spills.

5. Pavement Needs Assessment

Survey notes and photographs were recorded during the visual condition survey to document observed conditions by type of pavement surface distress. Engineering judgement was used to determine if and what type of remedial pavement preservation was necessary to correct observed deficiencies. Field records and photographs were used to develop recommendations for needed pavement preservation projects. In addition, pavement structure design concepts were developed for projected 2010 traffic loads. Design concepts were developed using state-of-the-practice pavement design methods, 2010 traffic projections, and a design vehicle specified by NPS. Following the development of design concepts, comparisons were made with existing pavement structures, as shown on construction documents, to determine pavement structure requirements for 2010.

6. Recommendations

For roadways that warranted pavement upgrades, recommendations and construction cost estimates were developed.

Park Roadways Considered in the Pavement Assessment

The pavement condition assessment was limited to Park roads that are planned to be used by the shuttle transit vehicles operating between the GCTC and the Park. Based on discussions with NPS personnel, the shuttle service between Tusayan and the Park will enter and exit the Park via the South Entrance Station located on State Route 64. From the South Entrance Station, transit vehicles will follow a loop route within the Park. From the South Entrance Station, transit vehicles will proceed to the northeast via South Entrance Road to two shuttle stops located at the Canyon View Information Plaza (CVIP). Transit vehicles will travel between Information Plaza stops via a connecting roadway, south of the CVIP area. From the CVIP, transit vehicles proceed west on South Entrance Road to Market Plaza. From Market Plaza, transit vehicles proceed west on Village Loop Road (South Leg) to shuttle stops west of Center Road and at the Maswik Transportation Center. From the turnaround near the Maswik Transportation Center, transit vehicles return to the South Entrance Station via Village Loop Road (South Leg) to Center Road to South Entrance Road.

From the South Entrance Station, vehicles return to Tusayan via State Route 64. Field measurements indicate that the shuttle loop, starting from and returning to the NPS boundary (located approximately 0.5 miles south of the South Entrance Station) is 13.1 miles in length and traverses approximately 9.5 miles of Park roads.

Review and Evaluation of Available Information

Historical records provided by the NPS included construction documents, final construction reports (containing unit construction costs), 2000 visitor and traffic volumes, and future traffic projections for 2005, 2015, and 2025. A summary of relevant information is provided below.

Construction Documents

Design plans, "as-constructed" plans, and final construction reports were obtained from NPS for all roads included in the pavement assessment except for the connecting roadway between the CVIP transit stops. The period of construction documents included 1987 to 1996. The information contained in these construction documents included pavement design, pavement thickness and composition, construction dates, soil classifications, construction costs, traffic forecast, and limited maintenance history. **Exhibit 1** lists the construction documents that were received from NPS.

Exhibit 1 — Construction Documents Received from the National Park Service

PROJECT NUMBER	PROJECT NAME	PROJECT LENGTH	DATE
PRA-GRCA 16(1),500(1), 501(1), and 12(3)	Center Road, Village Loop Road, Village Loop Bypass, South Entrance Road (As Constructed)	**Schedule A**, 1.93 miles (Center Road, Village Loop Road, and Village Loop Bypass) **Schedule B**, 2.58 miles (South Entrance Road)	Nov. 1995
PRA-GRCA 500(2) and 12(4)	Village Loop Road and South Entrance Road (Construction Plans and Final Construction Report)	**Schedule A**, 1.13 miles (Village Loop Road and South Entrance Road) **Schedule B**, 1.16 miles (South Entrance Road) **Schedule C**, 1.21 miles (South Entrance Road)	Jan. 1996 May 1998
PRA-GRCA 602(1)	Maswik Parking Area (Construction Plans and Final Construction Report)	0.81 miles	June 1991 July 1996
PRA-GRCA 110(A)	South Rim Entrance Station (As Constructed and Final Construction Report)	N/A	June 1987
PRA-GRCA 12(1)	Rehabilitation, Entrance Station, and Sign and Parking Areas, South Entrance Road (Construction Plans and Final Construction Report)	6.71 miles	July 1987
PRA-GRCA 12(2)	South Entrance Road (Final Construction Report)	6.4 miles	Oct. 1995

Typical section pavement designs, as-constructed pavement sections, and dates of construction for Park roadways are summarized in **Exhibit 2**.

Exhibit 2 — Summary of Typical Pavement Sections

ROAD	TYPICAL PAVEMENT SECTION	DATE OF CONSTRUCTION/DESIGN
Center Road: South Entrance Road to Village Loop (South Leg)	4 inches, hot asphalt pavement (2 lifts) 4 inches, crushed aggregate 6 inches, recycled surfacing	1995
South Entrance Road: (Old) Visitor Center to Village Loop Road	4 inches, hot asphalt pavement (2 lifts) 4 inches, crushed aggregate 6 inches, recycled surfacing	1995
Village Loop Road: East of Center Road to west of Center Road	4 inches, hot asphalt pavement (2 lifts) 4 inches, crushed aggregate 6 inches, recycled surfacing	1995
Village Loop Road: South Entrance Road to east of Center Road	5.5 inches, hot asphalt pavement (2 lifts) 3 inches, recycled asphaltic base 9 inches, existing surface depth	1996 (design)
Maswik Transportation Center Turnaround	3 inches, hot asphalt pavement (2 lifts) 8 inches, aggregate base	1991 (design)
South Entrance Road: Boundary to (Old) Visitor Center	5.5 inches, hot asphalt concrete pavement (2 lifts) 6 inches, crushed aggregate base or, 6 inches, existing surface and base	1987 (design)

Traffic Volumes

U.S. Department of the Interior Monthly Use Reports for calendar year 2000 were provided by the NPS. These reports contain entering volumes of visitors and vehicles, categorized by destination, vehicle type, and trip purpose. These data were not categorized by road segment within the Park and were not used in the pavement assessment.

Future Traffic Projections

Traffic projections were developed and provided by NPS through DEA, Inc. Traffic projections were provided as one-way traffic volumes on Park roadways for the years 2005, 2015, and 2025. Projections were categorized by point of entry to the Park, type of trip (trip destination), and type of vehicle. Point of entry was stratified as entering the South Entrance Station and the East Entrance Station.

Trip type via passenger car or recreational vehicle was stratified by overnight stay at the Village, administrative trip to the Village, and trip directly to an exit station. Trips entering at the East Entrance Station and proceeding to the South Entrance Station were further stratified by the destination (the Grand Canyon Transit Center in Tusayan or other). Vehicle type stratification included tour bus, transit bus, and non-transit (passenger vehicles, recreational vehicles, and administrative vehicles, combined).

Exhibit 3 summarizes the traffic volume projections by road segment. Traffic volume projections were determined by combining one-way traffic projections on a given segment of roadway. For example, traffic projections on the South Entrance Road between the Park Boundary and Center Road was a combination of (1) overnight passenger cars and recreational vehicles entering and exiting the Park, (2) Park administrative traffic, (3) passenger vehicles and RVs traveling between the South Entrance Station and the East Entrance Station with no destination within the Park, (4) tour buses entering at the South and East Entrance Stations traveling this segment of South Entrance Road, and (5) transit buses entering and exiting the Park via the South Entrance Station. Traffic volume projections were determined in a similar fashion for other Park roadways with the assumptions that (1) entering volumes equal exiting volumes on a daily basis, (2) vehicles take the most direct route to and from various Park destinations, and (3) vehicles entering the East Entrance Station that do not have an overnight destination will exit the Park immediately at the South Entrance Station (and visa versa).

Exhibit 3 — Summary of Future Traffic Projections

ROUTE SEGMENT/VEHICLE TYPE	DAILY 2005 TRAFFIC PROJECTION	DAILY 2015 TRAFFIC PROJECTION	DAILY 2025 TRAFFIC PROJECTION
South Entrance Road: Park Boundary to Center Road			
-Passenger cars/RVs/admin.	5,502	5,803	6,060
-Tour uses	288	312	332
-Transit buses	716	784	842
South Entrance Road: Center Road to Desert View Drive			
-Passenger cars/RVs/admin.	1,850	2,008	2,144
-Tour uses	144	156	166
-Transit buses	358	392	421
South Entrance Road and Canyon View Information Plaza Road: Desert View Drive to Village Loop Road			
-Passenger cars/RVs/admin.	0	0	0
-Tour uses	170	184	196
-Transit buses	358	392	421
Village Loop Road: Canyon View Information Plaza Road to Maswik Transportation Center			
-Passenger cars/RVs/admin.	3,774	3,854	3,922
-Tour uses	340	368	392
-Transit buses	716	784	842
Center Road: Village Loop Road to South Entrance Road			
-Passenger cars/RVs/admin.	1,887	1,927	1,961
-Tour uses	170	184	196
-Transit buses	358	392	421

Traffic volumes for the 2010 design year were estimated by interpolating between 2005 and 2015 traffic projections and are summarized in **Exhibit 4**.

Exhibit 4 — 2010 Design Year Traffic Projections

ROUTE SEGMENT/VEHICLE TYPE	DAILY 2010 TRAFFIC PROJECTION
South Entrance Road: Park Boundary to Center Road	
-Passenger cars/RVs/admin.	5,653
-Tour uses	300
-Transit buses	750
South Entrance Road: Center Road to Desert View Drive	
-Passenger cars/RVs/admin.	1,929
-Tour uses	150
-Transit buses	375
South Entrance Road and Canyon View Information Plaza Road: Desert View Drive to Village Loop Road	
-Passenger cars/RVs/admin.	0
-Tour uses	177
-Transit buses	375
Village Loop Road: Canyon View Information Plaza Road to Maswik Transportation Center	
-Passenger cars/RVs/admin.	3,814
-Tour uses	354
-Transit buses	750
Center Road: Village Loop Road to South Entrance Road	
-Passenger cars/RVs/admin.	1,907
-Tour uses	177
-Transit buses	375

Pavement Condition Survey

The pavement condition survey was performed by road section. **Exhibit 5** defines the survey sections.

Exhibit 5 — Pavement Survey Sections

Roadway Section No.	Beginning Location	Ending Location	Approximate Length
1 (South Entrance Road)	NPS Boundary (0.5 miles south of South Entrance Station)	South Entrance Station	0.5 miles
2 (South Entrance Road)	South Entrance Station	Intersection with Center Road	1.7 miles
3 (South Entrance Road)	Intersection with Center Road	Intersection SR 64 (to East Entrance Station and Cameron)	1.4 miles
4 (South Entrance Road)	Intersection SR 64 East (to East Entrance Station and Cameron)	Intersection Canyon View Information Plaza Road	0.4 miles
5 (Canyon View Information Plaza Road, excluding concrete pavement)	Intersection with South Entrance Road	Intersection with Village Loop Road	2.5 miles
6 (Canyon View Information Plaza Road)	Concrete Bus Turnarounds	Concrete Bus Turnarounds	
7 (Village Loop Road)	Intersection with Canyon View Information Plaza Road	0.2 miles west of Intersection with Canyon View Information Plaza Road	0.2 miles
8 (Village Loop Road)	0.2 miles west of Intersection with Canyon View Information Plaza Road	Maswik Transportation Center	0.6 miles
9 (Center Road)	Intersection with Village Loop Road	Intersection with South Entrance Road	1.5 miles

The condition survey for both rigid (concrete) and flexible (asphalt) pavement facilities consisted of a visual inspection of the pavement surfaces for signs of distress resulting from vehicular traffic and environmental influences. The visual pavement condition survey provided an indication of the rate of deterioration of a pavement from a functional point of view and an indication of structural distress. The visual survey can not however, predict the remaining structural capacity of a pavement.

The visual condition survey was performed at Grand Canyon National Park on March 23, 2001. The visual condition survey included both walking and driving. Distresses were recorded and found to be typical of pavement surfaces for the various ages of the roadway surfaces. Examination of specific distresses indicated whether distress was due to load, climate, or other causes. Typical load-related distresses result when surfaces are over-stressed by applied loads, usually from vehicles. Environment-related distresses typically arise due to exposure to climatic conditions, undermining, and temperature cycles. Other related distresses are caused by actions not related to load or environment, such as oil or fuel spills.

Pavement Distress Observations by Section

During the visual condition survey, certain distress types were observed for asphalt concrete (AC) and Portland cement concrete (PCC) pavements. Descriptions of these distresses, by pavement survey sections defined in Exhibit 5 are shown in **Exhibit 6**. The distress definitions presented in Exhibit 6 are consistent with those found in the US Army Corps of Engineers *Concrete Distress Manual*.

Existing Conditions and Observed Unusual Distresses

In general, existing pavement conditions are typical of pavement surfaces of the age of the roadways surveyed and as a result, immediate corrective actions are not warranted. However, several areas of unusual distress were observed during the visual survey and should be corrected as part of routine pavement maintenance or as part of programmed pavement reconstruction or preservation projects. The areas of unusual distress are described below:

- Bleeding was observed in every section of AC pavement, regardless of the age of the pavement. Bleeding distress is irreversible and can be avoided with an appropriate AC mix design and/or appropriate pavement construction inspection. Severe bleeding will create unsafe surfaces with low friction coefficients, especially during wet pavement conditions. While it is not necessary to take immediate corrective actions to resolve bleeding distresses, mitigation for bleeding is to mill existing distressed pavement and replace the surface with an appropriate AC design.

- Moderate distress was observed at a majority of intersections of Park roadways. Intersections are areas of high stress from high traffic volumes, vehicle stops and starts, and vehicle turning maneuvers. Typically, intersections represent areas where pavement distress is high and failures occur more often than non-intersection areas. While it is not necessary to take immediate corrective actions to resolve intersection distresses, mitigation involves the overlay of AC pavement with an appropriate mix design or the replacement of AC pavement with PCC pavement in the intersection areas.

- The bus pullout west of the intersection of Village Loop Road and Canyon View Information Plaza Road is severely rutted. Bus vibrations, starting, and stopping are the principal cause of the distress. While it is not necessary to take immediate corrective actions, this pullout should be replaced as soon as possible with a Portland cement concrete mix.

Cracking was observed on the newly constructed PCC pavement near the Canyon View Information Plaza transit stops. This distress is unusual for a newly constructed pavement surface and corrective action in the form of crack filling should be initiated as a part of routine maintenance. Failure to take action in a timely manner may result in further distress as a result of water infiltration and temperature cycles.

Pavement Design Concepts for 2010

Pavement design procedures published by the American Association of State Highway and Transportation Officials (AASHTO) were used as the basis for developing pavement design concepts for 2010 traffic projections. The design concepts assumed the use of the existing material as a base for pavement surface overlay. From the projected traffic and appropriate application of design vehicles including the use of a 40-foot bus as a transit design vehicle, AC overlay pavement depths were determined. These required overlays are summarized in **Exhibit 7**. Construction documents for

Kimley-Horn and Associates, Inc.

Exhibit 6 – Distress Descriptions

	Description	Section (see Exhibit 5)									Example
		1	2	3	4	5	6	7	8	9	
Asphalt Concrete (AC) Distress Definitions	**Bleeding -** A film of bituminous material on the pavement surface that creates a shiny, reflective surface that usually becomes sticky. Excessive amounts of asphalt cement in the mix, excessive application of a bituminous sealant, and/or low air voids content cause bleeding. Pavement bleeding occurs when asphalt fills the voids of the mix during hot weather and then expands onto the pavement surface. Because the bleeding process is not reversible during cold weather, asphalt accumulates on the surface.										
	Longitudinal Cracks - Cracks that are parallel with (longitudinal) or across (transverse) with to the facility centerline. A poorly constructed paving lane joint or shrinkage of the AC surface due to temperature cycling or asphalt hardening may cause them.										
	Transverse Cracks - Transverse cracks extend across the pavement at approximately right angles to the facility centerline or paving direction. These cracks typically occur when the asphalt concrete shrinks due to temperature cycling or hardening of the asphalt binder. They are not usually load-associated.										
	Alligator or Fatigue Cracking - Typically associated with older asphalt pavements with relatively high volumes of commercial traffic or at intersections, this distress type appears as a series of interconnecting cracks and is caused by fatigue failure of the asphalt concrete surface under repeated traffic loading. Alligator cracking is considered a major structural distress.										
	Block Cracking - Typically associated with older asphalt pavements with relatively high volumes of commercial traffic or at intersections, block cracking is defined by interconnected cracks that divide the pavement into approximately rectangular pieces. Block cracking is caused mainly by shrinkage of the asphalt concrete and daily temperature cycling. This type of distress is not load-associated and usually indicates that the asphaltic concrete has hardened significantly.										
	Rutting - Often occurring in conjunction with alligator cracking, rutting is a surface depression in the wheel path and stems from a permanent deformation in any of the pavement layers or subgrade. Consolidation or lateral movement of the materials due to traffic loads usually causes it. Significant rutting can be an indicator of a major structural failure of the pavement.										
	Patching - An area of pavement that has been replaced with new material to repair an existing problem or utility cut, a patch is considered a distress no matter how well it is performing. A patch, or the pavement adjacent to the patch, usually does not perform as well as the original pavement section. Some roughness is usually associated with this distress.										
	Slippage - This distress type is an area of pavement that has moved horizontally due to the forces exerted upon it. Typically associated with pavements that had been grooved, slippage occurs when there is a poor bond between the surface and the next layer in the pavement structure.										

Exhibit 6 – Distress Descriptions (Cont'd)

	Description	Section (see Exhibit 5)									Example
		1	2	3	4	5	6	7	8	9	
Portland Cement Concrete Pavement (PCCP) Distresses Definitions	**Linear Cracking** - Typically caused by a combination of load repetition, curling stresses, and shrinkage stresses, low severity cracking is usually related to warping or friction and not considered to be a major structural (load-related) distress. Medium or high severity cracking is usually considered as a major structural distress.										
	Spalling - Spalling is a breakdown of the concrete slab edges and results from excessive stresses at the joint or crack. Spalling is caused by infiltration of incompressible materials (such as soil, sand, or rocks), traffic loads, or weak concrete at the joint combined with traffic loads.										

Sections 5 and 6 were not available and a determination of a pavement section design concept was not possible.

Exhibit 7—AC Pavement Overlay Sections for 2010

Survey Section	Overlay Required (Inches)
Section 1: South Entrance Road	1.00
Sections 2 through 4: South Entrance Road	3.00
Sections 5 and 6: Canyon View Information Plaza	Information on existing pavement structure is unknown
Section 7: Village Loop Road	1.00
Section 8: Village Loop Road	3.00
Section 9: Center Road	3.00

Given observations of widespread bleeding on all asphalt pavement surfaces, it is recommended that at least 2 inches of existing AC surface be milled and replaced in addition to the overlay sections shown in Exhibit 7.

The estimated unit cost for a 2-inch mill and replace plus a 1-inch AC overlay is $210,000 per mile. The estimated unit cost for a 2-inch mill and replace plus a 3-inch AC overlay is $330,000 per mile. These cost estimates reflect 2001 dollars and are based on 2000 ADOT construction costs for pavement projects in Coconiño County plus 10 percent to account for construction projects in outlying areas. Additionally, a 15 percent contingency was added to offset unforeseen costs associated with these projects.

Recommendations

According to the pavement assessment described above, all of the roadway pavements within the Park that will serve as the GCTC-to-Park transit route will need to be upgraded to meet 2010 loading requirements. Because of this and the routine pavement surface maintenance to correct unusual distresses, it is recommended that a program be established to replace all transit route pavement surfaces. Program implementation should be in accordance with the need to correct observed distresses.

The highest priority project that should be completed is Section 7 (Village Loop Road from the intersection of Canyon View Information Plaza Road to 0.2 miles west of that intersection). This project includes full replacement of the bus pullout described above with a Portland cement concrete pavement and includes milling and replacing existing roadway AC to a depth of 2 inches with 3 inches of a high performance SHRP (Strategic Highway Research Program) asphaltic concrete mix design. The estimated cost associated with this project is approximately $ 50,000 if constructed as part of a more extensive pavement preservation project. If this small project were constructed by itself the costs would be much higher.

The second project that should be completed is a combined project including Sections 1 through 4. While recommended as a single project, the project can be reduced into smaller sections with a significantly higher construction cost. Pavement surfaces in all four sections are approximately the same age and the same condition. All sections should be milled simultaneously to a depth of 2 inches. Milled Section 1 should be replaced with 3 inches and milled Sections 2 through 4 should be replaced with 5 inches of a high performance SHRP asphaltic concrete mix design.

The estimated cost for the combined project is $1,155,000. The cost for each Section of this project, assuming construction as a single project, is:

- Section 1--$105,000
- Section 2--$510,000
- Section 3--$420,000
- Section 4--$120,000

The remaining projects (Sections 5, 6, 8, and 9) can be completed separately or as one combined project. These pavements are currently in relatively good condition and have the longest remaining life. However, if the bleeding increases or if other failures arise, these projects should be moved forward in the program. The estimated cost for this combined project is $1,430,000. The cost for constructing individual Sections, assuming constructed as a single project is:

- Section 5--$750,000
- Section 6--$50,000
- Section 8--$180,000
- Section 9--$450,000

The cost estimates for Sections 5 assumes a milling of 2 inches and replacement with 5 inches of a high performance SHRP asphaltic concrete mix design. The cost estimates for Sections 6 assumes crack sealing only.

The total estimated cost for all projects within the program is $ 2,635,000.

Appendix C
Costs: Capital, Operations & Maintenance, Life Cycle

DSC-22 (6/97)

Denver Service Center - Estimate

Estimate By: DEA, Inc.

Project: Grand Canyon BRT Alternatives

Date: 10/29/02

Park: Grand Canyon National Park

Package **BRT and LRT Options - Full Transit System**

Reviewed By:

No Growth Scenario

Date:

Item No.	Description	Qty.	Unit	Cost/Unit	Rim Shuttles Net Cost	**Part of all Alts** Subtotal
2500	**Utilities**	0.00	LS	$ 1,880,410.00	$ -	$ -
2300	**Earthwork - Assume Proportional to Guideway Length**				$ -	$ -
	Common Excavation	0	CY	$ 7.00	$ -	
	Rock Excavation	0	CY	$ 25.00	$ -	
	Backfill common	0	CY	$ 4.00	$ -	
	Backfill w/ native import material	0		$ 10.00	$ -	
2700	**Track Grade Preparation**	0	RF	$ 140.00	$ -	$ -
5650	**Trackwork/Guide Rail**	0	LS	$ 20,193,262.00	$ -	$ -
3300	**Dedicated/Shared Transit Roadway**					$ -
	2-way	0	LF	$ 250.00	$ -	
	1-way	0	LF	$ 150.00	$ -	
	New Maswik Road	0	LF	$ 250.00	$ -	
3300	**Structures, Ditches, Retaining Walls, Roads**				$ -	$ -
	Long Jim Drainage	0	LS	$ 255,000.00	$ -	
	Maintenance Area Access Road	0	LF	$ 250.00	$ -	
	Maintenance Area Access Road Bridge	0	LF	$ 4,500.00	$ -	
	Extend South Entrance By-Pass Lane (12-foot lane)	0	LF	$ 150.00	$ -	
	Center Road	0	LF	$ 250.00	$ -	
	Center Road Bridge	0	LF	$ 4,500.00	$ -	
	Hwy 64 Roundabout	0	LS	$ 4,968,652.00	$ -	
	Hwy 64 Intersection/Signal	0	LS	$ 200,000.00	$ -	
	Resurface Roads per ADOT study	0	LS	$ 1,205,000.00	$ -	
	Retaining wall - 10' High	0	LF	$ 310.00	$ -	
	Soundwall	0	LF	$ 280.00	$ -	
	Powerline Relocation	0	LF	$ 40.00	$ -	
	Cyclone Fencing 8' tall	0	LF	$ 24.00	$ -	
	Demolish Service Road at CVIP	0	LF	$ 44.50	$ -	
	New Service Road at CVIP	0	LF	$ 111.25	$ -	
3300	**Grade Crossings/Overcrossings**				$ -	$ -
	Major Street at Grade	0	LS	$ 450,000.00	$ -	
	Pedestrian Overcrossing at GCTC	0	LS	$ 581,994.00	$ -	
	Maint Facility Crossing Panels	0	LF	$ 140.00	$ -	
13000	**Stations**				$ -	$ -
	GCTC	0	LS	$ 1,318,401.00	$ -	
	Concrete Paving in Station	0	SY	$ 116.40	$ -	
	Demolish Paving at Station & Alignment					
	Village	0	LS	$ 1,683,991.00	$ -	
	Concrete Paving in Station		SY	$ 116.40	$ -	
	CVIP Platforms - Shelters	0	LS	$ 221,851.22	$ -	
	Concrete Paving in Station		SY	$ 116.40	$ -	
	Demolish Bus Parking at Station					
	"Permanent" Paving Existing Bus Parking at CVIP	0	EA	$ 7,404.00	$ -	
	New Bus Parking at CVIP	0	EA	$ 7,404.00	$ -	
	Wayfinding at GCTC	0.0	LS	$ 1,315,284.00	$ -	
	Wayfinding at Village	0	LS	$ 197,719.00	$ -	
	Wayfinding at CVIP	0.00	LS	$ 197,719.00	$ -	
21000	**Fare Collection/Reservations**				$ -	$ -
	System	0.00	LS	$ 2,387,838.00	$ -	
	Kiosks in Tusayan	0.00	EA	$ 40,000.00	$ -	
	Temporary Fee Collection & Reservations at GCTC	0.00	EA	$ 500,000.00	$ -	
2800	**Transit Center Sitework**					$ -
	Landscape at GCTC	0.0	LS	$ 5,017,767.00	$ -	
	Road Drainage and Utilities at GCTC	0.0	LS	$ 10,271,616.00	$ -	
	Change in Parking Spaces		EA	$ 1,944.00	$ -	
	Change in RV/Bus Spaces		EA	$ 7,404.00	$ -	
	Landscape at Village	0	LS	$ 530,097.00	$ -	
	Landscape at CVIP	0	LS	$ -	$ -	
2800	**Maintenance Facility**					$ -
	Equipment and Furnishings	0.00	LS	$ 5,720,000.00	$ -	
	Site Preparation	0	AC	$ 5,000.00	$ -	
	Maintenance Bldg.	0	SF	$ 67.50	$ -	
	Maintenance Facility Parking and Road	0	SF	$ 7.00	$ -	

DSC-22 (6/97)

Denver Service Center - Estimate

Project: Grand Canyon BRT Alternatives

Park: Grand Canyon National Park

Package **BRT and LRT Options - Full Transit System**

No Growth Scenario

Estimate By: DEA, Inc.

Date: 10/29/02

Reviewed By:

Date:

Item No.	Description	Qty.	Unit	Cost/Unit	Rim Shuttles Net Cost	**Part of all Alts** Subtotal
18000	**Electrification**					
	Powerline to Park					
	Substations (included in OCS)					
	Overhead Catenary System					
18000	**Signals and Communications**				$ -	$ -
	System	0	LS	$ 6,276,896.00	$ -	
Subtotal	**Direct Construction Costs**				$ -	$ -
1300	**Engineering and Administration**			15%	$ -	$ -
	Subtotal				$ -	
1300	**Construction Contingency**			20%	$ -	$ -
	Subtotal				$ -	
1300	**Escalation to 2003 @ 4% per year**			4.00%		

DSC-22 (6/97)

Denver Service Center - Estimate

Estimate By: BRW, Inc.

Project: Grand Canyon BRT Alternatives

Date: 10/30/00

Park: Grand Canyon National Park

Package **BRT and LRT Options - Full Transit System**

No Growth Scenario

Reviewed By:

Date:

Item No.	Description	Qty.	Unit	Cost/Unit	LRT Prospectus Net Cost	Subtotal
2500	**Utilities**	1.00	LS	$ 1,880,410.00	$ 1,880,410	$ 1,880,410
2300	**Earthwork - Assume Proportional to Guideway Length**				$ -	$ 11,082,661
	Common Excavation	60,019	CY	$ 7.00	$ 420,133	
	Rock Excavation	340,108	CY	$ 25.00	$ 8,502,700	
	Backfill common	294,522	CY	$ 4.00	$ 1,178,088	
	Backfill w/ native import material	98,174		$ 10.00	$ 981,740	
2700	**Track Grade Preparation**	46,957	RF	$ 140.00	$ 6,573,980	$ 6,573,980
5650	**Trackwork/Guide Rail**	1	LS	$ 20,193,262.00	$ 20,193,262	$ 20,193,262
3300	**Dedicated/Shared Transit Roadway**					$ -
	2-way		LF	$ 250.00	$ -	
	1-way		LF	$ 150.00	$ -	
	New Maswik Road		LF	$ 250.00	$ -	
3300	**Structures, Ditches, Retaining Walls, Roads**				$ -	$ 7,816,327
	Long Jim Drainage	1	LS	$ 255,000.00	$ 255,000	
	Maintenance Area Access Road	1,660	LF	$ 250.00	$ 415,000	
	Maintenance Area Access Road Bridge	100	LF	$ 4,500.00	$ 450,000	
	Extend South Entrance By-Pass Lane (12-foot lane)					
	Center Road	2,100	LF	$ 250.00	$ 525,000	
	Center Road Bridge	110	LF	$ 4,500.00	$ 495,000	
	Hwy 64 Roundabout	1	LS	$ 4,968,652.00	$ 4,968,652	
	Hwy 64 Intersection/Signal	0	LS	$ -	$ -	
	Resurface Roads per ADOT study					
	Retaining wall - 10' High	703	LF	$ 310.00	$ 217,930	
	Soundwall	500	LF	$ 280.00	$ 140,000	
	Powerline Relocation	2,750	LF	$ 40.00	$ 110,000	
	Cyclone Fencing 8' tall	255	LF	$ 24.00	$ 6,120	
	Demolish Service Road at CVIP	1,000	LF	$ 44.50	$ 44,500	
	New Service Road at CVIP	1,700	LF	$ 111.25	$ 189,125	
3300	**Grade Crossings/Overcrossings**				$ -	$ 3,288,994
	Major Street at Grade	6	LS	$ 450,000.00	$ 2,700,000	
	Pedestrian Overcrossing at GCTC	1	LS	$ 581,994.00	$ 581,994	
	Maint Facility Crossing Panels	50	LF	$ 140.00	$ 7,000	
13000	**Stations**				$ -	$ 16,800,523
	GCTC	1	LS	$ 12,301,116.00	$ 12,301,116	
	Concrete Paving in Station		SY	$ 116.40	$ -	
	Demolish Paving at Station & Alignment					
	Village	1	LS	$ 1,683,991.00	$ 1,683,991	
	Concrete Paving in Station		SY	$ 116.40	$ -	
	CVIP Platforms - Shelters	1	LS	$ 1,104,694.00	$ 1,104,694	
	Concrete Paving in Station		SY	$ 116.40	$ -	
	Demolish Bus Parking at Station					
	"Permanent" Paving Existing Bus Parking at CVIP	0	EA	$ 7,404.00	$ -	
	New Bus Parking at CVIP	0	EA	$ 7,404.00	$ -	
	Wayfinding at GCTC	1.00	LS	$ 1,315,284.00	$ 1,315,284	
	Wayfinding at Village	1	LS	$ 197,719.00	$ 197,719	
	Wayfinding at CVIP	1	LS	$ 197,719.00	$ 197,719	
21000	**Fare Collection/Reservations**				$ -	$ 2,387,838
	System	1	LS	$ 2,387,838.00	$ 2,387,838	
	Kiosks in Tusayan					
	Temporary Fee Collection & Reservations at GCTC					
2800	**Transit Center Sitework**				$ -	$ 15,819,480
	Landscape at GCTC	1.00	LS	$ 5,017,767.00	$ 5,017,767	
	Road Drainage and Utilities at GCTC	1.00	LS	$ 10,271,616.00	$ 10,271,616	
	Change in Parking Spaces		EA	$ 1,944.00	$ -	
	Change in RV/Bus Spaces		EA	$ 7,404.00	$ -	
	Landscape at Village	1	LS	$ 530,097.00	$ 530,097	
	Landscape at CVIP	0	LS	$ -	$ -	
2800	**Maintenance Facility**					$ 11,874,000
	Equipment and Furnishings	1.00	LS	$ 5,720,000.00	$ 5,720,000	
	Site Preparation	50	AC	$ 5,000.00	$ 250,000	
	Maintenance Bldg.	82,800	SF	$ 67.50	$ 5,589,000	
	Maintenance Facility Parking and Road	45,000	SF	$ 7.00	$ 315,000	

DSC-22 (6/97)

Denver Service Center - Estimate

Project: Grand Canyon BRT Alternatives

Park: Grand Canyon National Park

Package **BRT and LRT Options - Full Transit System**

No Growth Scenario

Estimate By: BRW, Inc.

Date: 10/30/00

Reviewed By:

Date:

Item No.	Description	Qty.	Unit	Cost/Unit	Net Cost (LRT Prospectus)	Subtotal
18000	**Electrification**					
	Powerline to Park					
	Substations (included in OCS)					
	Overhead Catenary System					
18000	**Signals and Communications**				$ -	$ 6,276,896
	System	1	LS	$ 6,276,896.00	$ 6,276,896	
Subtotal	**Direct Construction Costs**				$ 103,994,371	$ 103,994,371
1300	**Engineering and Administration**			15%	$ 15,599,156	$ 15,599,156
	Subtotal				$ 119,593,527	
1300	**Construction Contingency**			20%	$ 23,918,705	$ 23,918,705
	Subtotal				$ 143,512,232	
1300	**Escalation to 2003 @ 4% per year**	3	yrs	1.12	**$ 161,431,743**	17,919,511

DSC-22 (6/97)

Denver Service Center - Estimate

Project: Grand Canyon BRT Alternatives
Park: Grand Canyon National Park
Package **BRT and LRT Options - Full Transit System**
No Growth Scenario

Estimate By: DEA, Inc.
Date: 10/29/02
Reviewed By:
Date:

Item No.	Description	Qty.	Unit	Cost/Unit	Option 1 Net Cost	Subtotal
2500	**Utilities**	0.75	LS	$ 1,880,410.00	$ 1,410,308	$ 1,410,308
2300	**Earthwork - Assume Proportional to Guideway Length**				$ -	$ -
	Common Excavation	0	CY	$ 7.00	$ -	
	Rock Excavation	0	CY	$ 25.00	$ -	
	Backfill common	0	CY	$ 4.00	$ -	
	Backfill w/ native import material	0		$ 10.00	$ -	
2700	**Track Grade Preparation**	0	RF	$ 140.00	$ -	$ -
5650	**Trackwork/Guide Rail**	0	LS	$ 20,193,262	$ -	$ -
3300	**Dedicated/Shared Transit Roadway**					$ -
	2-way	0	LF	$ 250.00	$ -	
	1-way	0	LF	$ 150.00	$ -	
	New Maswik Road	0	LF	$ 250.00	$ -	
3300	**Structures, Ditches, Retaining Walls, Roads**				$ -	$ 7,998,652
	Long Jim Drainage	1	LS	$ 255,000.00	$ 255,000	
	Maintenance Area Access Road	0	LF	$ 250.00	$ -	
	Maintenance Area Access Road Bridge	0	LF	$ 4,500.00	$ -	
	Extend South Entrance By-Pass Lane (12-foot lane)	0	LF	$ 150.00	$ -	
	Center Road	0	LF	$ 250.00	$ -	
	Center Road Bridge	0	LF	$ 4,500.00	$ -	
	Hwy 64 Roundabout	1	LS	$ 4,968,652	$ 4,968,652	
	Hwy 64 Intersection/Signal	0	LS	$ -	$ -	
	Resurface Roads per ADOT study	1	LS	$ 2,635,000	$ 2,635,000	
	Retaining wall - 10' High	0	LF	$ 310.00	$ -	
	Soundwall	500	LF	$ 280.00	$ 140,000	
	Powerline Relocation	0	LF	$ 40.00	$ -	
	Cyclone Fencing 8' tall	0	LF	$ 24.00	$ -	
	Demolish Service Road at CVIP	0	LF	$ 44.50	$ -	
	New Service Road at CVIP	0	LF	$ 111.25	$ -	
3300	**Grade Crossings/Overcrossings**				$ -	$ 581,994
	Major Street at Grade	0	LS	$ 450,000.00	$ -	
	Pedestrian Overcrossing at GCTC	1	LS	$ 581,994.00	$ 581,994	
	Maint Facility Crossing Panels	0	LF	$ 140.00	$ -	
13000	**Stations**				$ -	$ 14,149,141
	GCTC	1	LS	$ 11,617,475	$ 11,617,475	
	Concrete Paving in Station	2,235	SY	$ 116.40	$ 260,154	
	Demolish Paving at Station & Alignment					
	Village	1	LS	$ 120,273.50	$ 120,274	
	Concrete Paving in Station	924	SY	$ 116.40	$ 107,605	
	CVIP Platforms - Shelters	1	LS	$ 221,851.22	$ 221,851	
	Concrete Paving in Station	0	SY	$ 116.40	$ -	
	Demolish Bus Parking at Station					
	"Permanent" Paving Existing Bus Parking at CVIP	15	EA	$ 7,404.00	$ 111,060	
	New Bus Parking at CVIP	0	EA	$ 7,404.00	$ -	
	Wayfinding at GCTC	1.00	LS	$ 1,315,284.00	$ 1,315,284	
	Wayfinding at Village	1	LS	$ 197,719.00	$ 197,719	
	Wayfinding at CVIP	1.00	LS	$ 197,719.00	$ 197,719	
21000	**Fare Collection/Reservations**				$ -	$ 2,507,838
	System	1	LS	$ 2,387,838.00	$ 2,387,838	
	Kiosks in Tusayan	3	EA	$ 40,000.00	$ 120,000	
	Temporary Fee Collection & Reservations at GCTC					
2800	**Transit Center Sitework**				$ -	$ 13,204,732
	Landscape at GCTC	1.0	LS	$ 5,017,767.00	$ 5,017,767	
	Road Drainage and Utilities at GCTC	1.0	LS	$ 10,271,616	$ 10,271,616	
	Change in Parking Spaces	-732	EA	$ 1,944.00	$ (1,422,708)	
	Change in RV/Bus Spaces	-161	EA	$ 7,404.00	$ (1,192,040)	
	Landscape at Village	1	LS	$ 530,097.00	$ 530,097	
	Landscape at CVIP	0	LS	$ -	$ -	
2800	**Maintenance Facility**					$ 10,158,000
	Equipment and Furnishings	0.7	LS	$ 5,720,000.00	$ 4,004,000	
	Site Preparation	50	AC	$ 5,000.00	$ 250,000	
	Maintenance Bldg.	82,800	SF	$ 67.50	$ 5,589,000	
	Maintenance Facility Parking and Road	45,000	SF	$ 7.00	$ 315,000	

DSC-22 (6/97)

Denver Service Center - Estimate

Project: Grand Canyon BRT Alternatives
Park: Grand Canyon National Park
Package **BRT and LRT Options - Full Transit System**
No Growth Scenario

Estimate By: DEA, Inc.
Date: 10/29/02
Reviewed By:
Date:

Item No.	Description	Qty.	Unit	Cost/Unit	Option 1 Net Cost	Subtotal
18000	**Electrification**					
	Powerline to Park					
	Substations (included in OCS)					
	Overhead Catenary System					
18000	**Signals and Communications**				$ -	$ -
	System	0	LS	$ 6,276,896.00	$ -	
Subtotal	**Direct Construction Costs**				$ 50,010,664	$ 50,010,664
1300	**Engineering and Administration**			15%	$ 7,501,600	$ 7,501,600
	Subtotal				$ 57,512,264	
1300	**Construction Contingency**			20%	$ 11,502,453	$ 11,502,453
	Subtotal				$ 69,014,717	
1300	**Escalation to 2003 @ 4% per year**	2	YR	1.08	**$ 74,646,318**	5,631,601

DSC-22 (6/97)

Denver Service Center - Estimate

Project: Grand Canyon BRT Alternatives
Park: Grand Canyon National Park
Package **BRT and LRT Options - Full Transit System**
No Growth Scenario

Estimate By: DEA, Inc.
Date: 10/29/02
Reviewed By:
Date:

Item No.	Description	Qty.	Unit	Cost/Unit	Option 2 Net Cost	Subtotal
2500	**Utilities**	0.75	LS	$ 1,880,410.00	$ 1,410,308	$ 1,410,308
2300	**Earthwork - Assume Proportional to Guideway Length**				$ -	$ 9,198,609
	Common Excavation	49,816	CY	$ 7.00	$ 348,710	
	Rock Excavation	282,290	CY	$ 25.00	$ 7,057,241	
	Backfill common	244,453	CY	$ 4.00	$ 977,813	
	Backfill w/ native import material	81,484		$ 10.00	$ 814,844	
2700	**Track Grade Preparation**		RF	$ 140.00	$ -	$ -
5650	**Trackwork/Guide Rail**		LS	$ 20,193,262	$ -	$ -
3300	**Dedicated/Shared Transit Roadway**					$ 9,180,000
	2-way	23,550	LF	$ 250.00	$ 5,887,500	
	1-way	9,450	LF	$ 150.00	$ 1,417,500	
	New Maswik Road	7,500	LF	$ 250.00	$ 1,875,000	
3300	**Structures, Ditches, Retaining Walls, Roads**				$ -	$ 7,065,655
	Long Jim Drainage	1	LS	$ 255,000.00	$ 255,000	
	Maintenance Area Access Road	1,500	LF	$ 250.00	$ 375,000	
	Maintenance Area Access Road Bridge	0	LF	$ 4,500.00	$ -	
	Extend South Entrance By-Pass Lane (12-foot lane)					
	Center Road	0	LF	$ 250.00	$ -	
	Center Road Bridge	0	LF	$ 4,500.00	$ -	
	Hwy 64 Roundabout	1	LS	$ 4,968,652	$ 4,968,652	
	Hwy 64 Intersection/Signal	0	LS	$ -	$ -	
	Resurface Roads per ADOT study	1	LS	$ 1,030,000	$ 1,030,001	
	Retaining wall - 10' High	583	LF	$ 310.00	$ 180,882	
	Soundwall	500	LF	$ 280.00	$ 140,000	
	Powerline Relocation	2,750	LF	$ 40.00	$ 110,000	
	Cyclone Fencing 8' tall	255	LF	$ 24.00	$ 6,120	
	Demolish Service Road at CVIP	0	LF	$ 44.50	$ -	
	New Service Road at CVIP	0	LF	$ 111.25	$ -	
3300	**Grade Crossings/Overcrossings**				$ -	$ 581,994
	Major Street at Grade	0	LS	$ 450,000.00	$ -	
	Pedestrian Overcrossing at GCTC	1	LS	$ 581,994.00	$ 581,994	
	Maint Facility Crossing Panels	0	LF	$ 140.00	$ -	
13000	**Stations**					$ 15,372,739
	GCTC	1	LS	$ 11,617,475	$ 11,617,475	
	Concrete Paving in Station	2,235	SY	$ 116.40	$ 260,154	
	Demolish Paving at Station & Alignment		SY	$ 18.18	$ -	
	Village	1	LS	$ 120,273.50	$ 120,274	
	Concrete Paving in Station	924	SY	$ 116.40	$ 107,554	
	CVIP Platforms - Shelters	1	LS	$ 1,038,211.47	$ 1,038,211	
	Concrete Paving in Station	1,721	SY	$ 116.40	$ 200,324	
	Demolish Bus Parking at Station	3,239	SY	$ 18.18	$ 58,885	
	"Permanent" Paving Existing Bus Parking at CVIP		EA	$ 7,404.00	$ -	
	New Bus Parking at CVIP	35	EA	$ 7,404.00	$ 259,140	
	Wayfinding at GCTC	1.0	LS	$ 1,315,284.00	$ 1,315,284	
	Wayfinding at Village	1	LS	$ 197,719.00	$ 197,719	
	Wayfinding at CVIP	1.00	LS	$ 197,719.00	$ 197,719	
21000	**Fare Collection/Reservations**				$ -	$ 2,507,838
	System	1	LS	$ 2,387,838.00	$ 2,387,838	
	Kiosks in Tusayan	3	EA	$ 40,000.00	$ 120,000	
	Temporary Fee Collection & Reservations at GCTC					
2800	**Transit Center Sitework**				$ -	$ 13,204,732
	Landscape at GCTC	1.0	LS	$ 5,017,767.00	$ 5,017,767	
	Road Drainage and Utilities at GCTC	1.0	LS	$ 10,271,616	$ 10,271,616	
	Change in Parking Spaces	-732	EA	$ 1,944.00	$ (1,422,708)	
	Change in RV/Bus Spaces	-161	EA	$ 7,404.00	$ (1,192,040)	
	Landscape at Village	1	LS	$ 530,097.00	$ 530,097	
	Landscape at CVIP	0	LS	$ -	$ -	
2800	**Maintenance Facility**					$ 11,302,000
	Equipment and Furnishings	0.9	LS	$ 5,720,000.00	$ 5,148,000	
	Site Preparation	50	AC	$ 5,000.00	$ 250,000	
	Maintenance Bldg.	82,800	SF	$ 67.50	$ 5,589,000	
	Maintenance Facility Parking and Road	45,000	SF	$ 7.00	$ 315,000	

DSC-22 (6/97)

Denver Service Center - Estimate

Project: Grand Canyon BRT Alternatives

Park: Grand Canyon National Park

Package **BRT and LRT Options - Full Transit System**

No Growth Scenario

Estimate By: DEA, Inc.

Date: 10/29/02

Reviewed By:

Date:

Item No.	Description	Qty.	Unit	Cost/Unit	Net Cost (Option 2)	Subtotal
18000	**Electrification**					
	Powerline to Park					
	Substations (included in OCS)					
	Overhead Catenary System					
18000	**Signals and Communications**				$ -	$ -
	System	0	LS	$ 6,276,896.00	$ -	
Subtotal	**Direct Construction Costs**				$ 69,823,874	$ 69,823,874
1300	**Engineering and Administration**			15%	$ 10,473,581	$ 10,473,581
	Subtotal				$ 80,297,455	
1300	**Construction Contingency**			20%	$ 16,059,491	$ 16,059,491
	Subtotal				$ 96,356,946	
1300	**Escalation to 2003 @ 4% per year**	2	YR	1.08	**$ 104,219,673**	7,862,727

DSC-22 (6/97)

Denver Service Center - Estimate

Project: Grand Canyon BRT Alternatives
Park: Grand Canyon National Park
Package **BRT and LRT Options - Full Transit System**
No Growth Scenario

Estimate By: DEA, Inc.
Date: 10/29/02
Reviewed By:
Date:

Item No.	Description	Qty.	Unit	Cost/Unit	Option 3 Net Cost	Subtotal
2500	**Utilities**	0.75	LS	$ 1,880,410.00	$ 1,410,308	$ 1,410,308
2300	**Earthwork - Assume Proportional to Guideway Length**				$ -	$ 11,082,661
	Common Excavation	60,019	CY	$ 7.00	$ 420,133	
	Rock Excavation	340,108	CY	$ 25.00	$ 8,502,700	
	Backfill common	294,522	CY	$ 4.00	$ 1,178,088	
	Backfill w/ native import material	98,174		$ 10.00	$ 981,740	
2700	**Track Grade Preparation**	0	RF	$ 140.00	$ -	$ -
5650	**Trackwork/Guide Rail**	0	LS	$ 5,048,316	$ -	$ -
3300	**Dedicated/Shared Transit Roadway**					$ 11,739,250
	2-way	46,957	LF	$ 250.00	$ 11,739,250	
	1-way	0	LF	$ 150.00	$ -	
	New Maswik Road				$ -	
3300	**Structures, Ditches, Retaining Walls, Roads**				$ -	$ 7,816,327
	Long Jim Drainage	1	LS	$ 255,000.00	$ 255,000	
	Maintenance Area Access Road	1,660	LF	$ 250.00	$ 415,000	
	Maintenance Area Access Road Bridge	100	LF	$ 4,500.00	$ 450,000	
	Extend South Entrance By-Pass Lane (12-foot lane)					
	Center Road	2,100	LF	$ 250.00	$ 525,000	
	Center Road Bridge	110	LF	$ 4,500.00	$ 495,000	
	Hwy 64 Roundabout	1	LS	$ 4,968,652	$ 4,968,652	
	Hwy 64 Intersection/Signal	0	LS	$ -	$ -	
	Resurface Roads per ADOT study					
	Retaining wall - 10' High	703	LF	$ 310.00	$ 217,930	
	Soundwall	500	LF	$ 280.00	$ 140,000	
	Powerline Relocation	2,750	LF	$ 40.00	$ 110,000	
	Cyclone Fencing 8' tall	255	LF	$ 24.00	$ 6,120	
	Demolish Service Road at CVIP	1,000	LF	$ 44.50	$ 44,500	
	New Service Road at CVIP	1,700	LF	$ 111.25	$ 189,125	
3300	**Grade Crossings/Overcrossings**				$ -	$ 1,931,994
	Major Street at Grade	6	LS	$ 225,000.00	$ 1,350,000	
	Pedestrian Overcrossing at GCTC	1	LS	$ 581,994.00	$ 581,994	
	Maint Facility Crossing Panels	0	LF	$ 140.00	$ -	
13000	**Stations**				$ -	$ 14,923,940
	GCTC	1	LS	$ 11,617,475	$ 11,617,475	
	Concrete Paving in Station	2,235	SY	$ 116.40	$ 260,154	
	Demolish Paving at Station & Alignment		SY	$ 18.18		
	Village	1	LS	$ 298,686.62	$ 298,687	
	Concrete Paving in Station	1,824	SY	$ 116.40	$ 212,301	
	CVIP Platforms - Shelters	1	LS	$ 600,752.06	$ 600,752	
	Concrete Paving in Station	1,417	SY	$ 116.40	$ 164,965	
	Demolish Bus Parking at Station	3,239	SY	$ 18.18	$ 58,885	
	"Permanent" Paving Existing Bus Parking at CVIP		EA	$ 7,404.00		
	New Bus Parking at CVIP		EA	$ 7,404.00		
	Wayfinding at GCTC	1.0	LS	$ 1,315,284.00	$ 1,315,284	
	Wayfinding at Village	1	LS	$ 197,719.00	$ 197,719	
	Wayfinding at CVIP	1.00	LS	$ 197,719.00	$ 197,719	
21000	**Fare Collection/Reservations**				$ -	$ 2,387,838
	System	1	LS	$ 2,387,838.00	$ 2,387,838	
	Kiosks in Tusayan					
	Temporary Fee Collection & Reservations at GCTC					
2800	**Transit Center Sitework**				$ -	$ 14,948,660
	Landscape at GCTC	1.0	LS	$ 5,017,767.00	$ 5,017,767	
	Road Drainage and Utilities at GCTC	1.0	LS	$ 10,271,616	$ 10,271,616	
	Change in Parking Spaces	-274	EA	$ 1,944.00	$ (531,915)	
	Change in RV/Bus Spaces	-46	EA	$ 7,404.00	$ (338,905)	
	Landscape at Village	1	LS	$ 530,097.00	$ 530,097	
	Landscape at CVIP	0	LS	$ -	$ -	
2800	**Maintenance Facility**					$ 11,874,000
	Equipment and Furnishings	1.0	LS	$ 5,720,000.00	$ 5,720,000	
	Site Preparation	50	AC	$ 5,000.00	$ 250,000	
	Maintenance Bldg.	82,800	SF	$ 67.50	$ 5,589,000	
	Maintenance Facility Parking and Road	45,000	SF	$ 7.00	$ 315,000	

DSC-22 (6/97)

Denver Service Center - Estimate

Project: Grand Canyon BRT Alternatives
Park: Grand Canyon National Park
Package **BRT and LRT Options - Full Transit System**
No Growth Scenario

Estimate By: DEA, Inc.
Date: 10/29/02
Reviewed By:
Date:

Item No.	Description	Qty.	Unit	Cost/Unit	Net Cost (Option 3)	Subtotal
18000	**Electrification**					$ 29,495,810
	Powerline to Park	1	LS	$ 14,000,000	$ 14,000,000	
	Substations (included in OCS)					
	Overhead Catenary System	46,957	LF	$ 330.00	$ 15,495,810	
18000	**Signals and Communications**				$ -	$ -
	System	0	LS	$ 6,276,896.00	$ -	
Subtotal	**Direct Construction Costs**				$ 107,610,787	$ 107,610,787
1300	**Engineering and Administration**			15%	$ 16,141,618	$ 16,141,618
	Subtotal				$ 123,752,406	
1300	**Construction Contingency**			20%	$ 24,750,481	$ 24,750,481
	Subtotal				$ 148,502,887	
1300	**Escalation to 2003 @ 4% per year**	2	YR	1.08	**$ 160,620,722**	12,117,836

DSC-22 (6/97)

Denver Service Center - Estimate

Project: Grand Canyon BRT Alternatives
Park: Grand Canyon National Park
Package **BRT and LRT Options - Full Transit System**
No Growth Scenario

Estimate By: DEA, Inc.
Date: 10/29/02
Reviewed By:
Date:

Item No.	Description	Qty.	Unit	Cost/Unit	Option 5A Net Cost	Subtotal
2500	**Utilities**	0.75	LS	$ 1,880,410.00	$ 1,410,308	$ 1,410,308
2300	**Earthwork - Assume Proportional to Guideway Length**				$ -	$ 11,082,661
	Common Excavation	60,019	CY	$ 7.00	$ 420,133	
	Rock Excavation	340,108	CY	$ 25.00	$ 8,502,700	
	Backfill common	294,522	CY	$ 4.00	$ 1,178,088	
	Backfill w/ native import material	98,174	CY	$ 10.00	$ 981,740	
2700	**Track Grade Preparation**	46,957	RF	$ 140.00	$ 6,573,980	$ 6,573,980
5650	**Trackwork/Guide Rail**	1	LS	$ 20,193,262	$ 20,193,262	$ 20,193,262
3300	**Dedicated/Shared Transit Roadway**					$ -
	2-way		LF	$ 250.00	$ -	
	1-way		LF	$ 150.00	$ -	
	New Maswik Road		LF	$ 250.00	$ -	
3300	**Structures, Ditches, Retaining Walls, Roads**				$ -	$ 7,816,327
	Long Jim Drainage	1	LS	$ 255,000.00	$ 255,000	
	Maintenance Area Access Road	1,660	LF	$ 250.00	$ 415,000	
	Maintenance Area Access Road Bridge	100	LF	$ 4,500.00	$ 450,000	
	Extend South Entrance By-Pass Lane (12-foot lane)					
	Center Road	2,100	LF	$ 250.00	$ 525,000	
	Center Road Bridge	110	LF	$ 4,500.00	$ 495,000	
	Hwy 64 Roundabout	1	LS	$ 4,968,652.00	$ 4,968,652	
	Hwy 64 Intersection/Signal	0	LS	$ -	$ -	
	Resurface Roads per ADOT study					
	Retaining wall - 10' High	703	LF	$ 310.00	$ 217,930	
	Soundwall	500	LF	$ 280.00	$ 140,000	
	Powerline Relocation	2,750	LF	$ 40.00	$ 110,000	
	Cyclone Fencing 8' tall	255	LF	$ 24.00	$ 6,120	
	Demolish Service Road at CVIP	1,000	LF	$ 44.50	$ 44,500	
	New Service Road at CVIP	1,700	LF	$ 111.25	$ 189,125	
3300	**Grade Crossings/Overcrossings**				$ -	$ 3,288,994
	Major Street at Grade	6	LS	$ 450,000.00	$ 2,700,000	
	Pedestrian Overcrossing at GCTC	1	LS	$ 581,994.00	$ 581,994	
	Maint Facility Crossing Panels	50	LF	$ 140.00	$ 7,000	
13000	**Stations**				$ -	$ 17,008,208
	GCTC	1	LS	$ 12,449,916	$ 12,449,916	
	Concrete Paving in Station		SY	$ 116.40	$ -	
	Demolish Paving at Station & Alignment					
	Village	1	LS	$ 1,683,991.00	$ 1,683,991	
	Concrete Paving in Station		SY	$ 116.40	$ -	
	CVIP Platforms - Shelters	1	LS	$ 1,104,694.00	$ 1,104,694	
	Concrete Paving in Station		SY	$ 116.40	$ -	
	Demolish Bus Parking at Station	3,239	SY	$ 18.18	$ 58,885	
	"Permanent" Paving Existing Bus Parking at CVIP	0	EA	$ -	$ -	
	New Bus Parking at CVIP	0	EA	$ 7,404.00	$ -	
	Wayfinding at GCTC	1.00	LS	$ 1,315,284.00	$ 1,315,284	
	Wayfinding at Village	1	LS	$ 197,719.00	$ 197,719	
	Wayfinding at CVIP	1.00	LS	$ 197,719.00	$ 197,719	
21000	**Fare Collection/Reservations**				$ -	$ 2,387,838
	System	1	LS	$ 2,387,838.00	$ 2,387,838	
	Kiosks in Tusayan					
	Temporary Fee Collection & Reservations at GCTC					
2800	**Transit Center Sitework**				$ -	$ 14,948,660
	Landscape at GCTC	1.0	LS	$ 5,017,767.00	$ 5,017,767	
	Road Drainage and Utilities at GCTC	1.0	LS	$ 10,271,616	$ 10,271,616	
	Change in Parking Spaces	-274	EA	$ 1,944.00	$ (531,915)	
	Change in RV/Bus Spaces	-46	EA	$ 7,404.00	$ (338,905)	
	Landscape at Village	1	LS	$ 530,097.00	$ 530,097	
	Landscape at CVIP	0	LS	$ -	$ -	
2800	**Maintenance Facility**					$ 11,874,000
	Equipment and Furnishings	1.0	LS	$ 5,720,000.00	$ 5,720,000	
	Site Preparation	50	AC	$ 5,000.00	$ 250,000	
	Maintenance Bldg.	82,800	SF	$ 67.50	$ 5,589,000	
	Maintenance Facility Parking and Road	45,000	SF	$ 7.00	$ 315,000	

DSC-22 (6/97)

Denver Service Center - Estimate

Project: Grand Canyon BRT Alternatives

Park: Grand Canyon National Park

Package **BRT and LRT Options - Full Transit System**

No Growth Scenario

Estimate By: DEA, Inc.

Date: 10/29/02

Reviewed By:

Date:

Item No.	Description	Qty.	Unit	Cost/Unit	Option 5A Net Cost	Subtotal
18000	**Electrification**					
	Powerline to Park					
	Substations (included in OCS)					
	Overhead Catenary System					
18000	**Signals and Communications**				$ -	$ 6,276,896
	System	1	LS	$ 6,276,896.00	$ 6,276,896	
Subtotal	**Direct Construction Costs**				$ 102,861,134	$ 102,861,134
1300	**Engineering and Administration**			15%	$ 15,429,170	$ 15,429,170
	Subtotal				$ 118,290,304	
1300	**Construction Contingency**			20%	$ 23,658,061	$ 23,658,061
	Subtotal				$ 141,948,364	
1300	**Escalation to 2003 @ 4% per year**	2	YR	1.08	**$ 153,531,351**	11,582,987

DSC-22 (6/97)

Denver Service Center - Estimate

Project: Grand Canyon BRT Alternatives
Park: Grand Canyon National Park
Package **BRT and LRT Options - Full Transit System**
No Growth Scenario

Estimate By: DEA, Inc.
Date: 10/29/02
Reviewed By:
Date:

Item No.	Description	Qty.	Unit	Cost/Unit	Net Cost (Option 5B)	Subtotal
2500	**Utilities**	0.75	LS	$ 1,880,410	$ 1,410,308	$ 1,410,308
2300	**Earthwork - Assume Proportional to Guideway Length**				$ -	$ 11,082,661
	Common Excavation	60,019	CY	$ 7.00	$ 420,133	
	Rock Excavation	340,108	CY	$ 25.00	$ 8,502,700	
	Backfill common	294,522	CY	$ 4.00	$ 1,178,088	
	Backfill w/ native import material	98,174	CY	$ 10.00	$ 981,740	
2700	**Track Grade Preparation**	46,957	RF	$ 140.00	$ 6,573,980	$ 6,573,980
5650	**Trackwork/Guide Rail**	1	LS	$ 20,193,262	$ 20,193,262	$ 20,193,262
3300	**Dedicated/Shared Transit Roadway**					$ -
	2-way		LF	$ 250.00	$ -	
	1-way		LF	$ 150.00	$ -	
	New Maswik Road		LF	$ 250.00	$ -	
3300	**Structures, Ditches, Retaining Walls, Roads**				$ -	$ 7,816,327
	Long Jim Drainage	1	LS	$ 255,000.00	$ 255,000	
	Maintenance Area Access Road	1,660	LF	$ 250.00	$ 415,000	
	Maintenance Area Access Road Bridge	100	LF	$ 4,500.00	$ 450,000	
	Extend South Entrance By-Pass Lane (12-foot lane)					
	Center Road	2,100	LF	$ 250.00	$ 525,000	
	Center Road Bridge	110	LF	$ 4,500.00	$ 495,000	
	Hwy 64 Roundabout	1	LS	$ 4,968,652	$ 4,968,652	
	Hwy 64 Intersection/Signal	0	LS	$ -	$ -	
	Resurface Roads per ADOT study					
	Retaining wall - 10' High	703	LF	$ 310.00	$ 217,930	
	Soundwall	500	LF	$ 280.00	$ 140,000	
	Powerline Relocation	2,750	LF	$ 40.00	$ 110,000	
	Cyclone Fencing 8' tall	255	LF	$ 24.00	$ 6,120	
	Demolish Service Road at CVIP	1,000	LF	$ 44.50	$ 44,500	
	New Service Road at CVIP	1,700	LF	$ 111.25	$ 189,125	
3300	**Grade Crossings/Overcrossings**				$ -	$ 3,288,994
	Major Street at Grade	6	LS	$ 450,000.00	$ 2,700,000	
	Pedestrian Overcrossing at GCTC	1	LS	$ 581,994.00	$ 581,994	
	Maint Facility Crossing Panels	50	LF	$ 140.00	$ 7,000	
13000	**Stations**				$ -	$ 17,008,208
	GCTC	1	LS	$ 12,449,916	$ 12,449,916	
	Concrete Paving in Station		SY	$ 116.40	$ -	
	Demolish Paving at Station & Alignment					
	Village	1	LS	$ 1,683,991	$ 1,683,991	
	Concrete Paving in Station		SY	$ 116.40	$ -	
	CVIP Platforms - Shelters	1	LS	$ 1,104,694	$ 1,104,694	
	Concrete Paving in Station		SY	$ 116.40	$ -	
	Demolish Bus Parking at Station	3,239	SY	$ 18.18	$ 58,885	
	"Permanent" Paving Existing Bus Parking at CVIP	0	EA	$ -	$ -	
	New Bus Parking at CVIP	0	EA	$ 7,404.00	$ -	
	Wayfinding at GCTC	1.00	LS	$ 1,315,284	$ 1,315,284	
	Wayfinding at Village	1	LS	$ 197,719.00	$ 197,719	
	Wayfinding at CVIP	1.00	LS	$ 197,719.00	$ 197,719	
21000	**Fare Collection/Reservations**				$ -	$ 2,387,838
	System	1	LS	$ 2,387,838	$ 2,387,838	
	Kiosks in Tusayan					
	Temporary Fee Collection & Reservations at GCTC					
2800	**Transit Center Sitework**				$ -	$ 14,948,660
	Landscape at GCTC	1.0	LS	$ 5,017,767	$ 5,017,767	
	Road Drainage and Utilities at GCTC	1.0	LS	$ 10,271,616	$ 10,271,616	
	Change in Parking Spaces	-274	EA	$ 1,944.00	$ (531,915)	
	Change in RV/Bus Spaces	-46	EA	$ 7,404.00	$ (338,905)	
	Landscape at Village	1	LS	$ 530,097.00	$ 530,097	
	Landscape at CVIP	0	LS	$ -	$ -	
2800	**Maintenance Facility**					$ 11,874,000
	Equipment and Furnishings	1.0	LS	$ 5,720,000	$ 5,720,000	
	Site Preparation	50	AC	$ 5,000.00	$ 250,000	
	Maintenance Bldg.	82,800	SF	$ 67.50	$ 5,589,000	
	Maintenance Facility Parking and Road	45,000	SF	$ 7.00	$ 315,000	

DSC-22 (6/97)

Denver Service Center - Estimate

Estimate By: DEA, Inc.

Project: Grand Canyon BRT Alternatives

Date: 10/29/02

Park: Grand Canyon National Park

Package **BRT and LRT Options - Full Transit System**

Reviewed By:

No Growth Scenario

Date:

Option 5B

Item No.	Description	Qty.	Unit	Cost/Unit	Net Cost	Subtotal
18000	**Electrification**					$ 28,087,100
	Powerline to Park	1	LS	$ 14,000,000	$ 14,000,000	
	Substations (included in OCS)	0	EA	$ 100,000.00	$ -	
	Overhead Catenary System	46,957	LF	$ 300.00	$ 14,087,100	
18000	**Signals and Communications**				$ -	$ 6,276,896
	System	1	LS	$ 6,276,896	$ 6,276,896	
Subtotal	**Direct Construction Costs**				$ 130,948,234	$ 130,948,234
1300	**Engineering and Administration**			15%	$ 19,642,235	$ 19,642,235
	Subtotal				$ 150,590,469	
1300	**Construction Contingency**			20%	$ 30,118,094	$ 30,118,094
	Subtotal				$ 180,708,562	
1300	**Escalation to 2003 @ 4% per year**	2	YR	1.08	**$ 195,454,381**	14,745,819

Grand Canyon National Park
Bus Rapid Transit Alternatives Analysis
Cash Flow Analysis and Life Cycle Cost
Option 1 - NO GROWTH

Year	Design/Construction/Procurement Activity	Transit Operation	Capital Cost - Construction	Capital Cost - Fixed Facility Rehab/Repair	Residual Value of Fixed Facilities	Capital Cost - Rim Shuttle Buses	Capital Cost - Line Haul Rail Vehicles	Capital Cost - Line Haul Buses	Residual Value of Retired Buses	Capital Cost - Major Vehicle Overhaul	Line Haul Operating and Maint. Cost	Shuttle Bus Operating and Maint. Cost	Total Transit O & M Cost	Total Cash Flow	*Real Property Depreciation*	*Vehicle Depreciation*	*Depreciation*	Total Cost	Net Present Value	Equivalent Annual Cost	South Rim Paying Visitors	Revenue	Discounted Revenue	Total Cost/ Total Visitor
2003		Existing shuttle	$ -											$ -			$ -	$ -			3,169,739			
2004	Design Option 1 Improvements	Existing shuttle	3,732,316											$ 3,732,316			$ -	$ 3,732,316			3,169,739			
2005	Design Option 1 Improvements	Existing shuttle	$ 3,732,316											$ 3,732,316			$ -	$ 3,732,316			3,169,739			
2006	Construct/Procure Option 1	Existing shuttle	$ 33,590,843							$ 25,000				$ 33,615,843			$ -	$ 33,615,843			3,169,739			
2007	Construct/Procure Option 1	Existing shuttle	$ 33,590,843			$ 15,647,500		$ 11,396,000						$ 60,634,343			$ -	$ 60,634,343			3,169,739			
2008		Option 1 - 2006 Cond.											$ 13,286,084	$ 13,286,084			$ -	$ 13,286,084			3,169,739			
2009	Replace Bus/Trailer Units (7)	Option 1 - 2006 Cond.				$ 4,427,500			$ -				$ 13,286,084	$ 17,713,584			$ -	$ 17,713,584			3,169,739			
2010	Replace 2 40' CNG	Option 1 - 2006 Cond.				$ 726,000			$ (72,600)	$ 280,000			$ 13,286,084	$ 14,219,484			$ -	$ 14,219,484			3,169,739			
2011	Replace 3 40' CNG	Option 1 - 2006 Cond.				$ 1,089,000			$ (108,900)				$ 13,286,084	$ 14,266,184			$ -	$ 14,266,184			3,169,739			
2012		Option 1 - 2006 Cond.								$ 2,518,000			$ 13,286,084	$ 15,804,084			$ -	$ 15,804,084			3,169,739			
2013		Option 1 - 2016 Cond.				$ -		$ -					$ 13,286,084	$ 13,286,084			$ -	$ 13,286,084			3,169,739			
2014		Option 1 - 2016 Cond.								$ 280,000			$ 13,286,084	$ 13,566,084			$ -	$ 13,566,084			3,169,739			
2015		Option 1 - 2016 Cond.								$ 25,000			$ 13,286,084	$ 13,311,084			$ -	$ 13,311,084			3,169,739			
2016		Option 1 - 2016 Cond.											$ 13,286,084	$ 13,286,084			$ -	$ 13,286,084			3,169,739			
2017		Option 1 - 2016 Cond.		$ 14,929,264						$ 159,000			$ 13,286,084	$ 28,374,347			$ -	$ 28,374,347			3,169,739			
2018		Option 1 - 2016 Cond.											$ 13,286,084	$ 13,286,084			$ -	$ 13,286,084			3,169,739			
2019		Option 1 - 2026 Cond.				$ -		$ -		$ 25,000			$ 13,286,084	$ 13,311,084			$ -	$ 13,311,084			3,169,739			
2020	Replace Intitial Buses	Option 1 - 2026 Cond.				$ 15,647,500		$ 11,396,000	$ (2,704,350)				$ 13,286,084	$ 37,625,234			$ -	$ 37,625,234			3,169,739			
2021	Replace Bus/Trailer Replacements (7)	Option 1 - 2026 Cond.				$ 4,427,500			$ (442,750)				$ 13,286,084	$ 17,270,834			$ -	$ 17,270,834			3,169,739			
2022	Replace 2 40' CNG	Option 1 - 2026 Cond.				$ 726,000			$ (72,600)	$ 280,000			$ 13,286,084	$ 14,219,484			$ -	$ 14,219,484			3,169,739			
2023	Replace 3 40' CNG	Option 1 - 2026 Cond.				$ 1,089,000			$ (108,900)				$ 13,286,084	$ 14,266,184			$ -	$ 14,266,184			3,169,739			
2024		Option 1 - 2026 Cond.								$ 2,518,000			$ 13,286,084	$ 15,804,084			$ -	$ 15,804,084			3,169,739			
2025		Option 1 - 2026 Cond.											$ 13,286,084	$ 13,286,084			$ -	$ 13,286,084			3,169,739			
2026		Option 1 - 2026 Cond.							$ (21,003,400)				$ 13,286,084	$ (7,717,316)			$ -	$ (7,717,316)			3,169,739			
Total			$ 74,646,318	$ 14,929,264		$ 43,780,000	$ -	$ 22,792,000	$ (24,513,500)	$ 6,110,000	$ -	$ -	$ 252,435,588	$ 390,179,669	$ -	$ -	$ -	$ 390,179,669	$ -	$0	76,073,743			$ 5.13

IRR

Inflation	**0.00%**	**All costs in constant 2003 US dollars**			
Base Year	2003				
South Rim				Visits/Total	
Share of Visits	90%	Paying visitors per total visitors	74.2%	Visits	92.7%
				Percent Re-Entering	20.0%
Option Construction		$	74,646,318		

Existing Fleet	**Description**	**Remaining Life in 2003**
3	New Flyer 40' CNG	7 years
2	New Flyer 40' CNG	8 years
7	Bus/Trailer - LNG	6 years

Fleet Requirements - Rim Shuttle System

2006	**Number**	**Unit Cost**
40' Buses	15	$ 363,000.00
60' Buses	26	$ 632,500.00
2016		
40' Buses	15	$ 363,000.00
60' Buses	26	$ 632,500.00
2026		
40' Buses	15	$ 363,000.00
60' Buses	26	$ 632,500.00

Fleet Requirements - Line Haul

2006	**Number**	**Unit Cost**
40' Buses	7	$ 363,000.00
60' Buses	14	$ 632,500.00
2016		
40' Buses	7	$ 363,000.00
60' Buses	14	$ 632,500.00
2026		
40' Buses	7	$ 363,000.00
60' Buses	14	$ 632,500.00

Assumed residual value of vehicles at retirement (percent of initial cost) 10%

Fleet Composition at contract end

Line Haul System	Number	Age	Value	Number	Age	Value	Number	Age	Value	Number	Age	Value	Number	Age	Value	Total Number	Total Value
40' Buses				7	7	$ 1,206,975										7	$ 1,206,975
60' Buses			$ -	14	7	$ 4,206,125	15	7	$ 4,506,563							29	$ 8,712,688
Rim Shuttles																	
40' Buses						$ -	10	7	$ 1,724,250	2	5	$ 453,750	3	4	$ 762,300.00	15	$ 2,940,300
60' Buses			$ -			$ -	19	7	$ 5,708,313	7	6	$ 2,435,125				26	$ 8,143,438
																	$ 21,003,400

Grand Canyon National Park
Bus Rapid Transit Alternatives Analysis
Cash Flow Analysis and Life Cycle Cost
Option 2 - NO GROWTH

Year	Design/Construction/Procurement Activity	Transit Operation	Capital Cost - Construction	Capital Cost - Fixed Facility Rehab/Repair	Residual Value of Fixed Facilities	Capital Cost - Rim Shuttle Buses	Capital Cost - Line Haul Rail Vehicles	Capital Cost - Line Haul Buses	Residual Value of Retired Buses	Capital Cost - Major Vehicle Overhaul	Line Haul Operating and Maint. Cost	Shuttle Bus Operating and Maint. Cost	Total Transit O & M Cost	Total Cash Flow	*Real Property Depreciation*	*Vehicle Depreciation*	*Depreciation*	Total Cost	Net Present Value	Equivalent Annual Cost	South Rim Paying Visitors	Revenue	Discounted Revenue	Total Cost/ Total Visitor
2003		Existing shuttle	$ -											$ -			$ -	$ -			3,169,739			
2004	Design Option 1 Improvements	Existing shuttle	5,210,984											$ 5,210,984			$ -	$ 5,210,984			3,169,739			
2005	Design Option 1 Improvements	Existing shuttle	$ 5,210,984											$ 5,210,984			$ -	$ 5,210,984			3,169,739			
2006	Construct/Procure Option 1	Existing shuttle	$ 46,898,853							$ 25,000				$ 46,923,853			$ -	$ 46,923,853			3,169,739			
2007	Construct/Procure Option 1	Existing shuttle	$ 46,898,853			$ 15,647,500		$ 19,701,000						$ 82,247,353			$ -	$ 82,247,353			3,169,739			
2008		Option 2B - 2006 Cond.											$ 14,363,383	$ 14,363,383			$ -	$ 14,363,383			3,169,739			
2009	Replace Bus/Trailer Units (7)	Option 2B - 2006 Cond.				$ 4,427,500			$ -				$ 14,363,383	$ 18,790,883			$ -	$ 18,790,883			3,169,739			
2010	Replace 2 40' CNG	Option 2B - 2006 Cond.				$ 726,000			$ (72,600)	$ 210,000			$ 14,363,383	$ 15,226,783			$ -	$ 15,226,783			3,169,739			
2011	Replace 3 40' CNG	Option 2B - 2006 Cond.				$ 1,089,000			$ (108,900)				$ 14,363,383	$ 15,343,483			$ -	$ 15,343,483			3,169,739			
2012		Option 2B - 2006 Cond.								$ 1,809,000			$ 14,363,383	$ 16,172,383			$ -	$ 16,172,383			3,169,739			
2013		Option 2B - 2016 Cond.				$ -		$ -					$ 14,363,383	$ 14,363,383			$ -	$ 14,363,383			3,169,739			
2014		Option 2B - 2016 Cond.								$ 210,000			$ 14,363,383	$ 14,573,383			$ -	$ 14,573,383			3,169,739			
2015		Option 2B - 2016 Cond.								$ 25,000			$ 14,363,383	$ 14,388,383			$ -	$ 14,388,383			3,169,739			
2016		Option 2B - 2016 Cond.								$ 420,000			$ 14,363,383	$ 14,783,383			$ -	$ 14,783,383			3,169,739			
2017		Option 2B - 2016 Cond.		$ 20,843,935						$ 159,000			$ 14,363,383	$ 35,366,318			$ -	$ 35,366,318			3,169,739			
2018		Option 2B - 2016 Cond.											$ 14,363,383	$ 14,363,383			$ -	$ 14,363,383			3,169,739			
2019		Option 2B - 2026 Cond.				$ -		$ 2,541,000		$ 25,000			$ 14,363,383	$ 16,929,383			$ -	$ 16,929,383			3,169,739			
2020	Replace Intitial Buses - Rim Shuttles	Option 2B - 2026 Cond.				$ 15,647,500			$ (1,818,850)	$ 10,000			$ 14,363,383	$ 28,202,033			$ -	$ 28,202,033			3,169,739			
2021	Replace Bus/Trailer Replacements (7)	Option 2B - 2026 Cond.				$ 4,427,500			$ (442,750)				$ 14,363,383	$ 18,348,133			$ -	$ 18,348,133			3,169,739			
2022	Replace 2 40' CNG	Option 2B - 2026 Cond.				$ 726,000			$ (72,600)	$ 210,000			$ 14,363,383	$ 15,226,783			$ -	$ 15,226,783			3,169,739			
2023	Replace 3 40' CNG	Option 2B - 2026 Cond.				$ 1,089,000			$ (108,900)				$ 14,363,383	$ 15,343,483			$ -	$ 15,343,483			3,169,739			
2024		Option 2B - 2026 Cond.								$ 1,809,000			$ 14,363,383	$ 16,172,383			$ -	$ 16,172,383			3,169,739			
2025		Option 2B - 2026 Cond.											$ 14,363,383	$ 14,363,383			$ -	$ 14,363,383			3,169,739			
2026		Option 2B - 2026 Cond.							$ (14,778,913)				$ 14,363,383	$ (415,530)			$ -	$ (415,530)			3,169,739			
Total			$ 104,219,673	$ 20,843,935		$ 43,780,000	$ -	$ 22,242,000	$ (17,403,513)	$ 4,912,000	$ -	$ -	$ 272,904,277	$ 451,498,372	$ -	$ -	$ -	$ 451,498,372	$ -	$0	76,073,743			$ 5.94

IRR

Inflation	**0.00%**	**All costs in constant 2003 US dollars**	
Base Year	2003		
South Rim			
Share of Visits	90%	Paying visitors per total visitors	74.2%
Option Construction		$ 104,219,673	

Existing Fleet	**Description**	**Remaining Life in 2003**
3	New Flyer 40' CNG	7 years
2	New Flyer 40' CNG	8 years
7	Bus/Trailer - LNG	6 years

Fleet Requirements - Rim Shuttle System

	Number	**Unit Cost**
2006		
40' Buses	15	$ 363,000.00
60' Buses	26	$ 632,500.00
2016		
40' Buses	15	$ 363,000.00
60' Buses	26	$ 632,500.00
2026		
40' Buses	15	$ 363,000.00
60' Buses	26	$ 632,500.00

Fleet Requirements - Line Haul

	Number	**Unit Cost**
2006		
40' Buses	7	$ 363,000.00
CIVIS Buses	13	$ 1,320,000.00
2016		
40' Buses	7	$ 363,000.00
CIVIS Buses	13	$ 1,320,000.00
2026		
40' Buses	7	$ 363,000.00
CIVIS Buses	13	$ 1,320,000.00

Assumed residual value of vehicles (percent of initial cost) 10%

Fleet Composition at contract end

Line Haul System	Number	Age	Value	Number	Age	Value	Number	Age	Value	Number	Age	Value	Number	Age	Value	Total Number	Total Value
40' Buses				7	7	$ 1,206,975										7	$ 1,206,975
CIVIS Buses	13	19	$ 2,488,200.00			$ -			$ -							13	$ 2,488,200
Rim Shuttles																	
40' Buses					8	$ -	10	7	$ 1,724,250	2	5	$ 453,750	3	4	$ 762,300	15	$ 2,940,300
60' Buses		14	$ -		8	$ -	19	7	$ 5,708,313	7	6	$ 2,435,125				26	$ 8,143,438
																	$ 14,778,913

Grand Canyon National Park
Bus Rapid Transit Alternatives Analysis
Cash Flow Analysis and Life Cycle Cost
Option 3 - NO GROWTH

Year	Design/Construction/Procurement Activity	Transit Operation	Capital Cost - Construction	Capital Cost - Fixed Facility Rehab/Repair	Residual Value of Fixed Facilities	Capital Cost - Rim Shuttle Buses	Capital Cost - Line Haul Rail Vehicles	Capital Cost - Line Haul Buses	Residual Value of Retired Buses	Capital Cost - Major Vehicle Overhaul	Line Haul Operating and Maint. Cost	Shuttle Bus Operating and Maint. Cost	Total Transit O & M Cost	Total Cash Flow	*Real Property Depreciation*	*Vehicle Depreciation*	*Depreciation*	Total Cost	Net Present Value	Equivalent Annual Cost	South Rim Paying Visitors	Revenue	Discounted Revenue	Total Cost/ Total Visitor
2003		Existing shuttle	$ -											$ -			$ -	$ -			3,169,739			
2004	Design Option 1 Improvements	Existing shuttle	8,031,036											$ 8,031,036			$ -	$ 8,031,036			3,169,739			
2005	Design Option 1 Improvements	Existing shuttle	$ 8,031,036											$ 8,031,036			$ -	$ 8,031,036			3,169,739			
2006	Construct/Procure Option 1	Existing shuttle	$ 72,279,325							$ 25,000				$ 72,304,325			$ -	$ 72,304,325			3,169,739			
2007	Construct/Procure Option 1	Existing shuttle	$ 72,279,325			$ 11,363,000		$ 37,400,000						$ 121,042,325			$ -	$ 121,042,325			3,169,739			
2008		Option 3B - 2006 Cond.											$ 15,085,226	$ 15,085,226			$ -	$ 15,085,226			3,169,739			
2009	Replace Bus/Trailer Units (7)	Option 3B - 2006 Cond.				$ 2,849,000			$ -	$ 72,000			$ 15,085,226	$ 18,006,226			$ -	$ 18,006,226			3,169,739			
2010	Replace 2 40' CNG	Option 3B - 2006 Cond.				$ 726,000			$ (72,600)	$ 665,000			$ 15,085,226	$ 16,403,626			$ -	$ 16,403,626			3,169,739			
2011	Replace 3 40' CNG	Option 3B - 2006 Cond.				$ 1,089,000			$ (108,900)				$ 15,085,226	$ 16,065,326			$ -	$ 16,065,326			3,169,739			
2012		Option 3B - 2006 Cond.								$ 760,000			$ 15,085,226	$ 15,845,226			$ -	$ 15,845,226			3,169,739			
2013		Option 3B - 2016 Cond.				$ -		$ -					$ 15,085,226	$ 15,085,226			$ -	$ 15,085,226			3,169,739			
2014		Option 3B - 2016 Cond.								$ 50,000			$ 15,085,226	$ 15,135,226			$ -	$ 15,135,226			3,169,739			
2015		Option 3B - 2016 Cond.								$ 943,000			$ 15,085,226	$ 16,028,226			$ -	$ 16,028,226			3,169,739			
2016		Option 3B - 2016 Cond.											$ 15,085,226	$ 15,085,226			$ -	$ 15,085,226			3,169,739			
2017		Option 3B - 2016 Cond.		$ 32,124,144						$ 159,000			$ 15,085,226	$ 47,368,370			$ -	$ 47,368,370			3,169,739			
2018		Option 3B - 2016 Cond.								$ 28,000			$ 15,085,226	$ 15,113,226			$ -	$ 15,113,226			3,169,739			
2019		Option 3B - 2026 Cond.				$ -		$ -		$ 25,000			$ 15,085,226	$ 15,110,226			$ -	$ 15,110,226			3,169,739			
2020	Replace Intitial Buses (Rim Shuttles)	Option 3B - 2026 Cond.				$ 11,363,000			$ (1,136,300)	$ 680,000			$ 15,085,226	$ 25,991,926			$ -	$ 25,991,926			3,169,739			
2021	Replace Bus/Trailer Replacements (7)	Option 3B - 2026 Cond.				$ 2,849,000			$ (284,900)	$ 72,000			$ 15,085,226	$ 17,721,326			$ -	$ 17,721,326			3,169,739			
2022	Replace 2 40' CNG	Option 3B - 2026 Cond.				$ 726,000			$ (72,600)	$ 50,000			$ 15,085,226	$ 15,788,626			$ -	$ 15,788,626			3,169,739			
2023	Replace 3 40' CNG	Option 3B - 2026 Cond.				$ 1,089,000			$ (108,900)				$ 15,085,226	$ 16,065,326			$ -	$ 16,065,326			3,169,739			
2024		Option 3B - 2026 Cond.								$ 732,000			$ 15,085,226	$ 15,817,226			$ -	$ 15,817,226			3,169,739			
2025		Option 3B - 2026 Cond.								$ 833,000			$ 15,085,226	$ 15,918,226			$ -	$ 15,918,226			3,169,739			
2026		Option 3B - 2026 Cond.							$ (24,262,425)				$ 15,085,226	$ (9,177,199)			$ -	$ (9,177,199)			3,169,739			
Total			$ 160,620,722	$ 32,124,144		$ 32,054,000	$ -	$ 37,400,000	$ (26,046,625)	$ 5,094,000	$ -	$ -	$ 286,619,294	$ 527,865,536	$ -	$ -	$ -	$ 527,865,536	$ -	$0	76,073,743			$ 6.94

IRR
Inflation **0.00%** **All costs in constant 2003 US dollars**
Base Year 2003
South Rim
Share of Visits 90% Paying visitors per total visitors 74.2%

Option Construction $ 160,620,722

Existing Fleet	**Description**	**Remaining Life in 2003**
3	New Flyer 40' CNG	7 years
2	New Flyer 40' CNG	8 years
7	Bus/Trailer - LNG	6 years

Fleet Requirements - Rim Shuttle System

	Number	**Unit Cost**
2006		
40' Buses	15	$ 363,000.00
Bus/Trailers	26	$ 407,000.00
2016		
40' Buses	15	$ 363,000.00
Bus/Trailers	26	$ 407,000.00
2026		
40' Buses	15	$ 363,000.00
Bus/Trailers	26	$ 407,000.00

Fleet Requirements - Line Haul

	Number	**Unit Cost**
2006		
40' Buses	0	$ 363,000.00
GLT Buses	17	$ 2,200,000.00
2016		
40' Buses	0	$ 363,000.00
GLT Buses	17	$ 2,200,000.00
2026		
60' Buses	0	$ 632,500.00
GLT Buses	17	$ 2,200,000.00

Assumed residual value of vehicles at retirement (percent of initial cost) 10%

Fleet Composition at contract end

	Number	Age	Value	Number	Age	Value	Number	Age	Value	Number	Age	Value	Number	Age	Value	Total Number	Total Value
Line Haul System																	
40' Buses																-	$ -
GLT Buses	17	19	$ 16,082,000	14	$ -		8	$ -								17	$ 16,082,000
Rim Shuttles																	
40' Buses				8	$ -		10	7	$ 1,724,250	2	5	$ 453,750	3	4	$ 762,300	15	$ 2,940,300
Bus/Trailers		14	$ -	8	$ -		19	7	$ 3,673,175	7	6	$ 1,566,950				26	$ 5,240,125
																	$ 24,262,425

Grand Canyon National Park
Bus Rapid Transit Alternatives Analysis
Cash Flow Analysis and Life Cycle Cost
Option 5A - NO GROWTH

Year	Design/Construction/Procurement Activity	Transit Operation	Capital Cost - Construction	Capital Cost - Fixed Facility Rehab/Repair	Residual Value of Fixed Facilities	Capital Cost - Rim Shuttle Buses	Capital Cost - Line Haul Rail Vehicles	Capital Cost - Line Haul Buses	Residual Value of Retired Vehicles	Capital Cost - Major Vehicle Overhaul	Line Haul Operating and Maint. Cost	Shuttle Bus Operating and Maint. Cost	Total Transit O & M Cost	Total Cash Flow	*Real Property Depreciation*	*Vehicle Depreciation*	*Depreciation*	Total Cost	Net Present Value	Equivalent Annual Cost	South Rim Paying Visitors	Revenue	Discounted Revenue	Total Cost/ Total Visitor
2003		Existing shuttle	$ -											$ -			$ -	$ -			3,169,739			
2004	Design Option 1 Improvements	Existing shuttle	7,676,568											$ 7,676,568			$ -	$ 7,676,568			3,169,739			
2005	Design Option 1 Improvements	Existing shuttle	$ 7,676,568											$ 7,676,568			$ -	$ 7,676,568			3,169,739			
2006	Construct/Procure Option 1	Existing shuttle	$ 69,089,108							$ 25,000				$ 69,114,108			$ -	$ 69,114,108			3,169,739			
2007	Construct/Procure Option 1	Existing shuttle	$ 69,089,108			$ 11,363,000	$ 36,960,000							$ 117,412,108			$ -	$ 117,412,108			3,169,739			
2008		Option 1 - 2006 Cond.											$ 14,608,414	$ 14,608,414			$ -	$ 14,608,414			3,169,739			
2009	Replace Bus/Trailer Units (7)	Option 1 - 2006 Cond.				$ 2,849,000			$ -	$ 40,000			$ 14,608,414	$ 17,497,414			$ -	$ 17,497,414			3,169,739			
2010	Replace 2 40' CNG	Option 1 - 2006 Cond.				$ 726,000			$ (72,600)	$ 710,000			$ 14,608,414	$ 15,971,814			$ -	$ 15,971,814			3,169,739			
2011	Replace 3 40' CNG	Option 1 - 2006 Cond.				$ 1,089,000			$ (108,900)				$ 14,608,414	$ 15,588,514			$ -	$ 15,588,514			3,169,739			
2012		Option 1 - 2006 Cond.								$ 588,000			$ 14,608,414	$ 15,196,414			$ -	$ 15,196,414			3,169,739			
2013	Expand System	Option 1 - 2016 Cond.				$ -	$ -			$ 60,000			$ 14,608,414	$ 14,668,414			$ -	$ 14,668,414			3,169,739			
2014		Option 1 - 2016 Cond.								$ 50,000			$ 14,608,414	$ 14,658,414			$ -	$ 14,658,414			3,169,739			
2015		Option 1 - 2016 Cond.								$ 810,000			$ 14,608,414	$ 15,418,414			$ -	$ 15,418,414			3,169,739			
2016		Option 1 - 2016 Cond.								$ 405,000			$ 14,608,414	$ 15,013,414			$ -	$ 15,013,414			3,169,739			
2017		Option 1 - 2016 Cond.		$ 30,706,270						$ 159,000			$ 14,608,414	$ 45,473,684			$ -	$ 45,473,684			3,169,739			
2018		Option 1 - 2016 Cond.											$ 14,608,414	$ 14,608,414			$ -	$ 14,608,414			3,169,739			
2019	Expand System	Option 1 - 2026 Cond.				$ -	$ -			$ 85,000			$ 14,608,414	$ 14,693,414			$ -	$ 14,693,414			3,169,739			
2020	Replace Intitial Buses	Option 1 - 2026 Cond.				$ 11,363,000			$ (4,832,300)	$ 760,000			$ 14,608,414	$ 21,899,114			$ -	$ 21,899,114			3,169,739			
2021	Replace Bus/Trailer Replacements (7)	Option 1 - 2026 Cond.				$ 2,849,000			$ (284,900)	$ 40,000			$ 14,608,414	$ 17,212,514			$ -	$ 17,212,514			3,169,739			
2022	Replace 2 40' CNG	Option 1 - 2026 Cond.				$ 726,000			$ (72,600)	$ 50,000			$ 14,608,414	$ 15,311,814			$ -	$ 15,311,814			3,169,739			
2023	Replace 3 40' CNG	Option 1 - 2026 Cond.				$ 1,089,000			$ (108,900)				$ 14,608,414	$ 15,588,514			$ -	$ 15,588,514			3,169,739			
2024		Option 1 - 2026 Cond.								$ 588,000			$ 14,608,414	$ 15,196,414			$ -	$ 15,196,414			3,169,739			
2025	Replace Expansion Buses - Defer	Option 1 - 2026 Cond.								$ 860,000			$ 14,608,414	$ 15,468,414			$ -	$ 15,468,414			3,169,739			
2026		Option 1 - 2026 Cond.							$ (19,859,785)				$ 14,608,414	$ (5,251,371)			$ -	$ (5,251,371)			3,169,739			
Total			$ 153,531,351	$ 30,706,270		$ 32,054,000	$ 36,960,000	$ -	$ (25,339,985)	$ 5,230,000	$ -	$ -	$ 277,559,866	$ 510,701,502	$ -	$ -	$ -	$ 510,701,502	$ -	$0	76,073,743			$ 6.71

IRR
Inflation **0.00%** **All costs in constant 2003 US dollars**
Base Year 2003
South Rim
Share of Visits 90% Paying visitors per total visitors 74.2%

Option Construction $ 153,531,351

Existing Fleet	**Description**	**Remaining Life in 2003**
3	New Flyer 40' CNG	7 years
2	New Flyer 40' CNG	8 years
7	Bus/Trailer - LNG	6 years

Fleet Requirements - Rim Shuttle System

2006	**Number**	**Unit Cost**
40' Buses	15	$ 363,000.00
Bus/Trailers	26	$ 407,000.00
2016		
40' Buses	15	$ 363,000.00
Bus/Trailers	26	$ 407,000.00
2026		
40' Buses	15	$ 363,000.00
Bus/Trailers	26	$ 407,000.00

Fleet Requirements - Line Haul

2006	**Number**	**Unit Cost**
Light Rail Vehic	12	$ 3,080,000.00
2016		
Light Rail Vehic	12	$ 3,080,000.00
		$ -
2026		
Light Rail Vehic	12	$ 3,080,000.00
		$ -

Assumed residual value of vehicles (percent of initial cost) 10%

Fleet Composition at contract end

Line Haul System	Number	Age	Value	Number	Age	Value	Number	Age	Value	Number	Age	Value	Number	Age	Value	Total Number	Total Value
40' Buses																-	$ -
LRT Vehicles	12	19	$ 11,679,360		$ -			$ -								12	$ 11,679,360
Rim Shuttles																	
40' Buses				8	$ -	10	7	$ 1,724,250	2	5	$ 453,750	3	4	$ 762,300		15	$ 2,940,300
Bus/Trailers		14	$ -	8	$ -	19	7	$ 3,673,175	7	6	$ 1,566,950					26	$ 5,240,125
Total																	$ 19,859,785

Grand Canyon National Park
Bus Rapid Transit Alternatives Analysis
Cash Flow Analysis and Life Cycle Cost
Option 5B - NO GROWTH

Year	Design/Construction/Procurement Activity	Transit Operation	Capital Cost - Construction	Capital Cost - Fixed Facility Rehab/Repair	Residual Value of Fixed Facilities	Capital Cost - Rim Shuttle Buses	Capital Cost - Line Haul Rail Vehicles	Capital Cost - Line Haul Buses	Residual Value of Retired Vehicles	Capital Cost - Major Vehicle Overhaul	Line Haul Operating and Maint. Cost	Shuttle Bus Operating and Maint. Cost	Total Transit O & M Cost	Total Cash Flow	*Real Property Depreciation*	*Vehicle Depreciation*	*Depreciation*	Total Cost	Net Present Value	Equivalent Annual Cost	South Rim Paying Visitors	Revenue	Discounted Revenue	Total Cost/ Total Visitor
2003		Existing shuttle	$ -							$ -				$ -			$ -	$ -			3,169,739			
2004	Design Option 1 Improvements	Existing shuttle	9,772,719							$ -				$ 9,772,719			$ -	$ 9,772,719			3,169,739			
2005	Design Option 1 Improvements	Existing shuttle	$ 9,772,719							$ -				$ 9,772,719			$ -	$ 9,772,719			3,169,739			
2006	Construct/Procure Option 1	Existing shuttle	$ 87,954,471							$ 25,000				$ 87,979,471			$ -	$ 87,979,471			3,169,739			
2007	Construct/Procure Option 1	Existing shuttle	$ 87,954,471			$ 11,363,000	$ 33,000,000			$ -				$ 132,317,471			$ -	$ 132,317,471			3,169,739			
2008		Option 1 - 2006 Cond.								$ -			$ 15,484,919	$ 15,484,919			$ -	$ 15,484,919			3,169,739			
2009	Replace Bus/Trailer Units (7)	Option 1 - 2006 Cond.				$ 2,849,000			$ -	$ 40,000			$ 15,484,919	$ 18,373,919			$ -	$ 18,373,919			3,169,739			
2010	Replace 2 40' CNG	Option 1 - 2006 Cond.				$ 726,000			$ (72,600)	$ 710,000			$ 15,484,919	$ 16,848,319			$ -	$ 16,848,319			3,169,739			
2011	Replace 3 40' CNG	Option 1 - 2006 Cond.				$ 1,089,000			$ (108,900)	$ -			$ 15,484,919	$ 16,465,019			$ -	$ 16,465,019			3,169,739			
2012		Option 1 - 2006 Cond.								$ 588,000			$ 15,484,919	$ 16,072,919			$ -	$ 16,072,919			3,169,739			
2013	Expand System	Option 1 - 2016 Cond.				$ -	$ -			$ 60,000			$ 15,484,919	$ 15,544,919			$ -	$ 15,544,919			3,169,739			
2014		Option 1 - 2016 Cond.								$ 50,000			$ 15,484,919	$ 15,534,919			$ -	$ 15,534,919			3,169,739			
2015		Option 1 - 2016 Cond.								$ 810,000			$ 15,484,919	$ 16,294,919			$ -	$ 16,294,919			3,169,739			
2016		Option 1 - 2016 Cond.								$ 405,000			$ 15,484,919	$ 15,889,919			$ -	$ 15,889,919			3,169,739			
2017		Option 1 - 2016 Cond.		$ 39,090,876						$ 159,000			$ 15,484,919	$ 54,734,795			$ -	$ 54,734,795			3,169,739			
2018		Option 1 - 2016 Cond.								$ -			$ 15,484,919	$ 15,484,919			$ -	$ 15,484,919			3,169,739			
2019	Expand System	Option 1 - 2026 Cond.				$ -	$ -			$ 85,000			$ 15,484,919	$ 15,569,919			$ -	$ 15,569,919			3,169,739			
2020	Replace Intitial Buses	Option 1 - 2026 Cond.				$ 11,363,000			$ (4,436,300)	$ 760,000			$ 15,484,919	$ 23,171,619			$ -	$ 23,171,619			3,169,739			
2021	Replace Bus/Trailer Replacements (7)	Option 1 - 2026 Cond.				$ 2,849,000			$ (284,900)	$ 40,000			$ 15,484,919	$ 18,089,019			$ -	$ 18,089,019			3,169,739			
2022	Replace 2 40' CNG	Option 1 - 2026 Cond.				$ 726,000			$ (72,600)	$ 50,000			$ 15,484,919	$ 16,188,319			$ -	$ 16,188,319			3,169,739			
2023	Replace 3 40' CNG	Option 1 - 2026 Cond.				$ 1,089,000			$ (108,900)	$ -			$ 15,484,919	$ 16,465,019			$ -	$ 16,465,019			3,169,739			
2024		Option 1 - 2026 Cond.								$ 588,000			$ 15,484,919	$ 16,072,919			$ -	$ 16,072,919			3,169,739			
2025	Replace Expansion Buses - Defer	Option 1 - 2026 Cond.								$ 860,000			$ 15,484,919	$ 16,344,919			$ -	$ 16,344,919			3,169,739			
2026		Option 1 - 2026 Cond.							$ (21,578,425)	$ -			$ 15,484,919	$ (6,093,506)			$ -	$ (6,093,506)			3,169,739			
Total			$ 195,454,381	$ 39,090,876		$ 32,054,000	$ 33,000,000	$ -	$ (26,662,625)	$ 5,230,000	$ -	$ -	$ 294,213,458	$ 572,380,090	$ -	$ -	$ -	$ 572,380,090	$ -	$0	76,073,743			$ 7.52

IRR
Inflation **0.00%** **All costs in constant 2003 US dollars**
Base Year 2003
South Rim
Share of Visits 90% Paying visitors per total visitors 74.2%

Option Construction $ 195,454,381

Existing Fleet	**Description**	**Remaining Life in 2003**
3	New Flyer 40' CNG	7 years
2	New Flyer 40' CNG	8 years
7	Bus/Trailer - LNG	6 years

Fleet Requirements - Rim Shuttle System

2006	**Number**	**Unit Cost**
40' Buses	15	$ 363,000.00
Bus/Trailers	26	$ 407,000.00
2016		
40' Buses	15	$ 363,000.00
Bus/Trailers	26	$ 407,000.00
2026		
40' Buses	15	$ 363,000.00
Bus/Trailers	26	$ 407,000.00

Fleet Requirements - Line Haul

2006	**Number**	**Unit Cost**
Light Rail Vehic	12	$ 2,750,000.00
2016		
Light Rail Vehic	12	$ 2,750,000.00
		$ -
2026		
Light Rail Vehic	12	$ 2,750,000.00
		$ -

Assumed residual value of vehicles (percent of initial cost) 10%

Fleet Composition at contract end

Line Haul System	Number	Age	Value	Number	Age	Value	Number	Age	Value	Number	Age	Value	Number	Age	Value	Total Number	Total Value
40' Buses																-	$ -
LRT Vehicles	14	19	$ 12,166,000			$ -			$ -							14	$ 12,166,000
Rim Shuttles																	
40' Buses				4	8	$ 580,800	10	7	$ 1,724,250	2	5	$ 453,750	3	4	$ 762,300	19	$ 3,521,100
Bus/Trailers	2	14	$ -	4	8	$ 651,200	19	7	$ 3,673,175	7	6	$ 1,566,950				32	$ 5,891,325
Total																	$ 21,578,425

DSC-22 (6/97)

Denver Service Center - Estimate

Project: Grand Canyon BRT Alternatives

Park: Grand Canyon National Park

Package **BRT and LRT Options - Full Transit System**

Estimate By: DEA, Inc.

Date: 09/11/02

Reviewed By:

Date:

Item No.	Description	Qty.	Unit	Cost/Unit	Rim Shuttles Net Cost	**Part of all Alts** Subtotal
2500	**Utilities**	0.00	LS	$ 1,880,410.00	$ -	$ -
2300	**Earthwork - Assume Proportional to Guideway Length**				$ -	$ -
	Common Excavation	0	CY	$ 7.00	$ -	
	Rock Excavation	0	CY	$ 25.00	$ -	
	Backfill common	0	CY	$ 4.00	$ -	
	Backfill w/ native import material	0		$ 10.00	$ -	
2700	**Track Grade Preparation**	0	RF	$ 140.00	$ -	$ -
5650	**Trackwork/Guide Rail**	0	LS	$ 20,193,262.00	$ -	$ -
3300	**Dedicated/Shared Transit Roadway**					$ -
	2-way	0	LF	$ 250.00	$ -	
	1-way	0	LF	$ 150.00	$ -	
	New Maswik Road	0	LF	$ 250.00	$ -	
3300	**Structures, Ditches, Retaining Walls, Roads**				$ -	$ -
	Long Jim Drainage	0	LS	$ 255,000.00	$ -	
	Maintenance Area Access Road	0	LF	$ 250.00	$ -	
	Maintenance Area Access Road Bridge	0	LF	$ 4,500.00	$ -	
	Extend South Entrance By-Pass Lane (12-foot lane)	0	LF	$ 150.00	$ -	
	Center Road	0	LF	$ 250.00	$ -	
	Center Road Bridge	0	LF	$ 4,500.00	$ -	
	Hwy 64 Roundabout	0	LS	$ 4,968,652.00	$ -	
	Hwy 64 Intersection/Signal	0	LS	$ 200,000.00	$ -	
	Resurface Roads per ADOT study	0	LS	$ 1,205,000.00	$ -	
	Retaining wall - 10' High	0	LF	$ 310.00	$ -	
	Soundwall	0	LF	$ 280.00	$ -	
	Powerline Relocation	0	LF	$ 40.00	$ -	
	Cyclone Fencing 8' tall	0	LF	$ 24.00	$ -	
	Demolish Service Road at CVIP	0	LF	$ 44.50	$ -	
	New Service Road at CVIP	0	LF	$ 111.25	$ -	
3300	**Grade Crossings/Overcrossings**				$ -	$ -
	Major Street at Grade	0	LS	$ 450,000.00	$ -	
	Pedestrian Overcrossing at GCTC	0	LS	$ 581,994.00	$ -	
	Maint Facility Crossing Panels	0	LF	$ 140.00	$ -	
13000	**Stations**				$ -	$ -
	GCTC	0	LS	$ 1,318,401.00	$ -	
	Concrete Paving in Station	0	SY	$ 116.40	$ -	
	Demolish Paving at Station & Alignment					
	Village	0	LS	$ 1,683,991.00	$ -	
	Concrete Paving in Station		SY	$ 116.40	$ -	
	CVIP Platforms - Shelters	0	LS	$ 221,851.22	$ -	
	Concrete Paving in Station		SY	$ 116.40	$ -	
	Demolish Bus Parking at Station					
	"Permanent" Paving Existing Bus Parking at CVIP	0	EA	$ 7,404.00	$ -	
	New Bus Parking at CVIP	0	EA	$ 7,404.00	$ -	
	Wayfinding at GCTC	0.0	LS	$ 1,315,284.00	$ -	
	Wayfinding at Village	0	LS	$ 197,719.00	$ -	
	Wayfinding at CVIP	0.00	LS	$ 197,719.00	$ -	
21000	**Fare Collection/Reservations**				$ -	$ -
	System	0.00	LS	$ 2,387,838.00	$ -	
	Kiosks in Tusayan	0.00	EA	$ 40,000.00	$ -	
	Temporary Fee Collection & Reservations at GCTC	0.00	EA	$ 500,000.00	$ -	
2800	**Transit Center Sitework**					$ -
	Landscape at GCTC	0.0	LS	$ 5,017,767.00	$ -	
	Road Drainage and Utilities at GCTC	0.0	LS	$ 10,271,616.00	$ -	
	Change in Parking Spaces		EA	$ 1,944.00	$ -	
	Change in RV/Bus Spaces		EA	$ 7,404.00	$ -	
	Landscape at Village	0	LS	$ 530,097.00	$ -	
	Landscape at CVIP	0	LS	$ -	$ -	
2800	**Maintenance Facility**					$ -
	Equipment and Furnishings	0.00	LS	$ 5,720,000.00	$ -	
	Site Preparation	0	AC	$ 5,000.00	$ -	
	Maintenance Bldg.	0	SF	$ 67.50	$ -	
	Maintenance Facility Parking and Road	0	SF	$ 7.00	$ -	

DSC-22 (6/97)

Denver Service Center - Estimate

Project: Grand Canyon BRT Alternatives

Park: Grand Canyon National Park

Package **BRT and LRT Options - Full Transit System**

Estimate By: DEA, Inc.

Date: 09/11/02

Reviewed By:

Date:

Item No.	Description	Qty.	Unit	Cost/Unit	Rim Shuttles Net Cost	**Part of all Alts** Subtotal
18000	**Electrification**					
	Powerline to Park					
	Substations (included in OCS)					
	Overhead Catenary System					
18000	**Signals and Communications**				$ -	$ -
	System	0	LS	$ 6,276,896.00	$ -	
Subtotal	**Direct Construction Costs**				$ -	$ -
1300	**Engineering and Administration**			15%	$ -	$ -
	Subtotal				$ -	
1300	**Construction Contingency**			20%	$ -	$ -
	Subtotal				$ -	
1300	**Escalation to 2003 @ 4% per year**			4.00%		

DSC-22 (6/97)

Denver Service Center - Estimate

Project: Grand Canyon BRT Alternatives
Park: Grand Canyon National Park
Package **BRT and LRT Options - Full Transit System**

Estimate By: BRW, Inc.
Date: 10/30/00
Reviewed By:
Date:

LRT Prospectus

Item No.	Description	Qty.	Unit	Cost/Unit	Net Cost	Subtotal
2500	**Utilities**	1.00	LS	$ 1,880,410.00	$ 1,880,410	$ 1,880,410
2300	**Earthwork - Assume Proportional to Guideway Length**				$ -	$ 11,082,661
	Common Excavation	60,019	CY	$ 7.00	$ 420,133	
	Rock Excavation	340,108	CY	$ 25.00	$ 8,502,700	
	Backfill common	294,522	CY	$ 4.00	$ 1,178,088	
	Backfill w/ native import material	98,174		$ 10.00	$ 981,740	
2700	**Track Grade Preparation**	46,957	RF	$ 140.00	$ 6,573,980	$ 6,573,980
5650	**Trackwork/Guide Rail**	1	LS	$ 20,193,262.00	$ 20,193,262	$ 20,193,262
3300	**Dedicated/Shared Transit Roadway**					$ -
	2-way		LF	$ 250.00	$ -	
	1-way		LF	$ 150.00	$ -	
	New Maswik Road		LF	$ 250.00	$ -	
3300	**Structures, Ditches, Retaining Walls, Roads**				$ -	$ 7,816,327
	Long Jim Drainage	1	LS	$ 255,000.00	$ 255,000	
	Maintenance Area Access Road	1,660	LF	$ 250.00	$ 415,000	
	Maintenance Area Access Road Bridge	100	LF	$ 4,500.00	$ 450,000	
	Extend South Entrance By-Pass Lane (12-foot lane)					
	Center Road	2,100	LF	$ 250.00	$ 525,000	
	Center Road Bridge	110	LF	$ 4,500.00	$ 495,000	
	Hwy 64 Roundabout	1	LS	$ 4,968,652.00	$ 4,968,652	
	Hwy 64 Intersection/Signal	0	LS	$ -	$ -	
	Resurface Roads per ADOT study					
	Retaining wall - 10' High	703	LF	$ 310.00	$ 217,930	
	Soundwall	500	LF	$ 280.00	$ 140,000	
	Powerline Relocation	2,750	LF	$ 40.00	$ 110,000	
	Cyclone Fencing 8' tall	255	LF	$ 24.00	$ 6,120	
	Demolish Service Road at CVIP	1,000	LF	$ 44.50	$ 44,500	
	New Service Road at CVIP	1,700	LF	$ 111.25	$ 189,125	
3300	**Grade Crossings/Overcrossings**				$ -	$ 3,288,994
	Major Street at Grade	6	LS	$ 450,000.00	$ 2,700,000	
	Pedestrian Overcrossing at GCTC	1	LS	$ 581,994.00	$ 581,994	
	Maint Facility Crossing Panels	50	LF	$ 140.00	$ 7,000	
13000	**Stations**				$ -	$ 16,800,523
	GCTC	1	LS	$ 12,301,116.00	$ 12,301,116	
	Concrete Paving in Station		SY	$ 116.40	$ -	
	Demolish Paving at Station & Alignment					
	Village	1	LS	$ 1,683,991.00	$ 1,683,991	
	Concrete Paving in Station		SY	$ 116.40	$ -	
	CVIP Platforms - Shelters	1	LS	$ 1,104,694.00	$ 1,104,694	
	Concrete Paving in Station		SY	$ 116.40	$ -	
	Demolish Bus Parking at Station					
	"Permanent" Paving Existing Bus Parking at CVIP	0	EA	$ 7,404.00	$ -	
	New Bus Parking at CVIP	0	EA	$ 7,404.00	$ -	
	Wayfinding at GCTC	1.00	LS	$ 1,315,284.00	$ 1,315,284	
	Wayfinding at Village	1	LS	$ 197,719.00	$ 197,719	
	Wayfinding at CVIP	1	LS	$ 197,719.00	$ 197,719	
21000	**Fare Collection/Reservations**				$ -	$ 2,387,838
	System	1	LS	$ 2,387,838.00	$ 2,387,838	
	Kiosks in Tusayan					
	Temporary Fee Collection & Reservations at GCTC					
2800	**Transit Center Sitework**				$ -	$ 15,819,480
	Landscape at GCTC	1.00	LS	$ 5,017,767.00	$ 5,017,767	
	Road Drainage and Utilities at GCTC	1.00	LS	$ 10,271,616.00	$ 10,271,616	
	Change in Parking Spaces		EA	$ 1,944.00	$ -	
	Change in RV/Bus Spaces		EA	$ 7,404.00	$ -	
	Landscape at Village	1	LS	$ 530,097.00	$ 530,097	
	Landscape at CVIP	0	LS	$ -	$ -	
2800	**Maintenance Facility**					$ 11,874,000
	Equipment and Furnishings	1.00	LS	$ 5,720,000.00	$ 5,720,000	
	Site Preparation	50	AC	$ 5,000.00	$ 250,000	
	Maintenance Bldg.	82,800	SF	$ 67.50	$ 5,589,000	
	Maintenance Facility Parking and Road	45,000	SF	$ 7.00	$ 315,000	

DSC-22 (6/97)

Denver Service Center - Estimate

Project: Grand Canyon BRT Alternatives

Park: Grand Canyon National Park

Package **BRT and LRT Options - Full Transit System**

Estimate By: BRW, Inc.

Date: 10/30/00

Reviewed By:

Date:

LRT Prospectus

Item No.	Description	Qty.	Unit	Cost/Unit	Net Cost	Subtotal
18000	**Electrification**					
	Powerline to Park					
	Substations (included in OCS)					
	Overhead Catenary System					
18000	**Signals and Communications**				$ -	$ 6,276,896
	System	1	LS	$ 6,276,896.00	$ 6,276,896	
Subtotal	**Direct Construction Costs**				$ 103,994,371	$ 103,994,371
1300	**Engineering and Administration**			15%	$ 15,599,156	$ 15,599,156
	Subtotal				$ 119,593,527	
1300	**Construction Contingency**			20%	$ 23,918,705	$ 23,918,705
	Subtotal				$ 143,512,232	
1300	**Escalation to 2003 @ 4% per year**	3	yrs	1.12	**$ 161,431,743**	17,919,511

DSC-22 (6/97)

Denver Service Center - Estimate

Project: Grand Canyon BRT Alternatives

Park: Grand Canyon National Park

Package **BRT and LRT Options - Full Transit System**

Estimate By: DEA, Inc.

Date: 09/11/02

Reviewed By:

Date:

Item No.	Description	Qty.	Unit	Cost/Unit	Option 1 Net Cost	Subtotal
2500	**Utilities**	0.75	LS	$ 1,880,410.00	$ 1,410,308	$ 1,410,308
2300	**Earthwork - Assume Proportional to Guideway Length**				$ -	$ -
	Common Excavation	0	CY	$ 7.00	$ -	
	Rock Excavation	0	CY	$ 25.00	$ -	
	Backfill common	0	CY	$ 4.00	$ -	
	Backfill w/ native import material	0		$ 10.00	$ -	
2700	**Track Grade Preparation**	0	RF	$ 140.00	$ -	$ -
5650	**Trackwork/Guide Rail**	0	LS	$ 20,193,262	$ -	$ -
3300	**Dedicated/Shared Transit Roadway**					$ -
	2-way	0	LF	$ 250.00	$ -	
	1-way	0	LF	$ 150.00	$ -	
	New Maswik Road	0	LF	$ 250.00	$ -	
3300	**Structures, Ditches, Retaining Walls, Roads**				$ -	$ 7,998,652
	Long Jim Drainage	1	LS	$ 255,000.00	$ 255,000	
	Maintenance Area Access Road	0	LF	$ 250.00	$ -	
	Maintenance Area Access Road Bridge	0	LF	$ 4,500.00	$ -	
	Extend South Entrance By-Pass Lane (12-foot lane)	0	LF	$ 150.00	$ -	
	Center Road	0	LF	$ 250.00	$ -	
	Center Road Bridge	0	LF	$ 4,500.00	$ -	
	Hwy 64 Roundabout	1	LS	$ 4,968,652	$ 4,968,652	
	Hwy 64 Intersection/Signal	0	LS	$ -	$ -	
	Resurface Roads per ADOT study	1	LS	$ 2,635,000	$ 2,635,000	
	Retaining wall - 10' High	0	LF	$ 310.00	$ -	
	Soundwall	500	LF	$ 280.00	$ 140,000	
	Powerline Relocation	0	LF	$ 40.00	$ -	
	Cyclone Fencing 8' tall	0	LF	$ 24.00	$ -	
	Demolish Service Road at CVIP	0	LF	$ 44.50	$ -	
	New Service Road at CVIP	0	LF	$ 111.25	$ -	
3300	**Grade Crossings/Overcrossings**				$ -	$ 581,994
	Major Street at Grade	0	LS	$ 450,000.00	$ -	
	Pedestrian Overcrossing at GCTC	1	LS	$ 581,994.00	$ 581,994	
	Maint Facility Crossing Panels	0	LF	$ 140.00	$ -	
13000	**Stations**				$ -	$ 14,149,141
	GCTC	1	LS	$ 11,617,475	$ 11,617,475	
	Concrete Paving in Station	2,235	SY	$ 116.40	$ 260,154	
	Demolish Paving at Station & Alignment					
	Village	1	LS	$ 120,273.50	$ 120,274	
	Concrete Paving in Station	924	SY	$ 116.40	$ 107,605	
	CVIP Platforms - Shelters	1	LS	$ 221,851.22	$ 221,851	
	Concrete Paving in Station	0	SY	$ 116.40	$ -	
	Demolish Bus Parking at Station					
	"Permanent" Paving Existing Bus Parking at CVIP	15	EA	$ 7,404.00	$ 111,060	
	New Bus Parking at CVIP	0	EA	$ 7,404.00	$ -	
	Wayfinding at GCTC	1.00	LS	$ 1,315,284.00	$ 1,315,284	
	Wayfinding at Village	1	LS	$ 197,719.00	$ 197,719	
	Wayfinding at CVIP	1.00	LS	$ 197,719.00	$ 197,719	
21000	**Fare Collection/Reservations**				$ -	$ 2,507,838
	System	1	LS	$ 2,387,838.00	$ 2,387,838	
	Kiosks in Tusayan	3	EA	$ 40,000.00	$ 120,000	
	Temporary Fee Collection & Reservations at GCTC					
2800	**Transit Center Sitework**				$ -	$ 13,948,458
	Landscape at GCTC	1.0	LS	$ 5,017,767.00	$ 5,017,767	
	Road Drainage and Utilities at GCTC	1.0	LS	$ 10,271,616	$ 10,271,616	
	Change in Parking Spaces	-413	EA	$ 1,944.00	$ (803,171)	
	Change in RV/Bus Spaces	-144	EA	$ 7,404.00	$ (1,067,851)	
	Landscape at Village	1	LS	$ 530,097.00	$ 530,097	
	Landscape at CVIP	0	LS	$ -	$ -	
2800	**Maintenance Facility**					$ 10,158,000
	Equipment and Furnishings	0.7	LS	$ 5,720,000.00	$ 4,004,000	
	Site Preparation	50	AC	$ 5,000.00	$ 250,000	
	Maintenance Bldg.	82,800	SF	$ 67.50	$ 5,589,000	
	Maintenance Facility Parking and Road	45,000	SF	$ 7.00	$ 315,000	

DSC-22 (6/97)

Denver Service Center - Estimate

Project: Grand Canyon BRT Alternatives

Park: Grand Canyon National Park

Package **BRT and LRT Options - Full Transit System**

Estimate By: DEA, Inc.

Date: 09/11/02

Reviewed By:

Date:

Item No.	Description	Qty.	Unit	Cost/Unit	Net Cost (Option 1)	Subtotal
18000	**Electrification**					
	Powerline to Park					
	Substations (included in OCS)					
	Overhead Catenary System					
18000	**Signals and Communications**				$ -	$ -
	System	0	LS	$ 6,276,896.00	$ -	
Subtotal	**Direct Construction Costs**				$ 50,754,391	$ 50,754,391
1300	**Engineering and Administration**			15%	$ 7,613,159	$ 7,613,159
	Subtotal				$ 58,367,549	
1300	**Construction Contingency**			20%	$ 11,673,510	$ 11,673,510
	Subtotal				$ 70,041,059	
1300	**Escalation to 2003 @ 4% per year**	2	YR	1.08	**$ 75,756,410**	5,715,350

DSC-22 (6/97)

Denver Service Center - Estimate

Project: Grand Canyon BRT Alternatives

Park: Grand Canyon National Park

Package **BRT and LRT Options - Full Transit System**

Estimate By: DEA, Inc.

Date: 09/11/02

Reviewed By:

Date:

Item No.	Description	Qty.	Unit	Cost/Unit	Option 2 Net Cost	Subtotal
2500	**Utilities**	0.75	LS	$ 1,880,410.00	$ 1,410,308	$ 1,410,308
2300	**Earthwork - Assume Proportional to Guideway Length**				$ -	$ 9,198,609
	Common Excavation	49,816	CY	$ 7.00	$ 348,710	
	Rock Excavation	282,290	CY	$ 25.00	$ 7,057,241	
	Backfill common	244,453	CY	$ 4.00	$ 977,813	
	Backfill w/ native import material	81,484		$ 10.00	$ 814,844	
2700	**Track Grade Preparation**		RF	$ 140.00	$ -	$ -
5650	**Trackwork/Guide Rail**		LS	$ 20,193,262	$ -	$ -
3300	**Dedicated/Shared Transit Roadway**					$ 9,180,000
	2-way	23,550	LF	$ 250.00	$ 5,887,500	
	1-way	9,450	LF	$ 150.00	$ 1,417,500	
	New Maswik Road	7,500	LF	$ 250.00	$ 1,875,000	
3300	**Structures, Ditches, Retaining Walls, Roads**				$ -	$ 7,065,655
	Long Jim Drainage	1	LS	$ 255,000.00	$ 255,000	
	Maintenance Area Access Road	1,500	LF	$ 250.00	$ 375,000	
	Maintenance Area Access Road Bridge	0	LF	$ 4,500.00	$ -	
	Extend South Entrance By-Pass Lane (12-foot lane)					
	Center Road	0	LF	$ 250.00	$ -	
	Center Road Bridge	0	LF	$ 4,500.00	$ -	
	Hwy 64 Roundabout	1	LS	$ 4,968,652	$ 4,968,652	
	Hwy 64 Intersection/Signal	0	LS	$ -	$ -	
	Resurface Roads per ADOT study	1	LS	$ 1,030,000	$ 1,030,001	
	Retaining wall - 10' High	583	LF	$ 310.00	$ 180,882	
	Soundwall	500	LF	$ 280.00	$ 140,000	
	Powerline Relocation	2,750	LF	$ 40.00	$ 110,000	
	Cyclone Fencing 8' tall	255	LF	$ 24.00	$ 6,120	
	Demolish Service Road at CVIP	0	LF	$ 44.50	$ -	
	New Service Road at CVIP	0	LF	$ 111.25	$ -	
3300	**Grade Crossings/Overcrossings**				$ -	$ 581,994
	Major Street at Grade	0	LS	$ 450,000.00	$ -	
	Pedestrian Overcrossing at GCTC	1	LS	$ 581,994.00	$ 581,994	
	Maint Facility Crossing Panels	0	LF	$ 140.00	$ -	
13000	**Stations**					$ 15,372,739
	GCTC	1	LS	$ 11,617,475	$ 11,617,475	
	Concrete Paving in Station	2,235	SY	$ 116.40	$ 260,154	
	Demolish Paving at Station & Alignment		SY	$ 18.18	$ -	
	Village	1	LS	$ 120,273.50	$ 120,274	
	Concrete Paving in Station	924	SY	$ 116.40	$ 107,554	
	CVIP Platforms - Shelters	1	LS	$ 1,038,211.47	$ 1,038,211	
	Concrete Paving in Station	1,721	SY	$ 116.40	$ 200,324	
	Demolish Bus Parking at Station	3,239	SY	$ 18.18	$ 58,885	
	"Permanent" Paving Existing Bus Parking at CVIP		EA	$ 7,404.00	$ -	
	New Bus Parking at CVIP	35	EA	$ 7,404.00	$ 259,140	
	Wayfinding at GCTC	1.0	LS	$ 1,315,284.00	$ 1,315,284	
	Wayfinding at Village	1	LS	$ 197,719.00	$ 197,719	
	Wayfinding at CVIP	1.00	LS	$ 197,719.00	$ 197,719	
21000	**Fare Collection/Reservations**				$ -	$ 2,507,838
	System	1	LS	$ 2,387,838.00	$ 2,387,838	
	Kiosks in Tusayan	3	EA	$ 40,000.00	$ 120,000	
	Temporary Fee Collection & Reservations at GCTC					
2800	**Transit Center Sitework**				$ -	$ 13,948,458
	Landscape at GCTC	1.0	LS	$ 5,017,767.00	$ 5,017,767	
	Road Drainage and Utilities at GCTC	1.0	LS	$ 10,271,616	$ 10,271,616	
	Change in Parking Spaces	-413	EA	$ 1,944.00	$ (803,171)	
	Change in RV/Bus Spaces	-144	EA	$ 7,404.00	$ (1,067,851)	
	Landscape at Village	1	LS	$ 530,097.00	$ 530,097	
	Landscape at CVIP	0	LS	$ -	$ -	
2800	**Maintenance Facility**					$ 11,302,000
	Equipment and Furnishings	0.9	LS	$ 5,720,000.00	$ 5,148,000	
	Site Preparation	50	AC	$ 5,000.00	$ 250,000	
	Maintenance Bldg.	82,800	SF	$ 67.50	$ 5,589,000	
	Maintenance Facility Parking and Road	45,000	SF	$ 7.00	$ 315,000	

DSC-22 (6/97)

Denver Service Center - Estimate

Project: Grand Canyon BRT Alternatives

Park: Grand Canyon National Park

Package **BRT and LRT Options - Full Transit System**

Estimate By: DEA, Inc.

Date: 09/11/02

Reviewed By:

Date:

Option 2

Item No.	Description	Qty.	Unit	Cost/Unit	Net Cost	Subtotal
18000	**Electrification**					
	Powerline to Park					
	Substations (included in OCS)					
	Overhead Catenary System					
18000	**Signals and Communications**				$ -	$ -
	System	0	LS	$ 6,276,896.00	$ -	
Subtotal	**Direct Construction Costs**				$ 70,567,600	$ 70,567,600
1300	**Engineering and Administration**			15%	$ 10,585,140	$ 10,585,140
	Subtotal				$ 81,152,740	
1300	**Construction Contingency**			20%	$ 16,230,548	$ 16,230,548
	Subtotal				$ 97,383,288	
1300	**Escalation to 2003 @ 4% per year**	2	YR	1.08	**$ 105,329,765**	7,946,476

DSC-22 (6/97)

Denver Service Center - Estimate

Project: Grand Canyon BRT Alternatives

Park: Grand Canyon National Park

Package **BRT and LRT Options - Full Transit System**

Estimate By: DEA, Inc.

Date: 09/11/02

Reviewed By:

Date:

Item No.	Description	Qty.	Unit	Cost/Unit	Option 3 Net Cost	Subtotal
2500	**Utilities**	0.75	LS	$ 1,880,410.00	$ 1,410,308	$ 1,410,308
2300	**Earthwork - Assume Proportional to Guideway Length**				$ -	$ 11,082,661
	Common Excavation	60,019	CY	$ 7.00	$ 420,133	
	Rock Excavation	340,108	CY	$ 25.00	$ 8,502,700	
	Backfill common	294,522	CY	$ 4.00	$ 1,178,088	
	Backfill w/ native import material	98,174		$ 10.00	$ 981,740	
2700	**Track Grade Preparation**	0	RF	$ 140.00	$ -	$ -
5650	**Trackwork/Guide Rail**	0	LS	$ 5,048,316	$ -	$ -
3300	**Dedicated/Shared Transit Roadway**					$ 11,739,250
	2-way	46,957	LF	$ 250.00	$ 11,739,250	
	1-way	0	LF	$ 150.00	$ -	
	New Maswik Road				$ -	
3300	**Structures, Ditches, Retaining Walls, Roads**				$ -	$ 7,816,327
	Long Jim Drainage	1	LS	$ 255,000.00	$ 255,000	
	Maintenance Area Access Road	1,660	LF	$ 250.00	$ 415,000	
	Maintenance Area Access Road Bridge	100	LF	$ 4,500.00	$ 450,000	
	Extend South Entrance By-Pass Lane (12-foot lane)					
	Center Road	2,100	LF	$ 250.00	$ 525,000	
	Center Road Bridge	110	LF	$ 4,500.00	$ 495,000	
	Hwy 64 Roundabout	1	LS	$ 4,968,652	$ 4,968,652	
	Hwy 64 Intersection/Signal	0	LS	$ -	$ -	
	Resurface Roads per ADOT study					
	Retaining wall - 10' High	703	LF	$ 310.00	$ 217,930	
	Soundwall	500	LF	$ 280.00	$ 140,000	
	Powerline Relocation	2,750	LF	$ 40.00	$ 110,000	
	Cyclone Fencing 8' tall	255	LF	$ 24.00	$ 6,120	
	Demolish Service Road at CVIP	1,000	LF	$ 44.50	$ 44,500	
	New Service Road at CVIP	1,700	LF	$ 111.25	$ 189,125	
3300	**Grade Crossings/Overcrossings**				$ -	$ 1,931,994
	Major Street at Grade	6	LS	$ 225,000.00	$ 1,350,000	
	Pedestrian Overcrossing at GCTC	1	LS	$ 581,994.00	$ 581,994	
	Maint Facility Crossing Panels	0	LF	$ 140.00	$ -	
13000	**Stations**				$ -	$ 14,923,940
	GCTC	1	LS	$ 11,617,475	$ 11,617,475	
	Concrete Paving in Station	2,235	SY	$ 116.40	$ 260,154	
	Demolish Paving at Station & Alignment		SY	$ 18.18		
	Village	1	LS	$ 298,686.62	$ 298,687	
	Concrete Paving in Station	1,824	SY	$ 116.40	$ 212,301	
	CVIP Platforms - Shelters	1	LS	$ 600,752.06	$ 600,752	
	Concrete Paving in Station	1,417	SY	$ 116.40	$ 164,965	
	Demolish Bus Parking at Station	3,239	SY	$ 18.18	$ 58,885	
	"Permanent" Paving Existing Bus Parking at CVIP		EA	$ 7,404.00		
	New Bus Parking at CVIP		EA	$ 7,404.00		
	Wayfinding at GCTC	1.0	LS	$ 1,315,284.00	$ 1,315,284	
	Wayfinding at Village	1	LS	$ 197,719.00	$ 197,719	
	Wayfinding at CVIP	1.00	LS	$ 197,719.00	$ 197,719	
21000	**Fare Collection/Reservations**				$ -	$ 2,387,838
	System	1	LS	$ 2,387,838.00	$ 2,387,838	
	Kiosks in Tusayan					
	Temporary Fee Collection & Reservations at GCTC					
2800	**Transit Center Sitework**				$ -	$ 15,947,113
	Landscape at GCTC	1.0	LS	$ 5,017,767.00	$ 5,017,767	
	Road Drainage and Utilities at GCTC	1.0	LS	$ 10,271,616	$ 10,271,616	
	Change in Parking Spaces	62	EA	$ 1,944.00	$ 120,229	
	Change in RV/Bus Spaces	1	EA	$ 7,404.00	$ 7,404	
	Landscape at Village	1	LS	$ 530,097.00	$ 530,097	
	Landscape at CVIP	0	LS	$ -	$ -	
2800	**Maintenance Facility**					$ 11,874,000
	Equipment and Furnishings	1.0	LS	$ 5,720,000.00	$ 5,720,000	
	Site Preparation	50	AC	$ 5,000.00	$ 250,000	
	Maintenance Bldg.	82,800	SF	$ 67.50	$ 5,589,000	
	Maintenance Facility Parking and Road	45,000	SF	$ 7.00	$ 315,000	

DSC-22 (6/97)

Denver Service Center - Estimate

Project: Grand Canyon BRT Alternatives

Park: Grand Canyon National Park

Package **BRT and LRT Options - Full Transit System**

Estimate By: DEA, Inc.

Date: 09/11/02

Reviewed By:

Date:

Option 3

Item No.	Description	Qty.	Unit	Cost/Unit	Net Cost	Subtotal
18000	**Electrification**					$ 29,495,810
	Powerline to Park	1	LS	$ 14,000,000	$ 14,000,000	
	Substations (included in OCS)					
	Overhead Catenary System	46,957	LF	$ 330.00	$ 15,495,810	
18000	**Signals and Communications**				$ -	$ -
	System	0	LS	$ 6,276,896.00	$ -	
Subtotal	**Direct Construction Costs**				$ 108,609,241	$ 108,609,241
1300	**Engineering and Administration**			15%	$ 16,291,386	$ 16,291,386
	Subtotal				$ 124,900,627	
1300	**Construction Contingency**			20%	$ 24,980,125	$ 24,980,125
	Subtotal				$ 149,880,752	
1300	**Escalation to 2003 @ 4% per year**	2	YR	1.08	**$ 162,111,022**	12,230,269

DSC-22 (6/97)

Denver Service Center - Estimate

Project: Grand Canyon BRT Alternatives

Park: Grand Canyon National Park

Package **BRT and LRT Options - Full Transit System**

Estimate By: DEA, Inc

Date: 09/11/02

Reviewed By:

Date:

Option 4 - Phase 1

Item No.	Description	Qty.	Unit	Cost/Unit	Net Cost	Subtotal
2500	**Utilities**	0.65	LS	$ 1,880,410.00	$ 1,222,267	$ 1,222,267
2300	**Earthwork - Assume Proportional to Guideway Length**				$ -	$ 1,770,129
	Common Excavation	9,586	CY	$ 7.00	$ 67,104	
	Rock Excavation	54,322	CY	$ 25.00	$ 1,358,056	
	Backfill common	47,041	CY	$ 4.00	$ 188,165	
	Backfill w/ native import material	15,680		$ 10.00	$ 156,804	
2700	**Track Grade Preparation**	0	RF	$ 140.00	$ -	$ -
5650	**Trackwork/Guide Rail**	0	LS	$ 20,193,262	$ -	$ -
3300	**Dedicated/Shared Transit Roadway**					$ 1,875,000
	2-way		LF	$ 250.00	$ -	
	1-way		LF	$ 150.00	$ -	
	New Maswik Road	7,500	LF	$ 250.00	$ 1,875,000	
3300	**Structures, Ditches, Retaining Walls, Roads**				$ -	$ 8,148,652
	Long Jim Drainage	1	LS	$ 255,000.00	$ 255,000	
	Maintenance Area Access Road	0	LF	$ 250.00	$ -	
	Maintenance Area Access Road Bridge	0	LF	$ 4,500.00	$ -	
	Extend South Entrance By-Pass Lane (12-foot lane)	4,000	LF	$ 150.00	$ 600,000	
	Center Road	0	LF	$ 250.00	$ -	
	Center Road Bridge	0	LF	$ 4,500.00	$ -	
	Hwy 64 Roundabout	1	LS	$ 4,968,652	$ 4,968,652	
	Hwy 64 Intersection/Signal	0	LS	$ 200,000	$ -	
	Resurface Roads per ADOT study	1	LS	$ 2,185,000	$ 2,185,000	
	Retaining wall - 10' High	0	LF	$ 310.00	$ -	
	Soundwall	500	LF	$ 280.00	$ 140,000	
	Powerline Relocation	0	LF	$ 40.00	$ -	
	Cyclone Fencing 8' tall	0	LF	$ 24.00	$ -	
	Demolish Service Road at CVIP	0	LF	$ 44.50	$ -	
	New Service Road at CVIP	0	LF	$ 111.25	$ -	
3300	**Grade Crossings/Overcrossings**				$ -	$ 581,994
	Major Street at Grade	0	LS	$ 450,000.00	$ -	
	Pedestrian Overcrossing at GCTC	1	LS	$ 581,994.00	$ 581,994	
	Maint Facility Crossing Panels	0	LF	$ 140.00	$ -	
13000	**Stations**				$ -	$ 14,149,089
	GCTC	1	LS	$ 11,617,475	$ 11,617,475	
	Concrete Paving in Station	2,235	SY	$ 116.40	$ 260,154	
	Demolish Paving at Station & Alignment					
	Village	1	LS	$ 120,273.50	$ 120,274	
	Concrete Paving in Station	924	SY	$ 116.40	$ 107,554	
	CVIP Platforms - Shelters	1	LS	$ 221,851.22	$ 221,851	
	Concrete Paving in Station	0	SY	$ 116.40	$ -	
	Demolish Bus Parking at Station					
	"Permanent" Paving Existing Bus Parking at CVIP	15	EA	$ 7,404.00	$ 111,060	
	New Bus Parking at CVIP		EA	$ 7,404.00		
	Wayfinding at GCTC	1.00	LS	$ 1,315,284.00	$ 1,315,284	
	Wayfinding at Village	1	LS	$ 197,719.00	$ 197,719	
	Wayfinding at CVIP	1.00	LS	$ 197,719.00	$ 197,719	
21000	**Fare Collection/Reservations**				$ -	$ 2,387,838
	System	1	LS	$ 2,387,838.00	$ 2,387,838	
	Kiosks in Tusayan					
	Temporary Fee Collection & Reservations at GCTC					
2800	**Transit Center Sitework**				$ -	$ 14,632,373
	Landscape at GCTC	1.00	LS	$ 5,017,767.00	$ 5,017,767	
	Road Drainage and Utilities at GCTC	1.00	LS	$ 10,271,616	$ 10,271,616	
	Change in Parking Spaces	-413	EA	$ 1,944.00	$ (803,171)	
	Change in RV/Bus Spaces	-62	EA	$ 6,170.00	$ (383,936)	
	Landscape at Village	1	LS	$ 530,097.00	$ 530,097	
	Landscape at CVIP	0	LS	$ -	$ -	
2800	**Maintenance Facility**					$ 9,586,000
	Equipment and Furnishings	0.6	LS	$ 5,720,000.00	$ 3,432,000	
	Site Preparation	50	AC	$ 5,000.00	$ 250,000	
	Maintenance Bldg.	82,800	SF	$ 67.50	$ 5,589,000	
	Maintenance Facility Parking and Road	45,000	SF	$ 7.00	$ 315,000	

DSC-22 (6/97)

Denver Service Center - Estimate

Project: Grand Canyon BRT Alternatives

Park: Grand Canyon National Park

Package **BRT and LRT Options - Full Transit System**

Estimate By: DEA, Inc

Date: 09/11/02

Reviewed By:

Date:

Option 4 - Phase 1

Item No.	Description	Qty.	Unit	Cost/Unit	Net Cost	Subtotal
18000	**Electrification**					
	Powerline to Park					
	Substations (included in OCS)					
	Overhead Catenary System					
18000	**Signals and Communications**				$ -	$ -
	System	0	LS	$ 6,276,896.00	$ -	
Subtotal	**Direct Construction Costs**				$ 54,353,342	$ 54,353,342
1300	**Engineering and Administration**			15%	$ 8,153,001	$ 8,153,001
	Subtotal				$ 62,506,344	
1300	**Construction Contingency**			20%	$ 12,501,269	$ 12,501,269
	Subtotal				$ 75,007,612	
1300	**Escalation to 2003 @ 4% per year**	2	YR	1.08	**$ 81,128,234**	

DSC-22 (6/97)

Denver Service Center - Estimate

Project: Grand Canyon BRT Alternatives

Park: Grand Canyon National Park

Package **BRT and LRT Options - Full Transit System**

Estimate By: DEA, Inc

Date: 09/11/02

Reviewed By:

Date:

Option 4 - Phase 2

Item No.	Description	Qty.	Unit	Cost/Unit	Net Cost	Subtotal
2500	**Utilities**	0.10	LS	$ 1,880,410	$ 188,041	$ 188,041
2300	**Earthwork - Assume Proportional to Guideway Length**				$ -	$ 11,082,661
	Common Excavation	60,019	CY	$ 7.00	$ 420,133	
	Rock Excavation	340,108	CY	$ 25.00	$ 8,502,700	
	Backfill common	294,522	CY	$ 4.00	$ 1,178,088	
	Backfill w/ native import material	98,174	CY	$ 10.00	$ 981,740	
2700	**Track Grade Preparation**	46,957	RF	$ 140.00	$ 6,573,980	$ 6,573,980
5650	**Trackwork/Guide Rail**	1	LS	$ 20,193,262	$ 20,193,262	$ 20,193,262
3300	**Dedicated/Shared Transit Roadway**					$ -
	2-way		LF	$ 250.00	$ -	
	1-way		LF	$ 150.00	$ -	
	New Maswik Road	0	LF	$ 250.00	$ -	
3300	**Structures, Ditches, Retaining Walls, Roads**				$ -	$ 2,452,675
	Long Jim Drainage	0	LS	$ 255,000.00	$ -	
	Maintenance Area Access Road	1,660	LF	$ 250.00	$ 415,000	
	Maintenance Area Access Road Bridge	100	LF	$ 4,500.00	$ 450,000	
	Extend South Entrance By-Pass Lane (12-foot lane)	0	LF	$ 150.00	$ -	
	Center Road	2,100	LF	$ 250.00	$ 525,000	
	Center Road Bridge	110	LF	$ 4,500.00	$ 495,000	
	Hwy 64 Roundabout	0	LS	$ 4,968,652	$ -	
	Hwy 64 Intersection/Signal	0	LS	$ 200,000	$ -	
	Resurface Roads per ADOT study	0	LS	$ 2,185,000	$ -	
	Retaining wall - 10' High	703	LF	$ 310.00	$ 217,930	
	Soundwall	0	LF	$ 280.00	$ -	
	Powerline Relocation	2,750	LF	$ 40.00	$ 110,000	
	Cyclone Fencing 8' tall	255	LF	$ 24.00	$ 6,120	
	Demolish Service Road at CVIP	1,000	LF	$ 44.50	$ 44,500	
	New Service Road at CVIP	1,700	LF	$ 111.25	$ 189,125	
3300	**Grade Crossings/Overcrossings**				$ -	$ 2,707,000
	Major Street at Grade	6	LS	$ 450,000.00	$ 2,700,000	
	Pedestrian Overcrossing at GCTC	0	LS	$ 581,994.00	$ -	
	Maint Facility Crossing Panels	50	LF	$ 140.00	$ 7,000	
13000	**Stations**				$ -	$ 4,245,140
	GCTC	1	LS	$ 832,441	$ 832,441	
	Concrete Paving in Station	0	SY	$ 116.40	$ -	
	Demolish Paving at Station & Alignment	3,565	SY	$ 18.18	$ 64,812	
	Village	1	LS	$1,683,991.00	$ 1,683,991	
	Concrete Paving in Station	0	SY	$ 116.40	$ -	
	CVIP Platforms - Shelters	1	LS	$1,104,694.00	$ 1,104,694	
	Concrete Paving in Station	0	SY	$ 116.40	$ -	
	Demolish Bus Parking at Station	3,239	SY	$ 18.18	$ 58,883	
	"Permanent" Paving Existing Bus Parking at CVIP		EA	$ 7,404.00	$ -	
	New Bus Parking at CVIP		EA	$ 7,404.00		
	Wayfinding at GCTC	0.2	LS	$1,315,284.00	$ 263,057	
	Wayfinding at Village	1	LS	$ 197,719.00	$ 197,719	
	Wayfinding at CVIP	0.20	LS	$ 197,719.00	$ 39,544	
21000	**Fare Collection/Reservations**				$ -	$ -
	System	0	LS	$2,387,838.00	$ -	
	Kiosks in Tusayan					
	Temporary Fee Collection & Reservations at GCTC					
2800	**Transit Center Sitework**				$ -	$ 7,194,887
	Landscape at GCTC	0.35	LS	$5,017,767.00	$ 1,756,218	
	Road Drainage and Utilities at GCTC	0.35	LS	$ 10,271,616	$ 3,595,066	
	Change in Parking Spaces	475	EA	$ 1,944.00	$ 923,400	
	Change in RV/Bus Spaces	63	EA	$ 6,170.00	$ 390,106	
	Landscape at Village	1	LS	$ 530,097.00	$ 530,097	
	Landscape at CVIP	0	LS	$ -	$ -	
2800	**Maintenance Facility**					$ 2,860,000
	Equipment and Furnishings	0.5	LS	$5,720,000.00	$ 2,860,000	
	Site Preparation	0	AC	$ 5,000.00	$ -	
	Maintenance Bldg.	0	SF	$ 67.50	$ -	
	Maintenance Facility Parking and Road	0	SF	$ 7.00	$ -	

DSC-22 (6/97)

Denver Service Center - Estimate

Project: Grand Canyon BRT Alternatives

Park: Grand Canyon National Park

Package **BRT and LRT Options - Full Transit System**

Estimate By: DEA, Inc

Date: 09/11/02

Reviewed By:

Date:

Option 4 - Phase 2

Item No.	Description	Qty.	Unit	Cost/Unit	Net Cost	Subtotal
18000	**Electrification**					
	Powerline to Park					
	Substations (included in OCS)					
	Overhead Catenary System					
18000	**Signals and Communications**				$ -	$ 6,276,896
	System	1	LS	$6,276,896.00	$ 6,276,896	
Subtotal	**Direct Construction Costs**				$ 63,774,542	$ 63,774,542
1300	**Engineering and Administration**			15%	$ 9,566,181	$ 9,566,181
	Subtotal				$ 73,340,724	
1300	**Construction Contingency**			20%	$ 14,668,145	$ 14,668,145
	Subtotal				$ 88,008,869	
1300	**Escalation to 2003 @ 4% per year**	2	YR	1.08	**$ 95,190,392**	

DSC-22 (6/97)
Denver Service Center - Estimate

Project: Grand Canyon BRT Alternatives
Park: Grand Canyon National Park
Package **BRT and LRT Options - Full Transit System**

Item No.	Description	Option 4 Total
2500	**Utilities**	$ 1,410,308
2300	**Earthwork - Assume Proportional to Guideway Length**	$ 12,852,790
	Common Excavation	
	Rock Excavation	
	Backfill common	
	Backfill w/ native import material	
2700	**Track Grade Preparation**	$ 6,573,980
5650	**Trackwork/Guide Rail**	$ 20,193,262
3300	**Dedicated/Shared Transit Roadway**	$ 1,875,000
	2-way	
	1-way	
	New Maswik Road	
3300	**Structures, Ditches, Retaining Walls, Roads**	$ 10,601,327
	Long Jim Drainage	
	Maintenance Area Access Road	
	Maintenance Area Access Road Bridge	
	Extend South Entrance By-Pass Lane (12-foot lane)	
	Center Road	
	Center Road Bridge	
	Hwy 64 Roundabout	
	Hwy 64 Intersection/Signal	
	Resurface Roads per ADOT study	
	Retaining wall - 10' High	
	Soundwall	
	Powerline Relocation	
	Cyclone Fencing 8' tall	
	Demolish Service Road at CVIP	
	New Service Road at CVIP	
3300	**Grade Crossings/Overcrossings**	$ 3,288,994
	Major Street at Grade	
	Pedestrian Overcrossing at GCTC	
	Maint Facility Crossing Panels	
13000	**Stations**	$ 18,394,230
	GCTC	
	Concrete Paving in Station	
	Demolish Paving at Station & Alignment	
	Village	
	Concrete Paving in Station	
	CVIP Platforms - Shelters	
	Concrete Paving in Station	
	Demolish Bus Parking at Station	
	"Permanent" Paving Existing Bus Parking at CVIP	
	New Bus Parking at CVIP	
	Wayfinding at GCTC	
	Wayfinding at Village	
	Wayfinding at CVIP	
21000	**Fare Collection/Reservations**	$ 2,387,838
	System	
	Kiosks in Tusayan	
	Temporary Fee Collection & Reservations at GCTC	
2800	**Transit Center Sitework**	$ 21,827,261
	Landscape at GCTC	
	Road Drainage and Utilities at GCTC	
	Change in Parking Spaces	
	Change in RV/Bus Spaces	
	Landscape at Village	
	Landscape at CVIP	
2800	**Maintenance Facility**	$ 12,446,000
	Equipment and Furnishings	
	Site Preparation	
	Maintenance Bldg.	
	Maintenance Facility Parking and Road	

DSC-22 (6/97)
Denver Service Center - Estimate

Project: Grand Canyon BRT Alternatives
Park: Grand Canyon National Park
Package **BRT and LRT Options - Full Transit System**

Item No.	Description	Option 4 Total
18000	**Electrification**	
	Powerline to Park	
	Substations (included in OCS)	
	Overhead Catenary System	
18000	**Signals and Communications**	$ 6,276,896
	System	
Subtotal	**Direct Construction Costs**	$ 118,127,885
1300	**Engineering and Administration**	
	Subtotal	
1300	**Construction Contingency**	$ -
	Subtotal	$ -
1300	**Escalation to 2003 @ 4% per year**	**$ 176,318,626**

DSC-22 (6/97)

Denver Service Center - Estimate

Project: Grand Canyon BRT Alternatives

Park: Grand Canyon National Park

Package **BRT and LRT Options - Full Transit System**

Estimate By: DEA, Inc.

Date: 09/11/02

Reviewed By:

Date:

Item No.	Description	Qty.	Unit	Cost/Unit	Option 5A Net Cost	Subtotal
2500	**Utilities**	0.75	LS	$ 1,880,410.00	$ 1,410,308	$ 1,410,308
2300	**Earthwork - Assume Proportional to Guideway Length**				$ -	$ 11,082,661
	Common Excavation	60,019	CY	$ 7.00	$ 420,133	
	Rock Excavation	340,108	CY	$ 25.00	$ 8,502,700	
	Backfill common	294,522	CY	$ 4.00	$ 1,178,088	
	Backfill w/ native import material	98,174	CY	$ 10.00	$ 981,740	
2700	**Track Grade Preparation**	46,957	RF	$ 140.00	$ 6,573,980	$ 6,573,980
5650	**Trackwork/Guide Rail**	1	LS	$ 20,193,262	$ 20,193,262	$ 20,193,262
3300	**Dedicated/Shared Transit Roadway**					$ -
	2-way		LF	$ 250.00	$ -	
	1-way		LF	$ 150.00	$ -	
	New Maswik Road		LF	$ 250.00	$ -	
3300	**Structures, Ditches, Retaining Walls, Roads**				$ -	$ 7,816,327
	Long Jim Drainage	1	LS	$ 255,000.00	$ 255,000	
	Maintenance Area Access Road	1,660	LF	$ 250.00	$ 415,000	
	Maintenance Area Access Road Bridge	100	LF	$ 4,500.00	$ 450,000	
	Extend South Entrance By-Pass Lane (12-foot lane)					
	Center Road	2,100	LF	$ 250.00	$ 525,000	
	Center Road Bridge	110	LF	$ 4,500.00	$ 495,000	
	Hwy 64 Roundabout	1	LS	$ 4,968,652.00	$ 4,968,652	
	Hwy 64 Intersection/Signal	0	LS	$ -	$ -	
	Resurface Roads per ADOT study					
	Retaining wall - 10' High	703	LF	$ 310.00	$ 217,930	
	Soundwall	500	LF	$ 280.00	$ 140,000	
	Powerline Relocation	2,750	LF	$ 40.00	$ 110,000	
	Cyclone Fencing 8' tall	255	LF	$ 24.00	$ 6,120	
	Demolish Service Road at CVIP	1,000	LF	$ 44.50	$ 44,500	
	New Service Road at CVIP	1,700	LF	$ 111.25	$ 189,125	
3300	**Grade Crossings/Overcrossings**				$ -	$ 3,288,994
	Major Street at Grade	6	LS	$ 450,000.00	$ 2,700,000	
	Pedestrian Overcrossing at GCTC	1	LS	$ 581,994.00	$ 581,994	
	Maint Facility Crossing Panels	50	LF	$ 140.00	$ 7,000	
13000	**Stations**				$ -	$ 17,008,208
	GCTC	1	LS	$ 12,449,916	$ 12,449,916	
	Concrete Paving in Station		SY	$ 116.40	$ -	
	Demolish Paving at Station & Alignment					
	Village	1	LS	$ 1,683,991.00	$ 1,683,991	
	Concrete Paving in Station		SY	$ 116.40	$ -	
	CVIP Platforms - Shelters	1	LS	$ 1,104,694.00	$ 1,104,694	
	Concrete Paving in Station		SY	$ 116.40	$ -	
	Demolish Bus Parking at Station	3,239	SY	$ 18.18	$ 58,885	
	"Permanent" Paving Existing Bus Parking at CVIP	0	EA	$ -	$ -	
	New Bus Parking at CVIP	0	EA	$ 7,404.00	$ -	
	Wayfinding at GCTC	1.00	LS	$ 1,315,284.00	$ 1,315,284	
	Wayfinding at Village	1	LS	$ 197,719.00	$ 197,719	
	Wayfinding at CVIP	1.00	LS	$ 197,719.00	$ 197,719	
21000	**Fare Collection/Reservations**				$ -	$ 2,387,838
	System	1	LS	$ 2,387,838.00	$ 2,387,838	
	Kiosks in Tusayan					
	Temporary Fee Collection & Reservations at GCTC					
2800	**Transit Center Sitework**				$ -	$ 15,945,879
	Landscape at GCTC	1.0	LS	$ 5,017,767.00	$ 5,017,767	
	Road Drainage and Utilities at GCTC	1.0	LS	$ 10,271,616	$ 10,271,616	
	Change in Parking Spaces	62	EA	$ 1,944.00	$ 120,229	
	Change in RV/Bus Spaces	1	EA	$ 6,170.00	$ 6,170	
	Landscape at Village	1	LS	$ 530,097.00	$ 530,097	
	Landscape at CVIP	0	LS	$ -	$ -	
2800	**Maintenance Facility**					$ 11,874,000
	Equipment and Furnishings	1.0	LS	$ 5,720,000.00	$ 5,720,000	
	Site Preparation	50	AC	$ 5,000.00	$ 250,000	
	Maintenance Bldg.	82,800	SF	$ 67.50	$ 5,589,000	
	Maintenance Facility Parking and Road	45,000	SF	$ 7.00	$ 315,000	

DSC-22 (6/97)

Denver Service Center - Estimate

Project: Grand Canyon BRT Alternatives

Park: Grand Canyon National Park

Package **BRT and LRT Options - Full Transit System**

Estimate By: DEA, Inc.

Date: 09/11/02

Reviewed By:

Date:

Option 5A

Item No.	Description	Qty.	Unit	Cost/Unit	Net Cost	Subtotal
18000	**Electrification**					
	Powerline to Park					
	Substations (included in OCS)					
	Overhead Catenary System					
18000	**Signals and Communications**				$ -	$ 6,276,896
	System	1	LS	$ 6,276,896.00	$ 6,276,896	
Subtotal	**Direct Construction Costs**				$ 103,858,353	$ 103,858,353
1300	**Engineering and Administration**			15%	$ 15,578,753	$ 15,578,753
	Subtotal				$ 119,437,106	
1300	**Construction Contingency**			20%	$ 23,887,421	$ 23,887,421
	Subtotal				$ 143,324,527	
1300	**Escalation to 2003 @ 4% per year**	2	YR	1.08	**$ 155,019,809**	11,695,281

DSC-22 (6/97)

Denver Service Center - Estimate

Project: Grand Canyon BRT Alternatives
Park: Grand Canyon National Park
Package **BRT and LRT Options - Full Transit System**

Estimate By: DEA, Inc.
Date: 09/11/02
Reviewed By:
Date:

Option 5B

Item No.	Description	Qty.	Unit	Cost/Unit	Net Cost	Subtotal
2500	**Utilities**	0.75	LS	$ 1,880,410	$ 1,410,308	$ 1,410,308
2300	**Earthwork - Assume Proportional to Guideway Length**				$ -	$ 11,082,661
	Common Excavation	60,019	CY	$ 7.00	$ 420,133	
	Rock Excavation	340,108	CY	$ 25.00	$ 8,502,700	
	Backfill common	294,522	CY	$ 4.00	$ 1,178,088	
	Backfill w/ native import material	98,174	CY	$ 10.00	$ 981,740	
2700	**Track Grade Preparation**	46,957	RF	$ 140.00	$ 6,573,980	$ 6,573,980
5650	**Trackwork/Guide Rail**	1	LS	$ 20,193,262	$ 20,193,262	$ 20,193,262
3300	**Dedicated/Shared Transit Roadway**					$ -
	2-way		LF	$ 250.00	$ -	
	1-way		LF	$ 150.00	$ -	
	New Maswik Road		LF	$ 250.00	$ -	
3300	**Structures, Ditches, Retaining Walls, Roads**				$ -	$ 7,816,327
	Long Jim Drainage	1	LS	$ 255,000.00	$ 255,000	
	Maintenance Area Access Road	1,660	LF	$ 250.00	$ 415,000	
	Maintenance Area Access Road Bridge	100	LF	$ 4,500.00	$ 450,000	
	Extend South Entrance By-Pass Lane (12-foot lane)					
	Center Road	2,100	LF	$ 250.00	$ 525,000	
	Center Road Bridge	110	LF	$ 4,500.00	$ 495,000	
	Hwy 64 Roundabout	1	LS	$ 4,968,652	$ 4,968,652	
	Hwy 64 Intersection/Signal	0	LS	$ -	$ -	
	Resurface Roads per ADOT study					
	Retaining wall - 10' High	703	LF	$ 310.00	$ 217,930	
	Soundwall	500	LF	$ 280.00	$ 140,000	
	Powerline Relocation	2,750	LF	$ 40.00	$ 110,000	
	Cyclone Fencing 8' tall	255	LF	$ 24.00	$ 6,120	
	Demolish Service Road at CVIP	1,000	LF	$ 44.50	$ 44,500	
	New Service Road at CVIP	1,700	LF	$ 111.25	$ 189,125	
3300	**Grade Crossings/Overcrossings**				$ -	$ 3,288,994
	Major Street at Grade	6	LS	$ 450,000.00	$ 2,700,000	
	Pedestrian Overcrossing at GCTC	1	LS	$ 581,994.00	$ 581,994	
	Maint Facility Crossing Panels	50	LF	$ 140.00	$ 7,000	
13000	**Stations**				$ -	$ 17,008,208
	GCTC	1	LS	$ 12,449,916	$ 12,449,916	
	Concrete Paving in Station		SY	$ 116.40	$ -	
	Demolish Paving at Station & Alignment					
	Village	1	LS	$ 1,683,991	$ 1,683,991	
	Concrete Paving in Station		SY	$ 116.40	$ -	
	CVIP Platforms - Shelters	1	LS	$ 1,104,694	$ 1,104,694	
	Concrete Paving in Station		SY	$ 116.40	$ -	
	Demolish Bus Parking at Station	3,239	SY	$ 18.18	$ 58,885	
	"Permanent" Paving Existing Bus Parking at CVIP	0	EA	$ -	$ -	
	New Bus Parking at CVIP	0	EA	$ 7,404.00	$ -	
	Wayfinding at GCTC	1.00	LS	$ 1,315,284	$ 1,315,284	
	Wayfinding at Village	1	LS	$ 197,719.00	$ 197,719	
	Wayfinding at CVIP	1.00	LS	$ 197,719.00	$ 197,719	
21000	**Fare Collection/Reservations**				$ -	$ 2,387,838
	System	1	LS	$ 2,387,838	$ 2,387,838	
	Kiosks in Tusayan					
	Temporary Fee Collection & Reservations at GCTC					
2800	**Transit Center Sitework**				$ -	$ 15,945,879
	Landscape at GCTC	1.0	LS	$ 5,017,767	$ 5,017,767	
	Road Drainage and Utilities at GCTC	1.0	LS	$ 10,271,616	$ 10,271,616	
	Change in Parking Spaces	62	EA	$ 1,944.00	$ 120,229	
	Change in RV/Bus Spaces	1	EA	$ 6,170.00	$ 6,170	
	Landscape at Village	1	LS	$ 530,097.00	$ 530,097	
	Landscape at CVIP	0	LS	$ -	$ -	
2800	**Maintenance Facility**					$ 11,874,000
	Equipment and Furnishings	1.0	LS	$ 5,720,000	$ 5,720,000	
	Site Preparation	50	AC	$ 5,000.00	$ 250,000	
	Maintenance Bldg.	82,800	SF	$ 67.50	$ 5,589,000	
	Maintenance Facility Parking and Road	45,000	SF	$ 7.00	$ 315,000	

DSC-22 (6/97)

Denver Service Center - Estimate

Project: Grand Canyon BRT Alternatives

Park: Grand Canyon National Park

Package **BRT and LRT Options - Full Transit System**

Estimate By: DEA, Inc.

Date: 09/11/02

Reviewed By:

Date:

Option 5B

Item No.	Description	Qty.	Unit	Cost/Unit	Net Cost	Subtotal
18000	**Electrification**					$ 28,087,100
	Powerline to Park	1	LS	$ 14,000,000	$ 14,000,000	
	Substations (included in OCS)	0	EA	$ 100,000.00	$ -	
	Overhead Catenary System	46,957	LF	$ 300.00	$ 14,087,100	
18000	**Signals and Communications**				$ -	$ 6,276,896
	System	1	LS	$ 6,276,896	$ 6,276,896	
Subtotal	**Direct Construction Costs**				$ 131,945,453	$ 131,945,453
1300	**Engineering and Administration**			15%	$ 19,791,818	$ 19,791,818
	Subtotal				$ 151,737,271	
1300	**Construction Contingency**			20%	$ 30,347,454	$ 30,347,454
	Subtotal				$ 182,084,725	
1300	**Escalation to 2003 @ 4% per year**	2	YR	1.08	**$ 196,942,839**	14,858,114

Grand Canyon National Park
Bus Rapid Transit Alternatives Analysis
Cash Flow Analysis and Life Cycle Cost
Option 1 - WITH EXPANSION

Year	Design/Construction/Procurement Activity	Transit Operation	Capital Cost - Construction	Capital Cost - Fixed Facility Rehab/Repair	Residual Value of Fixed Facilities	Capital Cost - Rim Shuttle Buses	Capital Cost - Line Haul Rail Vehicles	Capital Cost - Line Haul Buses	Residual Value of Retired Buses	Capital Cost - Major Vehicle Overhaul	Line Haul Operating and Maint. Cost	Shuttle Bus Operating and Maint. Cost	Total Transit O & M Cost	Total Cash Flow	*Real Property Depreciation*	*Vehicle Depreciation*	*Depreciation*	Total Cost	Net Present Value	Equivalent Annual Cost	South Rim Paying Visitors	Revenue	Discounted Revenue	Total Cost/ Total Visitor
2003		Existing shuttle	$ -											$ -			$ -	$ -			3,112,940			
2004	Design Option 1 Improvements	Existing shuttle	3,787,820											$ 3,787,820			$ -	$ 3,787,820			3,187,693			
2005	Design Option 1 Improvements	Existing shuttle	$ 3,787,820											$ 3,787,820			$ -	$ 3,787,820			3,262,447			
2006	Construct/Procure Option 1	Existing shuttle	$ 34,090,384							$ 25,000				$ 34,115,384			$ -	$ 34,115,384			3,337,200			
2007	Construct/Procure Option 1	Existing shuttle	$ 34,090,384			$ 15,647,500		$ 14,019,500						$ 63,757,384			$ -	$ 63,757,384			3,398,745			
2008		Option 1 - 2006 Cond.											$ 13,779,500	$ 13,779,500			$ -	$ 13,779,500			3,460,289			
2009	Replace Bus/Trailer Units (7)	Option 1 - 2006 Cond.				$ 4,427,500			$ -				$ 13,779,500	$ 18,207,000			$ -	$ 18,207,000			3,521,834			
2010	Replace 2 40' CNG	Option 1 - 2006 Cond.				$ 726,000			$ (72,600)	$ 310,000			$ 13,779,500	$ 14,742,900			$ -	$ 14,742,900			3,583,379			
2011	Replace 3 40' CNG	Option 1 - 2006 Cond.				$ 1,089,000			$ (108,900)				$ 13,779,500	$ 14,759,600			$ -	$ 14,759,600			3,644,923			
2012		Option 1 - 2006 Cond.								$ 2,784,000			$ 13,779,500	$ 16,563,500			$ -	$ 16,563,500			3,706,461			
2013	Expand System	Option 1 - 2016 Cond.				$ 1,265,000		$ 632,500					$ 14,614,800	$ 16,512,300			$ -	$ 16,512,300			3,767,999			
2014		Option 1 - 2016 Cond.								$ 310,000			$ 14,614,800	$ 14,924,800			$ -	$ 14,924,800			3,829,537			
2015		Option 1 - 2016 Cond.								$ 25,000			$ 14,614,800	$ 14,639,800			$ -	$ 14,639,800			3,891,075			
2016		Option 1 - 2016 Cond.											$ 14,614,800	$ 14,614,800			$ -	$ 14,614,800			3,952,613			
2017		Option 1 - 2016 Cond.		$ 15,151,282						$ 159,000			$ 14,614,800	$ 29,925,082			$ -	$ 29,925,082			4,011,211			
2018		Option 1 - 2016 Cond.											$ 14,614,800	$ 14,614,800			$ -	$ 14,614,800			4,069,809			
2019	Expand System	Option 1 - 2026 Cond.				$ 3,982,000		$ 4,427,500		$ 25,000			$ 16,821,000	$ 25,255,500			$ -	$ 25,255,500			4,128,407			
2020	Replace Intitial Buses	Option 1 - 2026 Cond.				$ 15,647,500		$ 10,752,500	$ (2,966,700)	$ 15,000			$ 16,821,000	$ 40,269,300			$ -	$ 40,269,300			4,187,005			
2021	Replace Bus/Trailer Replacements (7)	Option 1 - 2026 Cond.				$ 4,427,500			$ (442,750)				$ 16,821,000	$ 20,805,750			$ -	$ 20,805,750			4,245,603			
2022	Replace 2 40' CNG	Option 1 - 2026 Cond.				$ 726,000			$ (72,600)	$ 462,000			$ 16,821,000	$ 17,936,400			$ -	$ 17,936,400			4,304,200			
2023	Replace 3 40' CNG	Option 1 - 2026 Cond.				$ 1,089,000			$ (108,900)				$ 16,821,000	$ 17,801,100			$ -	$ 17,801,100			4,362,798			
2024		Option 1 - 2026 Cond.								$ 2,799,000			$ 16,821,000	$ 19,620,000			$ -	$ 19,620,000			4,421,396			
2025	Replace Expansion Buses - Defer	Option 1 - 2026 Cond.											$ 16,821,000	$ 16,821,000			$ -	$ 16,821,000			4,479,994			
2026		Option 1 - 2026 Cond.							$ (18,954,100)				$ 16,821,000	$ (2,133,100)			$ -	$ (2,133,100)			4,538,592			
Total			$ 75,756,410	$ 15,151,282		$ 49,027,000	$ -	$ 29,832,000	$ (22,726,550)	$ 6,914,000	$ -	$ -	$ 291,154,300	$ 445,108,442	$ -	$ -	$ -	$ 445,108,442	$ -	$0	92,406,150			$ 4.82

IRR

Inflation	**0.00%**	**All costs in constant 2003 US dollars**			
Base Year	2003				
South Rim				Visits/Total	
Share of Visits	90%	Paying visitors per total visitors	74.2%	Visits	92.7%
				Percent Re-Entering	20.0%
Option Construction		$	75,756,410		

Existing Fleet	**Description**	**Remaining Life in 2003**
3	New Flyer 40' CNG	7 years
2	New Flyer 40' CNG	8 years
7	Bus/Trailer - LNG	6 years

Fleet Requirements - Rim Shuttle System

2006	**Number**	**Unit Cost**
40' Buses	15	$ 363,000.00
60' Buses	26	$ 632,500.00
2016		
40' Buses	15	$ 363,000.00
60' Buses	28	$ 632,500.00
2026		
40' Buses	19	$ 363,000.00
60' Buses	32	$ 632,500.00

Fleet Requirements - Line Haul

2006	**Number**	**Unit Cost**
40' Buses	9	$ 363,000.00
60' Buses	17	$ 632,500.00
2016		
40' Buses	9	$ 363,000.00
60' Buses	18	$ 632,500.00
2026		
40' Buses		
60' Buses	25	$ 632,500.00

Assumed residual value of vehicles at retirement (percent of initial cost) 10%

Fleet Composition at contract end

Line Haul System	Number	Age	Value	Number	Age	Value	Number	Age	Value	Number	Age	Value	Number	Age	Value	Total Number	Total Value
40' Buses																-	$ -
60' Buses	3	14	$ -	7	8	$ 1,771,000	15	7	$ 4,506,563							25	$ 6,277,563
Rim Shuttles																	
40' Buses				4	8	$ 580,800	10	7	$ 1,724,250	2	5	$ 453,750	3	4	$ 762,300.00	19	$ 3,521,100
60' Buses	2	14	$ -	4	8	$ 1,012,000	19	7	$ 5,708,313	7	6	$ 2,435,125				32	$ 9,155,438
																	$ 18,954,100

Grand Canyon National Park
Bus Rapid Transit Alternatives Analysis
Cash Flow Analysis and Life Cycle Cost
Option 2 - WITH EXPANSION

Year	Design/Construction/Procurement Activity	Transit Operation	Capital Cost - Construction	Capital Cost - Fixed Facility Rehab/Repair	Residual Value of Fixed Facilities	Capital Cost - Rim Shuttle Buses	Capital Cost - Line Haul Rail Vehicles	Capital Cost - Line Haul Buses	Residual Value of Retired Buses	Capital Cost - Major Vehicle Overhaul	Line Haul Operating and Maint. Cost	Shuttle Bus Operating and Maint. Cost	Total Transit O & M Cost	Total Cash Flow	*Real Property Depreciation*	*Vehicle Depreciation*	*Depreciation*	Total Cost	Net Present Value	Equivalent Annual Cost	South Rim Paying Visitors	Revenue	Discounted Revenue	Total Cost/ Total Visitor
2003		Existing shuttle	$ -											$ -			$ -	$ -			3,112,940			
2004	Design Option 1 Improvements	Existing shuttle	5,266,488											$ 5,266,488			$ -	$ 5,266,488			3,187,693			
2005	Design Option 1 Improvements	Existing shuttle	$ 5,266,488											$ 5,266,488			$ -	$ 5,266,488			3,262,447			
2006	Construct/Procure Option 1	Existing shuttle	$ 47,398,394							$ 25,000				$ 47,423,394			$ -	$ 47,423,394			3,337,200			
2007	Construct/Procure Option 1	Existing shuttle	$ 47,398,394			$ 15,647,500		$ 21,747,000						$ 84,792,894			$ -	$ 84,792,894			3,398,745			
2008		Option 2B - 2006 Cond.											$ 14,535,300	$ 14,535,300			$ -	$ 14,535,300			3,460,289			
2009	Replace Bus/Trailer Units (7)	Option 2B - 2006 Cond.				$ 4,427,500			$ -				$ 14,535,300	$ 18,962,800			$ -	$ 18,962,800			3,521,834			
2010	Replace 2 40' CNG	Option 2B - 2006 Cond.				$ 726,000			$ (72,600)	$ 225,000			$ 14,535,300	$ 15,413,700			$ -	$ 15,413,700			3,583,379			
2011	Replace 3 40' CNG	Option 2B - 2006 Cond.				$ 1,089,000			$ (108,900)				$ 14,535,300	$ 15,515,400			$ -	$ 15,515,400			3,644,923			
2012		Option 2B - 2006 Cond.								$ 1,922,000			$ 14,535,300	$ 16,457,300			$ -	$ 16,457,300			3,706,461			
2013	Expand System	Option 2B - 2016 Cond.				$ 1,265,000		$ 1,320,000					$ 15,266,600	$ 17,851,600			$ -	$ 17,851,600			3,767,999			
2014		Option 2B - 2016 Cond.								$ 225,000			$ 15,266,600	$ 15,491,600			$ -	$ 15,491,600			3,829,537			
2015		Option 2B - 2016 Cond.								$ 25,000			$ 15,266,600	$ 15,291,600			$ -	$ 15,291,600			3,891,075			
2016		Option 2B - 2016 Cond.								$ 420,000			$ 15,266,600	$ 15,686,600			$ -	$ 15,686,600			3,952,613			
2017		Option 2B - 2016 Cond.		$ 21,065,953						$ 159,000			$ 15,266,600	$ 36,491,553			$ -	$ 36,491,553			4,011,211			
2018		Option 2B - 2016 Cond.											$ 15,266,600	$ 15,266,600			$ -	$ 15,266,600			4,069,809			
2019	Expand System - Convert 40' to 60' on LH	Option 2B - 2026 Cond.				$ 3,982,000		$ 6,435,000		$ 25,000			$ 17,542,000	$ 27,984,000			$ -	$ 27,984,000			4,128,407			
2020	Replace Intitial Buses - Rim Shuttles	Option 2B - 2026 Cond.				$ 15,647,500			$ (1,891,450)	$ 10,000			$ 17,542,000	$ 31,308,050			$ -	$ 31,308,050			4,187,005			
2021	Replace Bus/Trailer Replacements (7)	Option 2B - 2026 Cond.				$ 4,427,500			$ (442,750)				$ 17,542,000	$ 21,526,750			$ -	$ 21,526,750			4,245,603			
2022	Replace 2 40' CNG	Option 2B - 2026 Cond.				$ 726,000			$ (72,600)	$ 326,000			$ 17,542,000	$ 18,521,400			$ -	$ 18,521,400			4,304,200			
2023	Replace 3 40' CNG	Option 2B - 2026 Cond.				$ 1,089,000			$ (108,900)				$ 17,542,000	$ 18,522,100			$ -	$ 18,522,100			4,362,798			
2024		Option 2B - 2026 Cond.								$ 1,932,000			$ 17,542,000	$ 19,474,000			$ -	$ 19,474,000			4,421,396			
2025	Replace Expansion Buses - Defer	Option 2B - 2026 Cond.											$ 17,542,000	$ 17,542,000			$ -	$ 17,542,000			4,479,994			
2026		Option 2B - 2026 Cond.							$ (19,052,138)				$ 17,542,000	$ (1,510,138)			$ -	$ (1,510,138)			4,538,592			
Total			$ 105,329,765	$ 21,065,953		$ 49,027,000	$ -	$ 29,502,000	$ (21,749,338)	$ 5,294,000	$ -	$ -	$ 304,612,100	$ 493,081,480	$ -	$ -	$ -	$ 493,081,480	$ -	$0	92,406,150			$ 5.34

IRR

Inflation	**0.00%**	**All costs in constant 2003 US dollars**
Base Year	2003	
South Rim		
Share of Visits	90%	Paying visitors per total visitors 74.2%

Option Construction $ 105,329,765

Existing Fleet	**Description**	**Remaining Life in 2003**
3	New Flyer 40' CNG	7 years
2	New Flyer 40' CNG	8 years
7	Bus/Trailer - LNG	6 years

Fleet Requirements - Rim Shuttle System

	Number	**Unit Cost**
2006		
40' Buses	15	$ 363,000.00
60' Buses	26	$ 632,500.00
2016		
40' Buses	15	$ 363,000.00
60' Buses	28	$ 632,500.00
2026		
40' Buses	19	$ 363,000.00
60' Buses	32	$ 632,500.00

Fleet Requirements - Line Haul

	Number	**Unit Cost**
2006		
40' Buses	9	$ 363,000.00
CIVIS Buses	14	$ 1,320,000.00
2016		
40' Buses	9	$ 363,000.00
CIVIS Buses	15	$ 1,320,000.00
2026		
60' Buses	6	$ 632,500.00
CIVIS Buses	17	$ 1,320,000.00

Assumed residual value of vehicles (percent of initial cost) 10%

Fleet Composition at contract end

	Number	Age	Value	Number	Age	Value	Number	Age	Value	Number	Age	Value	Number	Age	Value	Total Number	Total Value
Line Haul System																	
60' Buses				6	8	$ 1,518,000										6	$ 1,518,000
CIVIS Buses	14	19	$ 2,679,600.00	1	14	$ 488,400	2	8	$ 1,689,600							17	$ 4,857,600
Rim Shuttles																	
40' Buses				4	8	$ 580,800	10	7	$ 1,724,250	2	5	$ 453,750	3	4	$ 762,300	19	$ 3,521,100
60' Buses	2	14	$ -	4	8	$ 1,012,000	19	7	$ 5,708,313	7	6	$ 2,435,125				32	$ 9,155,438
																	$ 19,052,138

Grand Canyon National Park
Bus Rapid Transit Alternatives Analysis
Cash Flow Analysis and Life Cycle Cost
Option 3 - WITH EXPANSION

Year	Design/Construction/Procurement Activity	Transit Operation	Capital Cost - Construction	Capital Cost - Fixed Facility Rehab/Repair	Residual Value of Fixed Facilities	Capital Cost - Rim Shuttle Buses	Capital Cost - Line Haul Rail Vehicles	Capital Cost - Line Haul Buses	Residual Value of Retired Buses	Capital Cost - Major Vehicle Overhaul	Line Haul Operating and Maint. Cost	Shuttle Bus Operating and Maint. Cost	Total Transit O & M Cost	Total Cash Flow	*Real Property Depreciation*	*Vehicle Depreciation*	*Depreciation*	Total Cost	Net Present Value	Equivalent Annual Cost	South Rim Paying Visitors	Revenue	Discounted Revenue	Total Cost/ Total Visitor
2003		Existing shuttle	$ -											$ -			$ -	$ -			3,112,940			
2004	Design Option 1 Improvements	Existing shuttle	8,105,551											$ 8,105,551			$ -	$ 8,105,551			3,187,693			
2005	Design Option 1 Improvements	Existing shuttle	$ 8,105,551											$ 8,105,551			$ -	$ 8,105,551			3,262,447			
2006	Construct/Procure Option 1	Existing shuttle	$ 72,949,960							$ 25,000				$ 72,974,960			$ -	$ 72,974,960			3,337,200			
2007	Construct/Procure Option 1	Existing shuttle	$ 72,949,960			$ 11,363,000		$ 39,600,000						$ 123,912,960			$ -	$ 123,912,960			3,398,745			
2008		Option 3B - 2006 Cond.											$ 15,641,000	$ 15,641,000			$ -	$ 15,641,000			3,460,289			
2009	Replace Bus/Trailer Units (7)	Option 3B - 2006 Cond.				$ 2,849,000			$ -	$ 76,000			$ 15,641,000	$ 18,566,000			$ -	$ 18,566,000			3,521,834			
2010	Replace 2 40' CNG	Option 3B - 2006 Cond.				$ 726,000			$ (72,600)	$ 665,000			$ 15,641,000	$ 16,959,400			$ -	$ 16,959,400			3,583,379			
2011	Replace 3 40' CNG	Option 3B - 2006 Cond.				$ 1,089,000			$ (108,900)				$ 15,641,000	$ 16,621,100			$ -	$ 16,621,100			3,644,923			
2012		Option 3B - 2006 Cond.								$ 791,000			$ 15,641,000	$ 16,432,000			$ -	$ 16,432,000			3,706,461			
2013	Expand System	Option 3B - 2016 Cond.				$ 814,000		$ 2,200,000					$ 16,666,800	$ 19,680,800			$ -	$ 19,680,800			3,767,999			
2014		Option 3B - 2016 Cond.								$ 50,000			$ 16,666,800	$ 16,716,800			$ -	$ 16,716,800			3,829,537			
2015		Option 3B - 2016 Cond.								$ 993,000			$ 16,666,800	$ 17,659,800			$ -	$ 17,659,800			3,891,075			
2016		Option 3B - 2016 Cond.											$ 16,666,800	$ 16,666,800			$ -	$ 16,666,800			3,952,613			
2017		Option 3B - 2016 Cond.		$ 32,422,204						$ 159,000			$ 16,666,800	$ 49,248,004			$ -	$ 49,248,004			4,011,211			
2018		Option 3B - 2016 Cond.								$ 36,000			$ 16,666,800	$ 16,702,800			$ -	$ 16,702,800			4,069,809			
2019	Expand System	Option 3B - 2026 Cond.				$ 3,080,000		$ 4,400,000		$ 25,000			$ 19,530,000	$ 27,035,000			$ -	$ 27,035,000			4,128,407			
2020	Replace Intitial Buses (Rim Shuttles)	Option 3B - 2026 Cond.				$ 11,363,000			$ (1,136,300)	$ 680,000			$ 19,530,000	$ 30,436,700			$ -	$ 30,436,700			4,187,005			
2021	Replace Bus/Trailer Replacements (7)	Option 3B - 2026 Cond.				$ 2,849,000			$ (284,900)	$ 76,000			$ 19,530,000	$ 22,170,100			$ -	$ 22,170,100			4,245,603			
2022	Replace 2 40' CNG	Option 3B - 2026 Cond.				$ 726,000			$ (72,600)	$ 50,000			$ 19,530,000	$ 20,233,400			$ -	$ 20,233,400			4,304,200			
2023	Replace 3 40' CNG	Option 3B - 2026 Cond.				$ 1,089,000			$ (108,900)				$ 19,530,000	$ 20,510,100			$ -	$ 20,510,100			4,362,798			
2024		Option 3B - 2026 Cond.								$ 437,000			$ 19,530,000	$ 19,967,000			$ -	$ 19,967,000			4,421,396			
2025	Replace Expansion Buses - Defer	Option 3B - 2026 Cond.								$ 857,000			$ 19,530,000	$ 20,387,000			$ -	$ 20,387,000			4,479,994			
2026		Option 3B - 2026 Cond.							$ (31,060,425)				$ 19,530,000	$ (11,530,425)			$ -	$ (11,530,425)			4,538,592			
Total			$ 162,111,022	$ 32,422,204		$ 35,948,000	$ -	$ 46,200,000	$ (32,844,625)	$ 4,920,000	$ -	$ -	$ 334,445,800	$ 583,202,401	$ -	$ -	$ -	$ 583,202,401	$ -	$0	92,406,150			$ 6.31

IRR

Inflation	**0.00%**	**All costs in constant 2003 US dollars**	
Base Year	2003		
South Rim			
Share of Visits	90%	Paying visitors per total visitors	74.2%
Option Construction		$ 162,111,022	

Existing Fleet	**Description**	**Remaining Life in 2003**
3	New Flyer 40' CNG	7 years
2	New Flyer 40' CNG	8 years
7	Bus/Trailer - LNG	6 years

Fleet Requirements - Rim Shuttle System

2006	**Number**	**Unit Cost**
40' Buses	15	$ 363,000.00
Bus/Trailers	26	$ 407,000.00
2016		
40' Buses	15	$ 363,000.00
Bus/Trailers	28	$ 407,000.00
2026		
40' Buses	19	$ 363,000.00
Bus/Trailers	32	$ 407,000.00

Fleet Requirements - Line Haul

2006	**Number**	**Unit Cost**
40' Buses	0	$ 363,000.00
GLT Buses	18	$ 2,200,000.00
2016		
40' Buses	0	$ 363,000.00
GLT Buses	19	$ 2,200,000.00
2026		
60' Buses	0	$ 632,500.00
GLT Buses	21	$ 2,200,000.00

Assumed residual value of vehicles at retirement (percent of initial cost) 10%

Fleet Composition at contract end

	Number	Age	Value	Number	Age	Value	Number	Age	Value	Number	Age	Value	Number	Age	Value	Total Number	Total Value
Line Haul System																	
40' Buses																-	$ -
GLT Buses	18	19	$ 17,028,000	1	14	$ 1,276,000	2	8	$ 3,344,000							21	$ 21,648,000
Rim Shuttles																	
40' Buses				4	8	$ 580,800	10	7	$ 1,724,250	2	5	$ 453,750	3	4	$ 762,300	19	$ 3,521,100
Bus/Trailers	2	14	$ -	4	8	$ 651,200	19	7	$ 3,673,175	7	6	$ 1,566,950				32	$ 5,891,325
																	$ 31,060,425

Grand Canyon National Park
Bus Rapid Transit Alternatives Analysis
Cash Flow Analysis and Life Cycle Cost
Option 4 - WITH EXPANSION

Year	Design/Construction/Procurement Activity	Transit Operation	Capital Cost - Construction	Capital Cost - Fixed Facility Rehab/Repair	Residual Value of Fixed Facilities	Capital Cost - Rim Shuttle Buses	Capital Cost - Line Haul Rail Vehicles	Capital Cost - Line Haul Buses	Residual Value of Retired Vehicles	Capital Cost - Major Vehicle Overhaul	Line Haul Operating and Maint. Cost	Shuttle Bus Operating and Maint. Cost	Total Transit O & M Cost	Total Cash Flow	*Real Property Depreciation*	*Vehicle Depreciation*	*Depreciation*	Total Cost	Net Present Value	Equivalent Annual Cost	South Rim Paying Visitors	Revenue	Discounted Revenue	Total Cost/ Total Visitor
2003		Existing shuttle	$ -											$ -			$ -	$ -			3,112,940			
2004	Design Option 4 Phase 1 Improvements	Existing shuttle	4,056,412											$ 4,056,412			$ -	$ 4,056,412			3,187,693			
2005	Design Option 4 Phase 1 Improvements	Existing shuttle	$ 4,056,412											$ 4,056,412			$ -	$ 4,056,412			3,262,447			
2006	Construct/Procure Option 4 Phase 1	Existing shuttle	$ 36,507,705							$ 25,000				$ 36,532,705			$ -	$ 36,532,705			3,337,200			
2007	Construct/Procure Option 4 Phase 1	Existing shuttle	$ 36,507,705			$ 11,363,000		$ 15,636,500						$ 63,507,205			$ -	$ 63,507,205			3,398,745			
2008		Option 4 Phase 1 - 2006 Cond.											$ 14,068,200	$ 14,068,200			$ -	$ 14,068,200			3,460,289			
2009	Replace Bus/Trailer Units (7)	Option 4 Phase 1 - 2006 Cond.				$ 2,849,000			$ -				$ 14,068,200	$ 16,917,200			$ -	$ 16,917,200			3,521,834			
2010	Replace 2 40' CNG	Option 4 Phase 1 - 2006 Cond.				$ 726,000			$ (72,600)	$ 310,000			$ 14,068,200	$ 15,031,600			$ -	$ 15,031,600			3,583,379			
2011	Replace 3 40' CNG	Option 4 Phase 1 - 2006 Cond.				$ 1,089,000			$ (108,900)				$ 14,068,200	$ 15,048,300			$ -	$ 15,048,300			3,644,923			
2012		Option 4 Phase 1 - 2006 Cond.								$ 2,954,400			$ 14,068,200	$ 17,022,600			$ -	$ 17,022,600			3,706,461			
2013	Expand System, Design Option 4 Phase 2	Option 4 Phase 1 - 2016 Cond.	$ 4,759,520			$ 814,000		$ 1,897,500					$ 15,162,700	$ 22,633,720			$ -	$ 22,633,720			3,767,999			
2014	Design Option 4 Phase 2 Improvements	Option 4 Phase 1 - 2016 Cond.	$ 4,759,520							$ 310,000			$ 15,162,700	$ 20,232,220			$ -	$ 20,232,220			3,829,537			
2015	Construct/Procure Option 4 Phase 2	Option 4 Phase 1 - 2016 Cond.	$ 42,835,677							$ 25,000			$ 15,162,700	$ 58,023,377			$ -	$ 58,023,377			3,891,075			
2016	Construct/Procure Option 4 Phase 2	Option 4 Phase 1 - 2016 Cond.	$ 42,835,677				$ 43,120,000						$ 15,162,700	$ 101,118,377			$ -	$ 101,118,377			3,952,613			
2017	**Switch to LRT - (Phase 2)**	Option 4 Phase 2 - 2016 Cond.		14,603,082					$ (6,410,113)	$ 159,000			$ 15,555,100	$ 23,907,070			$ -	$ 23,907,070			4,011,211			
2018		Option 4 Phase 2 - 2016 Cond.											$ 15,555,100	$ 15,555,100			$ -	$ 15,555,100			4,069,809			
2019	Expand System	Option 4 Phase 2 - 2026 Cond.				$ 3,080,000				$ 25,000			$ 18,660,400	$ 21,765,400			$ -	$ 21,765,400			4,128,407			
2020	Replace Intitial Buses	Option 4 Phase 2 - 2026 Cond.				$ 11,363,000			$ (2,699,950)	$ 25,000			$ 18,660,400	$ 27,348,450			$ -	$ 27,348,450			4,187,005			
2021	Replace Bus/Trailer Replacements (7)	Option 4 Phase 2 - 2026 Cond.				$ 2,849,000			$ (284,900)				$ 18,660,400	$ 21,224,500			$ -	$ 21,224,500			4,245,603			
2022	Replace 2 40' CNG	Option 4 Phase 2 - 2026 Cond.				$ 726,000			$ (72,600)	$ 564,000			$ 18,660,400	$ 19,877,800			$ -	$ 19,877,800			4,304,200			
2023	Replace 3 40' CNG	Option 4 Phase 2 - 2026 Cond.				$ 1,089,000			$ (108,900)				$ 18,660,400	$ 19,640,500			$ -	$ 19,640,500			4,362,798			
2024		Option 4 Phase 2 - 2026 Cond.								$ 2,979,000			$ 18,660,400	$ 21,639,400			$ -	$ 21,639,400			4,421,396			
2025	Replace Expansion Buses - Defer	Option 4 Phase 2 - 2026 Cond.											$ 18,660,400	$ 18,660,400			$ -	$ 18,660,400			4,479,994			
2026		Option 4 Phase 2 - 2026 Cond.							$ (12,664,905)				$ 18,660,400	$ 5,995,495			$ -	$ 5,995,495			4,538,592			
Total			$ 176,318,626	$ 14,603,082		$ 35,948,000	$ 43,120,000	$ 17,534,000	$ (22,422,868)	$ 7,376,400	$ -	$ -	$ 311,385,200	$ 583,862,441	$ -	$ -	$ -	$ 583,862,441	$ -	$0	92,406,150			$ 6.32

IRR
Inflation **0.00%** **All costs in constant 2003 US dollars**
Base Year 2003
South Rim
Share of Visits 90% Paying visitors per total visitors 74.2%

Option Construction - Phase 1 $ 81,128,234
Option Construction - Phase 2 $ 95,190,392

Existing Fleet	**Description**	**Remaining Life in 2003**
3	New Flyer 40' CNG	7 years
2	New Flyer 40' CNG	8 years
7	Bus/Trailer - LNG	6 years

Fleet Requirements - Rim Shuttle System

	Number	**Unit Cost**
2006		
40' Buses	15	$ 363,000.00
Bus/Trailers	26	$ 407,000.00
2016		
40' Buses	15	$ 363,000.00
Bus/Trailers	28	$ 407,000.00
2026		
40' Buses	19	$ 363,000.00
Bus/Trailers	32	$ 407,000.00

Fleet Requirements - Line Haul

	Number	**Unit Cost**
2006		
40' Buses	3	$ 363,000.00
60' Buses	23	$ 632,500.00
2016 - Phase 1		
40' Buses	3	$ 363,000.00
60' Buses	26	$ 632,500.00
2016 - Phase 2		
Light Rail Vehic	14	$ 3,080,000.00
2026		
Light Rail Vehic	14	$ 3,080,000.00

Assumed residual value of vehicles (percent of initial cost) 10%

Fleet Composition at contract end

Line Haul System	Number	Age	Value	Number	Age	Value	Number	Age	Value	Number	Age	Value	Number	Age	Value	Total Number	Total Value
40' Buses																-	$ -
LRT Vehicles	14	10	$ 3,252,480.00			$ -			$ -							14	$ 3,252,480
Rim Shuttles																	
40' Buses				4	8	$ 580,800	10	7	$ 1,724,250	2	5	$ 453,750	3	4	$ 762,300	19	$ 3,521,100
Bus/Trailers	2	14	$ -	4	8	$ 651,200	19	7	$ 3,673,175	7	6	$ 1,566,950				32	$ 5,891,325
Total																	$ 12,664,905
Line Haul System at Conversion to LRT																	
40' Buses	3	9	$ 353,925.00														$ 353,925
60' Buses	23	9	$ 4,727,937.50	3	4	$1,328,250.00											$ 6,056,188
																	$ 6,410,113

Grand Canyon National Park
Bus Rapid Transit Alternatives Analysis
Cash Flow Analysis and Life Cycle Cost
Option 5A - WITH EXPANSION

Year	Design/Construction/Procurement Activity	Transit Operation	Capital Cost - Construction	Capital Cost - Fixed Facility Rehab/Repair	Residual Value of Fixed Facilities	Capital Cost - Rim Shuttle Buses	Capital Cost - Line Haul Rail Vehicles	Capital Cost - Line Haul Buses	Residual Value of Retired Vehicles	Capital Cost - Major Vehicle Overhaul	Line Haul Operating and Maint. Cost	Shuttle Bus Operating and Maint. Cost	Total Transit O & M Cost	Total Cash Flow	*Real Property Depreciation*	*Vehicle Depreciation*	*Depreciation*	Total Cost	Net Present Value	Equivalent Annual Cost	South Rim Paying Visitors	Revenue	Discounted Revenue	Total Cost/ Total Visitor
2003		Existing shuttle	$ -											$ -			$ -	$ -			3,112,940			
2004	Design Option 5 Improvements	Existing shuttle	7,750,990											$ 7,750,990			$ -	$ 7,750,990			3,187,693			
2005	Design Option 5 Improvements	Existing shuttle	$ 7,750,990											$ 7,750,990			$ -	$ 7,750,990			3,262,447			
2006	Construct/Procure Option 5	Existing shuttle	$ 69,758,914							$ 25,000				$ 69,783,914			$ -	$ 69,783,914			3,337,200			
2007	Construct/Procure Option 5	Existing shuttle	$ 69,758,914			$ 11,363,000	$ 43,120,000							$ 124,241,914			$ -	$ 124,241,914			3,398,745			
2008		Option 5 - 2006 Cond.											$ 14,676,400	$ 14,676,400			$ -	$ 14,676,400			3,460,289			
2009	Replace Bus/Trailer Units (7)	Option 5 - 2006 Cond.				$ 2,849,000			$ -	$ 44,000			$ 14,676,400	$ 17,569,400			$ -	$ 17,569,400			3,521,834			
2010	Replace 2 40' CNG	Option 5 - 2006 Cond.				$ 726,000			$ (72,600)	$ 720,000			$ 14,676,400	$ 16,049,800			$ -	$ 16,049,800			3,583,379			
2011	Replace 3 40' CNG	Option 5 - 2006 Cond.				$ 1,089,000			$ (108,900)				$ 14,676,400	$ 15,656,500			$ -	$ 15,656,500			3,644,923			
2012		Option 5 - 2006 Cond.								$ 615,000			$ 14,676,400	$ 15,291,400			$ -	$ 15,291,400			3,706,461			
2013	Expand System	Option 5 - 2016 Cond.				$ 814,000	$ -			$ 60,000			$ 15,555,100	$ 16,429,100			$ -	$ 16,429,100			3,767,999			
2014		Option 5 - 2016 Cond.								$ 50,000			$ 15,555,100	$ 15,605,100			$ -	$ 15,605,100			3,829,537			
2015		Option 5 - 2016 Cond.								$ 814,000			$ 15,555,100	$ 16,369,100			$ -	$ 16,369,100			3,891,075			
2016		Option 5 - 2016 Cond.								$ 405,000			$ 15,555,100	$ 15,960,100			$ -	$ 15,960,100			3,952,613			
2017		Option 5 - 2016 Cond.		$ 31,003,962						$ 159,000			$ 15,555,100	$ 46,718,062			$ -	$ 46,718,062			4,011,211			
2018		Option 5 - 2016 Cond.											$ 15,555,100	$ 15,555,100			$ -	$ 15,555,100			4,069,809			
2019	Expand System	Option 5 - 2026 Cond.				$ 3,080,000	$ -			$ 85,000			$ 18,660,400	$ 21,825,400			$ -	$ 21,825,400			4,128,407			
2020	Replace Intitial Buses	Option 5 - 2026 Cond.				$ 11,363,000			$ (5,448,300)	$ 760,000			$ 18,660,400	$ 25,335,100			$ -	$ 25,335,100			4,187,005			
2021	Replace Bus/Trailer Replacements (7)	Option 5 - 2026 Cond.				$ 2,849,000			$ (284,900)	$ 52,000			$ 18,660,400	$ 21,276,500			$ -	$ 21,276,500			4,245,603			
2022	Replace 2 40' CNG	Option 5 - 2026 Cond.				$ 726,000			$ (72,600)	$ 50,000			$ 18,660,400	$ 19,363,800			$ -	$ 19,363,800			4,304,200			
2023	Replace 3 40' CNG	Option 5 - 2026 Cond.				$ 1,089,000			$ (108,900)				$ 18,660,400	$ 19,640,500			$ -	$ 19,640,500			4,362,798			
2024		Option 5 - 2026 Cond.								$ 669,000			$ 18,660,400	$ 19,329,400			$ -	$ 19,329,400			4,421,396			
2025	Replace Expansion Buses - Defer	Option 5 - 2026 Cond.								$ 860,000			$ 18,660,400	$ 19,520,400			$ -	$ 19,520,400			4,479,994			
2026		Option 5 - 2026 Cond.							$ (23,038,345)				$ 18,660,400	$ (4,377,945)			$ -	$ (4,377,945)			4,538,592			
Total			$ 155,019,809	$ 31,003,962		$ 35,948,000	$ 43,120,000	$ -	$ (29,134,545)	$ 5,368,000	$ -	$ -	$ 315,995,800	$ 557,321,025	$ -	$ -	$ -	$ 557,321,025	$ -	$0	92,406,150			$ 6.03

IRR
Inflation **0.00%** **All costs in constant 2003 US dollars**
Base Year 2003
South Rim
Share of Visits 90% Paying visitors per total visitors 74.2%

Option Construction $ 155,019,809

Existing Fleet	**Description**	**Remaining Life in 2003**
3	New Flyer 40' CNG	7 years
2	New Flyer 40' CNG	8 years
7	Bus/Trailer - LNG	6 years

Fleet Requirements - Rim Shuttle System

2006	**Number**	**Unit Cost**
40' Buses	15	$ 363,000.00
Bus/Trailers	26	$ 407,000.00
2016		
40' Buses	15	$ 363,000.00
Bus/Trailers	28	$ 407,000.00
2026		
40' Buses	19	$ 363,000.00
Bus/Trailers	32	$ 407,000.00

Fleet Requirements - Line Haul

2006	**Number**	**Unit Cost**
Light Rail Vehic	14	$ 3,080,000.00
2016		
Light Rail Vehic	14	$ 3,080,000.00
		$ -
2026		
Light Rail Vehic	14	$ 3,080,000.00
		$ -

Assumed residual value of vehicles (percent of initial cost) 10%

Fleet Composition at contract end

Line Haul System	Number	Age	Value	Number	Age	Value	Number	Age	Value	Number	Age	Value	Number	Age	Value	Total Number	Total Value
40' Buses																-	$ -
LRT Vehicles	14	19	$ 13,625,920			$ -			$ -							14	$ 13,625,920
Rim Shuttles																	
40' Buses				4	8	$ 580,800	10	7	$ 1,724,250	2	5	$ 453,750	3	4	$ 762,300	19	$ 3,521,100
Bus/Trailers	2	14	$ -	4	8	$ 651,200	19	7	$ 3,673,175	7	6	$ 1,566,950				32	$ 5,891,325
Total																	$ 23,038,345

Grand Canyon National Park
Bus Rapid Transit Alternatives Analysis
Cash Flow Analysis and Life Cycle Cost
Option 5B - WITH EXPANSION

Year	Design/Construction/Procurement Activity	Transit Operation	Capital Cost - Construction	Capital Cost - Fixed Facility Rehab/Repair	Residual Value of Fixed Facilities	Capital Cost - Rim Shuttle Buses	Capital Cost - Line Haul Rail Vehicles	Capital Cost - Line Haul Buses	Residual Value of Retired Vehicles	Capital Cost - Major Vehicle Overhaul	Line Haul Operating and Maint. Cost	Shuttle Bus Operating and Maint. Cost	Total Transit O & M Cost	Total Cash Flow	*Real Property Depreciation*	*Vehicle Depreciation*	*Depreciation*	Total Cost	Net Present Value	Equivalent Annual Cost	South Rim Paying Visitors	Revenue	Discounted Revenue	Total Cost/ Total Visitor
2003		Existing shuttle	$ -											$ -			$ -	$ -			3,112,940			
2004	Design Option 1 Improvements	Existing shuttle	9,847,142											$ 9,847,142			$ -	$ 9,847,142			3,187,693			
2005	Design Option 1 Improvements	Existing shuttle	$ 9,847,142											$ 9,847,142			$ -	$ 9,847,142			3,262,447			
2006	Construct/Procure Option 1	Existing shuttle	$ 88,624,277							$ 25,000				$ 88,649,277			$ -	$ 88,649,277			3,337,200			
2007	Construct/Procure Option 1	Existing shuttle	$ 88,624,277			$ 11,363,000	$ 38,500,000							$ 138,487,277			$ -	$ 138,487,277			3,398,745			
2008		Option 1 - 2006 Cond.											$ 15,556,984	$ 15,556,984			$ -	$ 15,556,984			3,460,289			
2009	Replace Bus/Trailer Units (7)	Option 1 - 2006 Cond.				$ 2,849,000			$ -	$ 44,000			$ 15,556,984	$ 18,449,984			$ -	$ 18,449,984			3,521,834			
2010	Replace 2 40' CNG	Option 1 - 2006 Cond.				$ 726,000			$ (72,600)	$ 720,000			$ 15,556,984	$ 16,930,384			$ -	$ 16,930,384			3,583,379			
2011	Replace 3 40' CNG	Option 1 - 2006 Cond.				$ 1,089,000			$ (108,900)				$ 15,556,984	$ 16,537,084			$ -	$ 16,537,084			3,644,923			
2012		Option 1 - 2006 Cond.								$ 615,000			$ 15,556,984	$ 16,171,984			$ -	$ 16,171,984			3,706,461			
2013	Expand System	Option 1 - 2016 Cond.				$ 814,000	$ -			$ 60,000			$ 16,488,406	$ 17,362,406			$ -	$ 17,362,406			3,767,999			
2014		Option 1 - 2016 Cond.								$ 50,000			$ 16,488,406	$ 16,538,406			$ -	$ 16,538,406			3,829,537			
2015		Option 1 - 2016 Cond.								$ 814,000			$ 16,488,406	$ 17,302,406			$ -	$ 17,302,406			3,891,075			
2016		Option 1 - 2016 Cond.								$ 405,000			$ 16,488,406	$ 16,893,406			$ -	$ 16,893,406			3,952,613			
2017		Option 1 - 2016 Cond.		$ 39,388,568						$ 159,000			$ 16,488,406	$ 56,035,974			$ -	$ 56,035,974			4,011,211			
2018		Option 1 - 2016 Cond.											$ 16,488,406	$ 16,488,406			$ -	$ 16,488,406			4,069,809			
2019	Expand System	Option 1 - 2026 Cond.				$ 3,080,000	$ -			$ 85,000			$ 19,780,024	$ 22,945,024			$ -	$ 22,945,024			4,128,407			
2020	Replace Intitial Buses	Option 1 - 2026 Cond.				$ 11,363,000			$ (4,986,300)	$ 760,000			$ 19,780,024	$ 26,916,724			$ -	$ 26,916,724			4,187,005			
2021	Replace Bus/Trailer Replacements (7)	Option 1 - 2026 Cond.				$ 2,849,000			$ (284,900)	$ 52,000			$ 19,780,024	$ 22,396,124			$ -	$ 22,396,124			4,245,603			
2022	Replace 2 40' CNG	Option 1 - 2026 Cond.				$ 726,000			$ (72,600)	$ 50,000			$ 19,780,024	$ 20,483,424			$ -	$ 20,483,424			4,304,200			
2023	Replace 3 40' CNG	Option 1 - 2026 Cond.				$ 1,089,000			$ (108,900)				$ 19,780,024	$ 20,760,124			$ -	$ 20,760,124			4,362,798			
2024		Option 1 - 2026 Cond.								$ 669,000			$ 19,780,024	$ 20,449,024			$ -	$ 20,449,024			4,421,396			
2025	Replace Expansion Buses - Defer	Option 1 - 2026 Cond.								$ 860,000			$ 19,780,024	$ 20,640,024			$ -	$ 20,640,024			4,479,994			
2026		Option 1 - 2026 Cond.							$ (21,578,425)				$ 19,780,024	$ (1,798,401)			$ -	$ (1,798,401)			4,538,592			
Total			$ 196,942,839	$ 39,388,568		$ 35,948,000	$ 38,500,000	$ -	$ (27,212,625)	$ 5,368,000	$ -	$ -	$ 334,955,548	$ 623,890,329	$ -	$ -	$ -	$ 623,890,329	$ -	$0	92,406,150			$ 6.75

IRR
Inflation **0.00%** **All costs in constant 2003 US dollars**
Base Year 2003
South Rim
Share of Visits 90% Paying visitors per total visitors 74.2%

Option Construction $ 196,942,839

Existing Fleet	**Description**	**Remaining Life in 2003**
3	New Flyer 40' CNG	7 years
2	New Flyer 40' CNG	8 years
7	Bus/Trailer - LNG	6 years

Fleet Requirements - Rim Shuttle System

2006	**Number**	**Unit Cost**
40' Buses	15	$ 363,000.00
Bus/Trailers	26	$ 407,000.00
2016		
40' Buses	15	$ 363,000.00
Bus/Trailers	28	$ 407,000.00
2026		
40' Buses	19	$ 363,000.00
Bus/Trailers	32	$ 407,000.00

Fleet Requirements - Line Haul

2006	**Number**	**Unit Cost**
Light Rail Vehic	14	$ 2,750,000.00
2016		
Light Rail Vehic	14	$ 2,750,000.00
		$ -
2026		
Light Rail Vehic	14	$ 2,750,000.00
		$ -

Assumed residual value of vehicles (percent of initial cost) 10%

Fleet Composition at contract end

Line Haul System	Number	Age	Value	Number	Age	Value	Number	Age	Value	Number	Age	Value	Number	Age	Value	Total Number	Total Value
40' Buses																-	$ -
LRT Vehicles	14	19	$ 12,166,000			$ -			$ -							14	$ 12,166,000
Rim Shuttles																	
40' Buses				4	8	$ 580,800	10	7	$ 1,724,250	2	5	$ 453,750	3	4	$ 762,300	19	$ 3,521,100
Bus/Trailers	2	14	$ -	4	8	$ 651,200	19	7	$ 3,673,175	7	6	$ 1,566,950				32	$ 5,891,325
Total																	$ 21,578,425

Appendix D
TRANSIT VEHICLE DESCRIPTIONS

CIVIS

CIVIS by Matra/Irisbus is a low-floor design bus technology that can be either steered like a regular bus or can be equipped for automatic guidance. The automatic guidance system uses an optical sensor system that steers the bus by following two parallel lines painted on the road surface. CIVIS comes in a 40-foot non-articulated, 60-foot articulated and an 80-foot double-articulated length. The vehicle design depicted herein is from the technical specifications for the Las Vegas vehicle being procured by the Clark County Regional Transportation Commission.

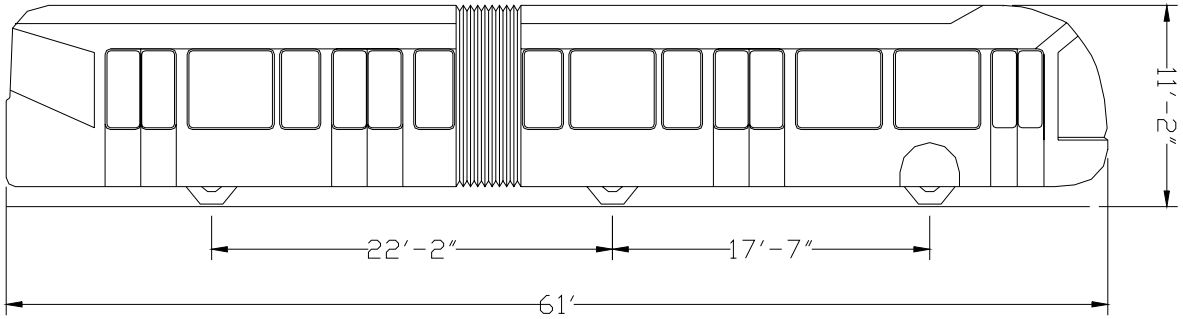
Propulsion can be either from overhead catenary contact or an on-board hybrid (diesel or CNG)/electric power system. The low floor design provides good accessibility and allows the vehicle interior to be highly adaptable to a wide range of seating arrangements.

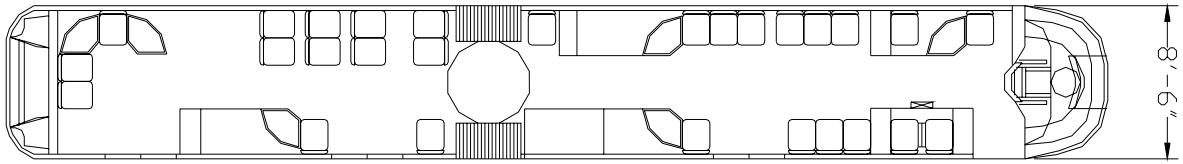
PERFORMANCE

Maximum Cruise Speed	44 mph
Propulsion	Electric 600 VDC/Diesel-CNG
Horsepower	300 @ 2400 rpm
Directional Capability	Single direction
Gradability (Maximum)	13%

VEHICLE CHARACTERISTICS

Length	732 inches
Width	102 inches
Width, with mirror	126 inches
Height	134 inches
Wheelbase (Front/Rear)	(211/266) inches
Overhang, Front	Approximately 127 inches
Overhang, Rear	Approximately 128 inches
Doors	3
Floor Height	13.4 inches
Approach Angle	NA
Departure Angle	NA
Turning Radius (wheels)	35.5 feet
Turning Radius (body envelope)	43 feet
GVWR-Weight	47,300 lbs.





AREA FOR PASSENGERS = 341 FT^2

DESIGN CAPACITY = 75 PAX

(34 SEATED, 4.5 FT^2 PER PASSENGER STANDING)

CIVIS – LAS VEGAS

Lea+Elliott
3/15/01

GLT BY BOMBARDIER

The Bombardier GLT is a low floor, rubber tired, double articulated vehicle that can either be guided by a double-flanged steel wheel that rides on a T-rail embedded in the road surface or can be steered manually. All axles of the vehicle are steered. The vehicle length is about 10 feet shorter than the Bombardier light rail vehicle. The technology was developed to fill the gap between light rail and conventional bus technology. This vehicle is equipped with doors on both sides although the vehicle operates in a single direction only.

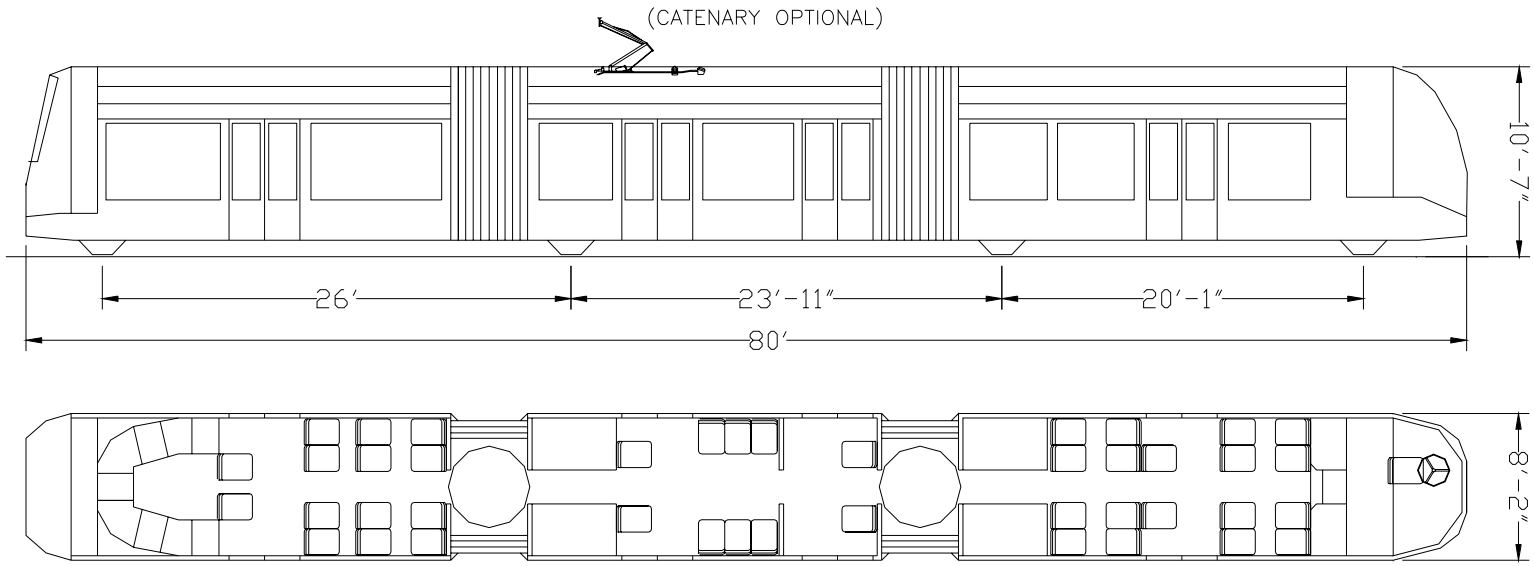
The current design requires an overhead contact wire to supply electric power, however, it can run off wire for up to four hours on a diesel engine. Batteries and a motor/alternator hybrid propulsion unit are offered but implementation status is under investigation.

PERFORMANCE

Maximum Cruise Speed..... 44 mph
Propulsion ..... Electric 300KW/Diesel Electric 200KW
Horsepower ..... NA
Directional Capability ..... Single direction
Gradability (Maximum) 13%

VEHICLE CHARACTERISTICS

Length ..... 960 inches
Width..... 98 inches
Width, with mirrors..... 122 inches
Height..... 127 inches
Wheelbase (Front/Middle/Rear) ..... (241/287/312) inches
Overhang, Front ..... Approximately 60 inches
Overhang, Rear ..... Approximately 60 inches
Doors..... 8
Floor Height ..... 13.4 inches
Approach Angle ..... NA
Departure Angle..... NA
Turning Radius (wheels)..... 40 feet
Turning Radius (body envelope) ..... N/A
GVWR-Weight ..... 55,116 lbs.



AREA FOR PASSENGERS = 378 FT^2

DESIGN CAPACITY = 84 PAX

(51 SEATED, 4.5 FT^2 PER PASSENGER STANDING)

Bombardier – GLT ARTICULATED BUS

Lea+Elliott
3/14/01

NEW FLYER C40LF

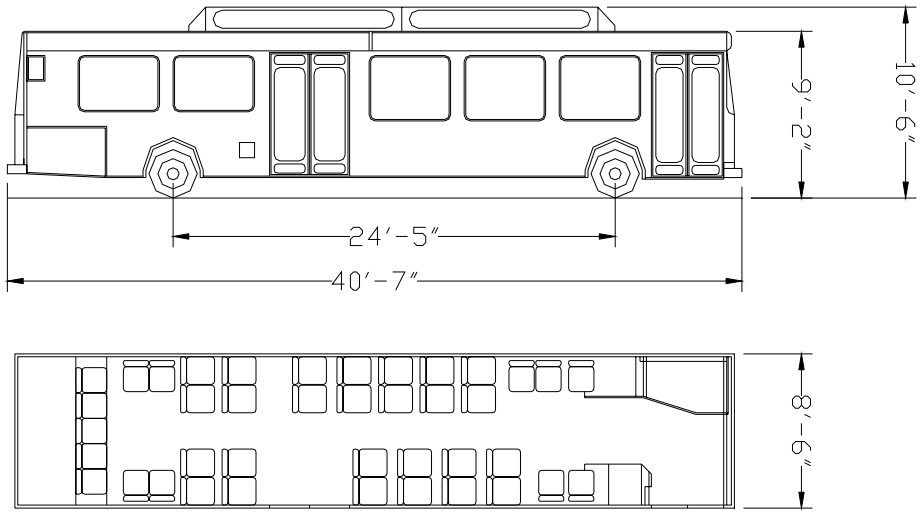
The New Flyer C40LF bus is the natural gas bus currently used at the Grand Canyon National Park. This Altoona tested CNG bus complies with ANSI NGV 3.1 and NFPA 52/57 regulations and additional safety precautions are utilized such as interlocks that provide a failsafe method to prevent the bus from starting when fueling or performing maintenance. CNG cylinders are roof-mounted, enclosed in two fiberglass gull-wing shrouds opening up and out when servicing. Fueling is accomplished at the curbside rear of coach. A maximum of seven roof-mounted tanks designed to withstand impacts of 5 mph, can be accommodated on a 40 ft coach.

PERFORMANCE

Maximum Cruise Speed	60 mph
Propulsion	Cummins Gas
Horsepower	275 @ 2400 rpm
Directional Capability	Single direction
Gradability (Maximum)	16%

VEHICLE CHARACTERISTICS

Length	487 inches
Width	102 inches
Width, with mirrors	126 inches
Height	161 inches
Wheelbase	293 inches
Overhang, Front	Approximately 97 inches
Overhang, Rear	Approximately 97 inches
Doors	2
Kneels to	11.5 inches
Floor Height	14.5 inches
Approach Angle	9˚
Departure Angle	9˚
Turning Radius (wheels)	N/A
Turning Radius (body envelope)	44 feet
GVWR-Weight	30,400 lbs.



AREA FOR PASSENGERS = 233 FT^2
DESIGN CAPACITY = 51 PAX
(40 SEATED, 4.5 FT^2 PER PASSENGER STANDING)

NEW FLYER NATURAL GAS BUS
C40LF

Lea+Elliott
3/16/01

NEW FLYER ARTICULATED

The New Flyer 60-foot articulated transit bus has all of the same features as the standard 40-foot low-floor diesel bus with increased passenger capacity and an optional third door to facilitate quick egress. There are large passenger windows and a variety of seating configurations that can accommodate up to 64 seated passengers.

As is the case with all New Flyer low-floor transit vehicles, each is equipped with a patented wheelchair access ramp design that provides a smooth transition from the curbside to the ADA designed wheelchair restraint system.

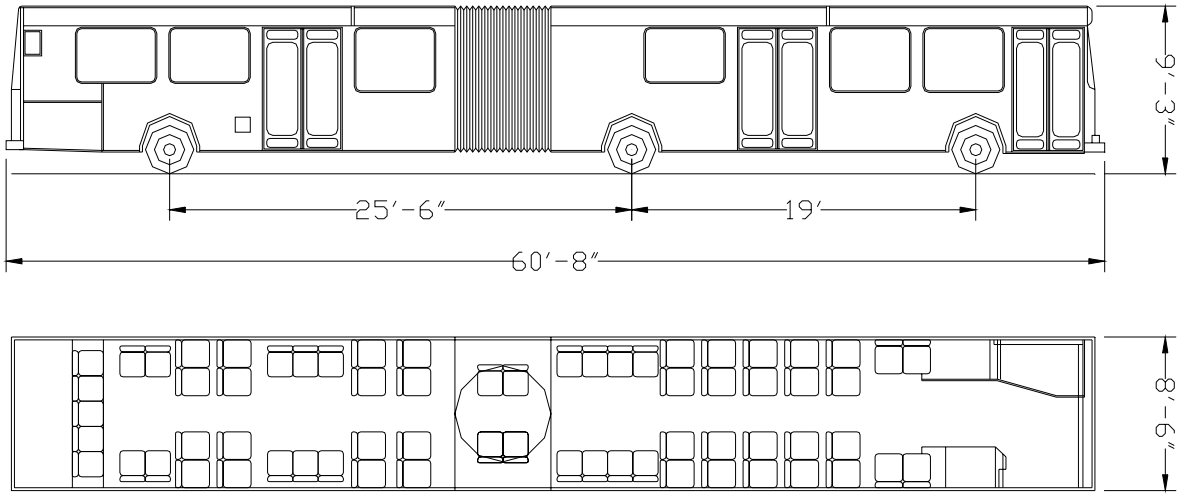
Currently, there are no plans to implement a CNG version of this vehicle.

PERFORMANCE

Maximum Cruise Speed	60 mph
Propulsion	Detroit Diesel Series 50
Horsepower	275 @ 2100
Directional Capability	Single direction
Gradability (Maximum)	16%

VEHICLE CHARACTERISTICS

Length	728 inches
Width	102 inches
Width, with mirrors	126 inches
Height (w/AC on rooftop)	120 inches
Wheelbase (Front / Rear)	228/306 inches
Overhang, Front	Approximately 97 inches
Overhang, Rear	Approximately 97 inches
Doors	3
Floor Height	N/A
Approach Angle	9˚
Departure Angle	9˚
Turning Radius (wheels)	N/A
Turning Radius (body envelope)	N/A
GVWR-Weight	39,880 lbs.



AREA FOR PASSENGERS = 358 FT^2
DESIGN CAPACITY = 79 PAX
(64 SEATED, 4.5 FT^2 PER PASSENGER STANDING)

NEW FLYER DIESEL BUS
D60LF

Lea+Elliott
3/16/01

REGIO SPRINTER

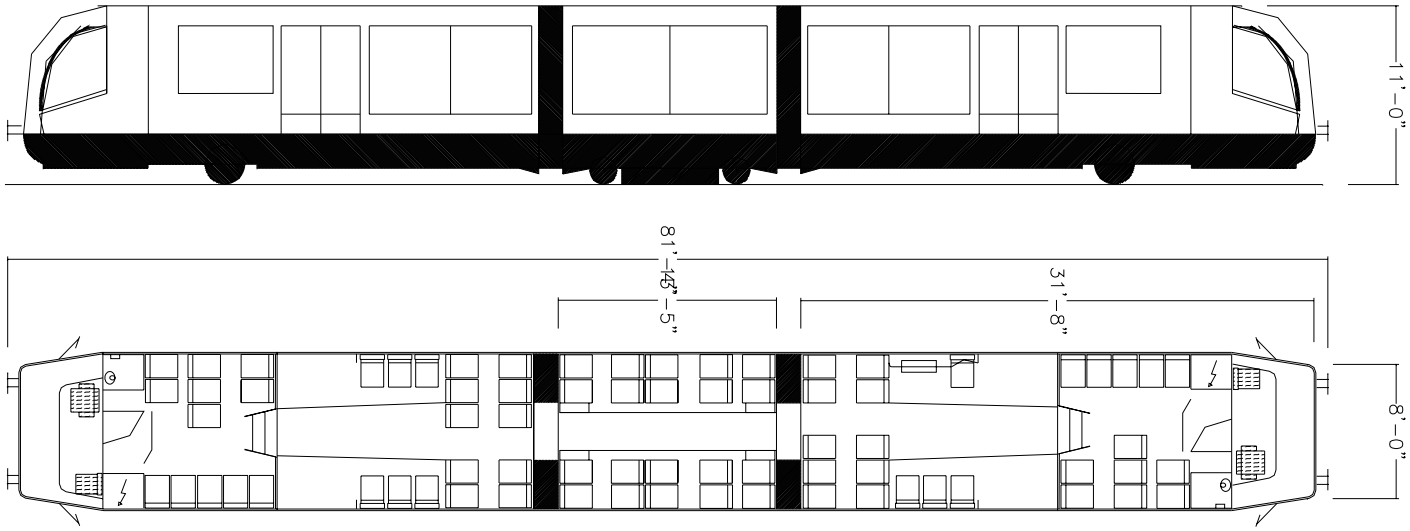
Siemans RegioSprinter is a light weight, low floor DMU designed specifically for regional and non-urban travel. The RegioSprinter is a bi-directional, double-articulated rail car with a low-floor design that allows access for disabled persons and has interior seating that accomodates 72 persons. This self-propelled rail car is equipped with two clean diesel engines and no locomotive is required for its operation. DMU's are considered cost efficient because they utilize low maintenance engines, have decreased infrastructure start-up costs and require only one operator. Its low-emission engines preclude the need for the electrification of rail lines.

PERFORMANCE

Maximum Cruise Speed..... 60 mph
Maximum Acceleration ..... 5 ft/s^2
Maximum Deceleration ..... 5 ft/s^2
Minimum Operational Headway..... 90 sec.
Engine .....5 cylinder turbo charged with 270 hp 200 rpm rating/CNG Option
Power .....2 x 228kW
Directional Capability.....Bidirectional
Minimum Track Radius ..... 262 ft
Gradability (Service / Maximum).....NA / NA

VEHICLE CHARACTERISTICS

Manufacturer .....Siemans
Model .....RegioSprinter
Number of Vehicles 3
Date in Service..... 1995
Length..... 1008 inches
Width..... 96 inches
Width, with mirrors..... 120 inches
Height.....132 inches
Wheelbase.....279.5 inches
Overhang, Front.....NA
Overhang, Rear .....NA
Doors 4
GVWR-Weight .....112,000 lbs.
Number of Seats..... 72



AREA FOR PASSENGERS = 563 FT^2
DESIGN CAPACITY = 125 PAX
(72 SEATED, 4.5 FT^2 PER PASSENGER STANDING)

REGIO SPRINTER

Lea+Elliott
3/23/01

Appendix E

White Paper

Alternatives for the Grand Canyon National Park Transportation System

Submitted by

EPRIsolutions

April 2001

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National Park Service — Grand Canyon Transit Project

Project Background

The National Park Service is proposing a transit system to serve Grand Canyon Village and the South Rim of Grand Canyon National Park. The primary or line haul route of this transit system will shuttle Grand Canyon visitors from a park-and-ride facility in the nearby small community of Tusayan, Arizona, to two stops in Grand Canyon Village, a total round-trip distance of 18 miles. The transit system will serve as the primary means of entry to Grand Canyon Village for day-use visitors and will initially serve an estimated 3.5 million visitors per year.

The National Park Service would like to minimize both noise and exhaust emissions from the transit system. The Grand Canyon area enjoys relatively low ambient noise levels and clean air, meaning that any intrusion in either is noticed more than might be the case in other places. Electric catenary for either buses or rail and electric hybrid are both of interest to the NPS as it plans the transit system. Cost of the transit system is important - it could either be federally funded or supported by fees collected at the park entrance. The project should be considered a long life project with the life cycle cost analysis accounting for a thirty year life.

CNG and LNG buses are currently being operated in the park and natural gas uses will continue to be preferred until fuel cell technology in buses becomes more mature. Initial engineering calculations found a maximum electrical load of 11.2 MW for an all electric light rail transit system.

Existing Facilities

Grand Canyon Village is served by a single 69kV line operated by Arizona Public Service. The current line, however, is a spur and has the potential to cause power loss if the line is compromised. The existing line and substation are not large enough to provide sufficient power for the proposed transit system. In addition, there is natural gas trucked to the site for use in the transit buses. The current source of natural gas is Topock, Arizona, over 150 road miles from the park. The nearest natural gas pipeline is approximately 40 miles away.

In order to provide sufficient and redundant power for a transit system at Grand Canyon, Arizona Public Service estimated (in 1998) the cost to be approximately $14.5 million. An Environmental Impact Statement would be required for this action which may take 3 to 5 years to perform.

Potential Solutions

This project has several alternate solutions, all of which will service the needs of the Park. The difference between them is how the energy is delivered to the final end point of concern, the drive mechanism of the transit system and the life cycle costs.

Option 1 — Bring in Electricity

Under this option, Arizona Public Service would extend their electric distribution system to the South Rim facility. As stated earlier, an Environmental Impact Report is required which is anticipated to take roughly three to four years to complete. The Park's view is that a delay of this length is too long. If this option is selected, then the current fleet of CNG buses would continue service until the distribution system extension is completed and a new electric transportation system is operational.

An electric distribution system upgrade could power an electric transit system directly (over-head wire) rail or bus, or indirectly (battery charging, hydrogen production, etc.). The electrical extension could also power all of the South Rim structures thereby eliminating the need for the propane fueled generators and their associated fuel requirements.

As quoted by Arizona Public Service, the costs of such an option would range from $12 to $14 million. However, the lifetime of distribution systems are very long compared to either engine or turbine generators which makes the life-cycle cost of the project quite competitive assuming a 30 year time consideration.

Costs: Financed cost of upgrade ($13 million) plus improvements at the site to use electricity ($500,000) plus electric usage fees ($850,000/yr)[1].
Pro: Low cost option overall. Scalable. Pay only for what you need (electric). Clean, quiet, reliable.
Con: High upfront costs. Long lead time for EIR and construction. Inextricably tied to electric utility's electric rates.

Option 2 — On-site Generation

Under this option, a large fossil based generator (most likely a combustion turbine) would be installed at or very near the park site. This generator's sole purpose would be to power South Rim facilities and the electric transportation system (overhead wire transit, or battery charging electric).

While clean and efficient, an on-site generator may not be the best option due to the nature of the electric load which can best be characterized as "peaky" with the average load being significantly less than the peak load. This is the case for both the hourly and monthly load profile. Since the electric load is directly proportional to the number of visitors at the South Rim, load will be highest during the daytime hours and during the summer months and holiday weekends and low (or nil) during the night and winter months.

This load profile is a poor match for gas turbines since turbines are mass based machines, that is, power and efficiency are directly tied to the mass of air the turbine can process. In this particular application, the peak load occurs when the daily temperatures are the highest. Compounding the problem is the site elevation, the South Rim of the Grand Canyon is located at an altitude of

[1] Based on average loading of 1,000 kW and electric an electric rate of $0.10 per kw-hr

7,000 feet where the air is much less dense (~12 psi at 7,000 ft vs. 14.7 psi at ocean level) than it is in regular applications.

This means that a 11.2 MW turbine cannot handle a 11.2 MW peak electrical load. Rather the turbine must be oversized by approximately 30% to overcome the decreased air density due to the warm temperatures and high altitude -- around 15.5 MW.

A 15+ MW turbine will be slightly less expensive ($9.0 million installed) than Option 1, but the generator still needs to be fueled. Extending a natural gas fuel line to the South Rim will be very expensive, potentially on the same order of magnitude as the electric distribution extension. The only alternative is be bring in fuel for the turbine via tractor-trailer.

While on-site fuel cells are a viable pollution free source of electricity, they are not yet commercialized to the point where they could provide all the power needs economically. It is suggested that this may be the solution in 3-5 years when their costs will be competitive with other types of localized generation.

Costs: 15 MW turbine delivered and installed ($9 million). Improvements to site facilities to accept power ($500,000). Cost of fuel including delivery vary depending upon type of fuel used (amber fuel, diesel, methanol, CNG, LPG, etc.) could be $20 per million BTU.
Pro: Fast implementation, plenty of cogeneration available for facility heating/cooling.
Con: Fuel delivery issues. Unit must be sized to the peak load. Some noise. visual distraction.

Option 3 — On Site Renewable System.

This option would comprise of a large photovoltaic system, wind power, or a combination of the two, mated to an energy storage system. Energy storage could be in the form of a traditional battery bank, flywheels, or a newer technology such as flow batteries or reversible fuel cell.

Such a system would support an all electric transportation system, or could be used to produce compressed hydrogen via an electrolyzer to be then be transferred to the transit system vehicles for use in a hydrogen fuel cell.

Since neither a wind study nor solar index study have been performed, it is difficult to assess a the exact sizing or cost for on-site renewable generation. Further, while technically feasible, the complexity, high costs, and the long lead time for implementation should be weighed carefully.

Costs: An installed PV array costs $9 million[2]. Wind Farms range between $1,400 and $1,500 per kilowatt of installed capacity.[3] Energy storage system sized to handle the 11.2 MW peak load, ($3 million).
Pros: No fuel costs, no electric costs, environmentally preferred. Quiet (PV).
Cons: Expensive, leading edge technology, questionable reliability. Requires good wind/solar radiation.

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[2] Assumes a required installed capacity of 2 MW to handle average electric loading at $4,000 per kW.
[3] Installed capacity is much different that the load to be served. Many wind farms are only 30% utilized meaning that if the desired load is 1.5 MW then the installed capacity must be 5 MW.

Option 4 — Electric or Hybrid-Electric Transit Fleet

Under this option, a hybrid of hybrid fossil and electric transit fleet would be selected. This could included a reciprocating engine, mobile turbine, or fuel cell engine mated to a battery system, flywheel, or capacitor set.

Examples of this are the Ballard buses running in Chicago which use onboard compressed hydrogen to fuel a 75 kW PEM fuel cell system. While it has not yet been demonstrated, a fuel cell powered light rail system is technically achievable and could be developed for this project.

This scenario option will avoid all the negative aspects of on-site generation and with the distribution extension. It will, however, require that fuel continue to be delivered to the South Rim facility.

Costs: Unknown costs as of yet, potentially $300/kW ($223/hp) for automotive engine costs. Plus fuel costs.
Pro: Potentially inexpensive option. Environmentally preferred. Avoid cons of Options 1 and 2
Con: Potential reliability issues. Tied to fuel delivery via tractor/trailer. Costs tied to fuel prices

Summary

The overarching issue with this project is not deciding on which type of transit system to move forward with, but rather how to supply the power to this new, large, "peaky" load situated more than 40 miles from either an electric or gas supply.

Preferred Option

The goal of the South Rim transportation improvement project is to (1) provide the power needs to a new and improved transit system, and; (2) have the energy solution be inexpensive, clean, and quiet, and; (3) it is desired to use an environmentally preferred technology, and; (4) the transit system improvement costs should be fiscally supported through park revenues.

No option listed above will meet all of these requirements on its own. On-site generation is less expensive than other options, but any generation device of this size must be supervised, fueled, maintained, and inspected regularly. If the renewable generation is selected, the energy storage system must be sized large enough to handle periods of no wind or low solar radiation — potentially very expensive.

The best solution may be a compromise between grid power and on-site generation. Here an extension of the distribution system (Option 1) will serve as the primary energy supply for an all electric transit system (overhead wire bus or rail), or to power recharging stations (battery powered bus or rail) or hydrogen production station (fuel cell bus or rail). If aesthetics are a strong enough concern, the distribution line could strung traditionally (above ground) and then switched to below ground for the last few miles approaching the South Rim facility. This would remove any visual impact to Grand Canyon visitors.

To bolster an environmentally preferred solution for this project, a "green" generating device would be showcased at the South Rim. This could be a 100 kW class fuel cell, PV array, or other novel generating device. The unit would be sized just large enough to meet the critical power load and installed such that the available cogeneration potential would serve the heating and cooling needs of Park buildings.

Under this scenario, the Park Department can showcase an ultra-clean, “green” generation device while maintaining all of the benefits of grid power. Since the grid will provide the majority of the power, there is no need for an expensive energy storage system and the associated interconnection equipment, thus saving on costs, and eliminating a large visual blight.

If the electrical grid experiences a blackout, the on-site generator will carry the critical loads of the transit system until power is restored. On site fuel storage can be sized to meet critical power needs for any number of days without refueling. And depending on future pricing points of natural gas and electricity, it’s possible that even a 100 kW an onsite generator could pay for itself and even offset some of the costs associated with the distribution extension.

Costs: all costs of option 1 plus $400,000[4] for a 100 kW class fuel cell
Pro: All advantages of Option 1. All advantages of Option 2. Image of clean power.
Con: Fuel delivery issues, albeit a fraction of that for Option 2. Fuel cell generators not a fully mature technology

Proposed Program

EPRIsolutions proposes a detailed engineering-life cycle cost analysis of all the tradeoffs to allow the National Park Service to arrive at the most economical alternative based on the factors discussed above. Such an analysis would explore in detail the purchase, installation, operation, maintenance and fuel costs for all the alternatives as well as the aesthetics of the different choices. We would work closely with the National Park Service as well as park visitors to insure the choice meets the defined environmental criteria.

Should this approach be of interest to the National Park Service, we will prepare a fully costed proposal for consideration.

[4] Projected Y2005 cost of 100 kW PEM FC system at $2,500/kW, plus installation

V ADDENDUM: EVALUATION OF GRAND CANYON RAILWAY'S PROPOSED REGIONAL RAIL

During the time that this report has been under formulation and review, an unsolicited proposal, called "Express Rail", was submitted to Grand Canyon National Park in 2002 by the Grand Canyon Railway (GCR). GCR is based in Williams, Arizona and presently provides train service once per day to Grand Canyon Village through a concession contract with the National Park Service. The rail line follows the historic Santa Fe railroad route from Williams to the South Rim. Service is provided by restored historic railroad equipment, including steam engines.

On January 29, 2003, the Superintendent of Grand Canyon National Park received a letter signed by the ten members of the Arizona Delegation (Senators John McCain and Jon Kyl and eight Congressional members), requesting the NPS to undertake a review of this initial proposal for Express Rail submitted by the Grand Canyon Railway, and compare the costs and benefits of this proposal with the other five options that were being analyzed by NPS. In April of 2003, an NPS Transportation Assistance Group (TAG) met to discuss strategies for reviewing GCR's proposal and requested that GCR submit a more detailed proposal, so that comparable analysis could be performed. GCR submitted a more detailed proposal, called *Regional Rail*, on October 31, 2003.

Regional Rail includes two phases of rail transit development. Phase I would provide voluntary passenger rail service from Williams to the Maswik Transportation Center and Phase II would provide light rail transit service from Tusayan, Arizona to the Canyon View Information Plaza (CVIP) near Mather Point on the South Rim. Phase 2 would be implemented when the number of private vehicles entering the South Rim reached 80% of the current number.

The National Park Service engaged the same consultants, along with the Volpe National Transportation Systems Center, utilized to prepare analyses for Options A and 1-5 to analyze this proposal in terms of the following:

- Visitation and Growth assumptions underpinning the proposal
- Viability of ridership assumptions
- Viability and accuracy of capital costs including the cost for both phases and any necessary expansion
- Viability and accuracy of operating and maintenance costs
- Cash flow, funding and financing
- Implementation approach

The consultants' evaluation follows in its entirety.

The Congress requested that NPS respond to several specific questions. Those questions with their attendant answers follow:

Questions:

1. *How does express rail compare with the other transportation options under consideration in meeting the goals of the 1995 General Management Plan (GMP)?*

Generally, Regional Rail and the other transportation options under consideration meet the goals of the 1995 GMP. Please see excerpts from the GMP Vision Statements and Objectives listed under Exhibit A, attached. One exception is as follows:

- Phase I of Regional Rail does not meet the objective for providing *efficient* transportation as listed in (i) Exhibit A. The estimated one-way travel time for the train is 75-80 minutes. The average wait of 30 minutes for visitors using the proposed train (1/2 of the initial 60-minute time between trains), results in an expected total travel time by train of 120 minutes, which is much longer than that for a private vehicle (60-75 minutes for the 59 mile trip from Williams to the Grand Canyon), and substantially longer than other transportation options. Even at the proposed 30-minute departures (proposed with increased use), travel time by rail exceeds private vehicle time by 20 minutes or more.
- Phase II, however includes a light rail system from Tusayan to CVIP with service every 15 minutes during peak visitation.
- Options A and 1-5 would have service no less frequent than ten minutes and no more frequent than two minutes from Tusayan to the park during peak season.

2. *What are the estimates of the initial capital costs for express rail track and equipment and how would they be funded?*

Analysis found that the capital costs stated in the GCR proposal underestimated the capital cost for each phase of their proposal and omitted some very important capital assets; in particular the need for additional shuttle buses to transport visitors within Grand Canyon Village. Four scenarios were analyzed using a variety of factors. The adjusted capital costs provided represent the 'most likely scenario' and are as follows:

Phase I (Williams to Maswik) used rail equipment	$176,000,000	
Phase I (Williams to Maswik) new rail equipment	$205,000,000	
Phase II (Tusayan to CVIP)	$169,000,000	
Total Capital Cost – used		$345,000,000
Total Capital Cost – new		$374,000,000

The GCR proposal assumes funding of all capital expenditures through federal, state and local government appropriations.

3. *What is the estimated ridership?*

Ridership projections are based on two primary factors. First is the assumed visitation and second is the capture rate for the voluntary portion of the proposed system from Williams to the Maswik Station. These estimates are critical in determining the user cost for the system.

Initial ridership (2006) is estimated at 3375 riders each way on a typical summer day.

This number reflects a 47% reduction compared to the GCR estimate for the following reasons:

- The GCR estimate did not account for the portion of visitors entering through the South Rim who were overnight visitors and therefore very unlikely to use the transit service.
- Initial visitation in private vehicles (candidates to use the train) used by GCR for 2003 was 29% higher than the published visitation value.
- The capture rate for the voluntary Phase 1 transit component was determined to be about 32% of day use visitors in private vehicles instead of the 50% assumed by GCR.

What are the expected annual operating revenues, expenses, and operating losses, if any?

Operating expenses are dependent to some degree on ridership projections. When assuming minimal growth for instance, expansion costs and the operating costs that accompany them are much smaller than if more robust increases in visitation are expected. In the analysis report attached, a "no growth" option indicates that Phase II of the GCR proposal will not be necessary. The operating expense presented below assumes modest growth (less than that projected by GCR) that includes implementation of Phase II.

Annual operating expense in 2026	$35,000,000

The GCR proposal assumes a profit equal to 15% of each year's projected operating and maintenance cost, therefore no operating losses are contemplated for them. This is included in the above figure. Operating revenues are based on the user fee needed to cover the cost of operations and maintenance. Please see question 4.

4. *How much would entrance fees have to be raised to fund express rail and how does this compare to the other options under consideration?*

The first year fees for Option 5a, financing scenario A were estimated to be approximately $6.20 in 2003 dollars. This assumed that 87 percent of visitors would pay a transit fee and 100 percent of visitors would ride the system; passes would not be accepted. The *Regional Rail* proposal estimated a first year fee of $5.00 per visitor based on the assumptions contained in the proposal, including a larger than expected visitation level and the ability to charge park visitors who are not using the Williams Rail system. In addition, the *Regional Rail* proposal did not account for the costs associated with the rim shuttle bus system. To more clearly illustrate the difference in costs between the Regional Rail proposal and the NPS assessment of the likely costs, the estimated transit fees were recalculated to include the operating costs of the Williams Rail, Tusayan Line, and the Rim Shuttle Buses, while applying visitation levels used for Options 1-5. The adjusted entrance fee per visitor would be about $11.00 for Regional Rail.

Option A would range between $ 0.80 and $3.60 per person, depending on the funding mix used, and with the assumption that park passes *would* be honored.

While the proposal suggests that visitor entrance fees to the Park would be allocated to the express rail operation, does the express rail proposal assume such entrance fees would fully cover express rail operating losses?

The GCR proposal suggests that visitor entrance fees to the park would cover all operating *expenses*, major overhauls and a 15% profit on those expenses. The intent is to increase the transit fee in $1.00 increments so that the fee increases are always slightly ahead of actual O&M cost increases, thereby creating a 'surplus set-aside'. The set –aside funds would be used for funding vehicle overhauls and to offset fluctuations in O&M increases. Therefore, there would be no operating losses. Note: Because no fee is charged to ride the Regional Rail trains, the entire amount of the operating expenses could be considered an "operating loss" that is covered by increased entrance fess charged to all visitors.

What level of return on investment is assumed to be funded through such a subsidy?

The GCR proposal assumes a profit equal to 15% of each year's projected operating and maintenance cost. The GCR proposal assumes a profit equal to 15% of each year's projected operating and maintenance cost. In its proposal, GCR invests little or no cash, though they should be recognized for the contribution of their assets as outlined in their proposal. GCR has assumed an annual profit equal to 15% of operating and maintenance expenses. In addition to the 15% operating return described above, the implementation of the Regional Rail proposal would result in the completion of federally funded improvements on assets owned or controlled by GCR. To the extent that ownership of these improvements is vested with GCR, they may realize increased investment returns. In addition, implementation of the GCR plan may enhance the value of other businesses owned or operated by GCR in Williams.

5. *To what extent will visitors be asked to fund each transportation option whether or not they actually use the service?*

The GCR proposal assumes all South Rim visitors will fund the operations and maintenance of the system regardless of whether or not they use it. Under Phase II of their proposal, use becomes mandatory for all visitors wishing to enter Grand Canyon Village. This payment scenario is consistent with Options 1-5.

Option A is a voluntary system. All South Rim visitors would likely be required to pay a transit fee, as part of their entrance fee. Depending on the funding scenario used, it may be possible to honor passes, meaning only those who pay the entrance fee would be contributing to the transit fee. However, visitors paying the fee would do so whether they used the transit system or not.

It seems reasonable to assess a fee to all visitors who have the *opportunity* to use the system (whether or not they actually use the system). It may be unacceptable to assess a fee for a transit system that some visitors would not have the opportunity to use – such as one that originates 59 miles from the primary park entrance.

What precedent exists within the National Park system for such an arrangement?

A precedent exists in Zion National Park where all visitors, whether or not they use the transit system, are assessed a fee as part of their entrance fee. However, the system is available (and easily accessed) to all visitors who enter at entrances where fees are collected. The same arrangement exists at Rocky Mountain National Park, where the entrance fee was raised by $5.00 to offset the costs of a voluntary shuttle that serves one of several visitor use areas. Other examples of cross subsidies exist in the National Park System. For example, the concession-operated transit systems in Yosemite, which are free to riders, are paid for through surcharges on concession goods and services.

6. *What financial risk would Grand Canyon Railway bear if the train is unsuccessful in attracting the estimated ridership?*

Because all South Rim visitors would be required to pay, regardless of whether or not they use the system, and because all of the capital costs of the system would be paid by the government, there would be no financial risk for Grand Canyon Railway. If ridership was below expectations, GCR could simply operate less service to maintain a balance between operating expenses and visitor fees.

7. *One of the requirements of P.L. 106-554 is that the Park Service consider a transit option for use only during peak visitation months. How does express rail compare with other transportation options if the transit system is used only seasonally?*

Only Option A of the NPS options considers seasonal operation during peak visitation months, and only for a portion of the system. Transit service from Long Jim Canyon to Canyon View Information Plaza would be run between Memorial Day and Labor Day initially, with expanded service into the shoulder seasons as visitation grows.

The GCR proposal recommends a seasonal operation for the Williams to Maswik portion of the system only, which consists of reduced service to 5 departures per day during winter months. As visitation grows to the point that Phase II could be implemented, the light rail system from Tusayan to CVIP would run year round, and the Williams to Maswik segment would continue a reduced service during winter months.

Which option would provide the most efficient transition to seasonal use of a transit system?

Option A consists of a very simple transit system, compared to Options 1-5 or GCR's proposal. Option A would provide the most efficient transition to seasonal use, due primarily to its capacity, proximity to the park and its low capital cost. Very little advance notice would be needed to inform visitors where to park and ride; notification could occur in Tusayan and elsewhere, using Intelligent Transportation Systems or other means

8. *Under the Grand Canyon Railway proposal, how would visitors be transported within the park? How does this compare with other options under review?*

As mentioned above under the discussion of capital costs, this appears to be something that is not addressed in the GCR proposal. All other options acknowledge the need for an expanded fleet of shuttle buses for transit within the village. Because the GCR proposal does not provide rail service from CVIP to Grand Canyon Village and because the station in the Village is far from the rim, the GCR proposal would require significantly more rim shuttles than other options in order to meet visitor travel needs.

All of the NPS Options would include an expanded system of shuttle buses serving destinations along the South Rim via *local* routes. The *line-haul transit* (common to Options 1-5) is intended to carry large numbers of day visitors into and out of the South Rim area and to transport visitors from Canyon View Information Plaza (CVIP) to Grand Canyon Village. The local routes would distribute day visitors and overnight visitors to scattered features along the canyon rim. Several shuttle bus routes would be operated, with transfers provided among the shuttle routes and the line-haul transit service at CVIP and in the village.

Option A uses a combination of an expanded system of shuttle buses combined with private vehicle access.

9. *Since the use of express rail would be voluntary under the proposal, how would any continuing vehicular congestion in the Park be addressed during peak periods?*

The GCR proposal calls for implementation of a second phase of development which will provide light rail transit from Tusayan to CVIP. Phase II would be implemented when the number of private vehicles entering the South Rim reached 80% of the current number. Phase II would be mandatory thus eliminating congestion.

Would parking access be restricted once lots are full and if so, how would those visitors be transported to and within the park?

The GCR proposal has no provisions for traffic management within the park for Phase I. Monitoring and control measures would need to be implemented, or rangers would need to direct traffic to alternate locations. In addition, communication devices, such as Intelligent Transportation Systems, would help to direct traffic to Williams, *before* parking lots reach their capacity.

With the implementation of Phase II, traffic would be restricted, and *if* the Williams to Maswik link can capture 50% of the visitors after Phase II has been completed, parking access for transit shouldn't be a problem.

Would visitors be diverted to Williams? To Tusayan? What location(s) would the Park Service recommend?

See above – traffic management strategies would need to be implemented. Once visitors were at or near the park, diverting them to Williams would be impractical, due to distance and time requirements. Diversion to Tusayan would be more practical, and would take less time to return to the park.

10. *The 1995 GMP envisioned a system in which individuals would continue to access the park by automobile until the parking capacity of the park was reached, with additional visitors transported to the park by transit systems. How do the different transportation options compare to the concept outlined in the GMP?*

The 1995 GMP envisioned day use vehicular access only to the Mather Point orientation center (CVIP); visitors staying in lodges or at the campground would be allowed to drive their cars into Grand Canyon Village but could only park their cars in locations away from the canyon rim. The GMP proposed a parking area at CVIP that would accommodate up to 1,225 cars. Once that lot reached capacity, day use visitors would be required to park at a proposed parking area north of Tusayan which would accommodate up to 2,600 vehicles by 2010.

Options 1-5 do not include parking at CVIP; all day use visitors would be required to park at a proposed parking area north of Tusayan. All day use visitors would be required to take transit to access Grand Canyon Village.

Option A has parking at CVIP and parking at a location north of Tusayan, however, the system would be voluntary and day use visitors could continue to access Grand Canyon Village.

Regional Rail does not include parking at CVIP. Under Phase I, visitors would be allowed to access Grand Canyon Village by automobile up to the point that South Rim visitation reaches 80% of current visitation. At that point Phase II would be implemented and all South Rim visitors would be required to take transit to access Grand Canyon Village (there is no distinction between day and overnight use visitor access).

11. *We also encourage you to seek the input and advice of the Arizona Department of Transportation regarding congestion issues relating to State Route 64 and the expected impact on traffic patterns depending upon a selected alternative.*

The Arizona Department of Transportation recently completed a report titled "Initial Feasibility Report – SR 64: I-40 to Moqui - Williams - Grand Canyon - Cameron Highway" which they have provided to the NPS. In this report, they discuss two scenarios for alternative transportation at Grand Canyon. The first assumes transit from Tusayan to the South Rim only while the second includes rail transit from Williams. Under the Tusayan-only scenario, vehicular traffic would continue to utilize SR 64 as they currently do. The comments under the Williams scenario include "The question of how many of the park visitors will utilize the rail system from Williams is speculative. Unless all visitors to the Grand Canyon are directed to use the Williams entry point, growth of traffic will continue…although at a slower pace than scenario one."

They conclude that under either scenario - "Ultimately, the corridor will require a four-lane facility to enhance safety and traffic operational characteristics…" and that "The timing for the development of the ultimate four-lane facility for SR 64 depends partly on decisions by the federal government on access to the park…"

Exhibit A

The following Vision Statements and Objectives are stated in the 1995 Grand Canyon National Park General Management Plan (GMP) and are related to transportation, access and visitor experience at the South Rim:

a. The South Rim should remain the focus for most park visitors, with diverse opportunities to view the canyon.
b. The South Rim should accommodate large numbers of visitors, but dense crowds and related conflicts and resource impacts should be minimized.
c. Historic resources should be appropriately used and their integrity maintained.
d. Alternative means of transportation – walking, biking, or using convenient public transit – should be encouraged.
e. Necessary services and facilities should be provided in existing disturbed areas wherever possible, or outside the park.
f. The park should work cooperatively with the community of Tusayan, Kaibab National Forest, and all other affected entities near the park to encourage compatible, aesthetic, and well-planned visitor information and services.
g. Any new development should be cost-effective, water-conserving, and energy-efficient.
h. Provide access that is appropriate and consistent with the character and nature of each landscape unit and the desired visitor experience.
i. Provide a safe, efficient, and environmentally sensitive transportation for visitors, employees, and residents, consistent with management zoning and resource considerations. Emphasize nonmotorized modes of transportation wherever feasible.

EVALUATION OF GRAND CANYON RAILWAY'S PROPOSED REGIONAL RAIL

GRAND CANYON NATIONAL PARK

Prepared for:

National Park Service

Prepared by:

David Evans and Associates, Inc.

DAVID EVANS AND ASSOCIATES INC.

October 2004

GRAND CANYON NATIONAL PARK
EVALUATION OF GRAND CANYON RAILWAY'S PROPOSED REGIONAL RAIL

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BACKGROUND AND PURPOSE

This report provides a summary of a technical and financial evaluation of a an unsolicited proposal submitted by the Grand Canyon Railway (GCR) to the National Park Service to provide rail transportation service to the South Rim area of Grand Canyon National Park. David Evans and Associates, Inc., PricewaterhouseCoopers LLP, and the Volpe National Transportation Systems Center conducted the evaluation for the National Park Service.

GCR presently provides train service once per day to Grand Canyon Village through a concession contract with the National Park Service. The rail line follows the historic Santa Fe railroad route from Williams, Arizona to the South Rim. Service is provided by restored historic railroad equipment, including steam engines.

The GCR proposal includes two phases of rail transit development. Phase 1 would expand passenger rail service from Williams and Phase 2 would provide light rail transit service from Tusayan, Arizona to the Canyon View Information Plaza near Mather Point on the South Rim. Phase 2 would be implemented when the number of private vehicles entering the South Rim reached 80% of the current number.

GCR proposes that a combination of federal and state funding sources be used to pay the capital costs of the proposed system and that visitor fees be collected to cover the operating and maintenance costs. GCR's proposal was presented as an alternative to Options 1-5.

GCR's proposal appears to be based on less detailed engineering and design than the level completed for Options 1-5. This report presents an assessment of the GCR proposal to the light rail alternative under consideration by NPS for Grand Canyon. The assessment is based, in part, on the costs of other passenger rail projects in the U.S. that employ the same technology proposed by GCR. The assessment also uses cost data developed during the planning and conceptual design of the NPS light rail alternatives. The evaluation did not include any additional data collection on conditions along the proposed GCR rail lines or additional design work.

Should NPS conclude from this analysis that the GCR proposal merits further consideration, more detailed mapping and engineering work would be required to bring the GCR proposal to the same level of detail and confidence in cash flow requirements as Options 1-5.

SUMMARY OF GRAND CANYON RAILWAY PROPOSAL

Visitation

GCR's proposal is predicated on the assumption that visitation to Grand Canyon National Park and to the South Rim area would grow at an average rate of 3.0% per year. South Rim visitation was assumed to total 3.78 million visitors in 2005, growing to 7.03 million visitors per year in 2026.[1]

GCR's estimates of current visitation do not match figures published by NPS for the South Rim. For example, GCR estimates that 3.5 million visitors entered the South Rim in private vehicles in 2003. The actual total published by NPS (see above) was 21% less than GCR's estimate.

Phase 1 – Williams Train

The proposed train service between Williams and Grand Canyon Village originates at GCR's existing Williams station. Trains would follow a 62-mile route mostly along the existing GCR tracks from Williams to the Grand Canyon. About 1 mile west of the Tusayan Airport runway a new section of track would be built to the west of the existing line to avoid a circuitous section of track that runs though Coconino Canyon. After about 4 ½ miles of travel on the new alignment, the line would re-join the existing train route along Bright Angel Wash and continue to Grand Canyon Village. Trains would stop at the existing Maswik Transportation Center, on tracks that are currently used to reverse trains and to bring the steam locomotives to a water source. Return trips to Williams would follow the same route.

To accommodate higher-speed service and more frequent trains, the existing line would be upgraded with new track and the addition of several passing sidings. A signal system would be provided to allow multiple trains to operate on the line at the same time and the existing road crossings would be upgraded to provide gates and signals. The existing station in Williams would be upgraded and an expanded parking lot would be provided. An allowance also is provided in the GCR cost estimate for upgrades at the Maswik Transportation Center. A new maintenance shop and storage yard would be built in Williams to accommodate the expanded fleet.

Service initially would be provided every hour in each direction during the spring, summer and fall seasons. As ridership increases over time, service could be expanded to every 30 minutes during peak seasons. The expected travel time for the one way trip from Williams to Grand Canyon Village is approximately 1 hour, 20 minutes. Service would begin at 6:00 am and the last train would leave Grand Canyon for Williams at 10:30 p.m. During the winter, GCR proposes to operate only five trains per day in each direction, with the first train leaving Williams at 7:00 am and the last train leaving Grand Canyon Village at 8:30 pm.

The Williams train would use traditional commuter rail equipment – large diesel-electric locomotives pulling passenger cars. Two options for equipment are described in the GCR proposal. A low-cost option using refurbished commuter rail coaches and locomotives is presented, along with an option to provide all new rolling stock. The plan calls for an initial fleet of 10 locomotives and 22 dual-level passenger cars, some of which would include cab controls to allow "push-pull" operation. This means that the locomotives would not need to be switched from one end of the train to the other to change the direction of travel. Additional equipment would be purchased to serve visitation growth, resulting in a 2026 fleet size of 15 locomotives and 36 passenger cars.

[1] Actual visitation to the South Rim in 2003 was 3.55 million, including 2.76 million in private vehicles, 597,000 in buses and 191,000 on the train from Williams. Of the 3.55 million visitors to the South Rim in 2003, 2.94 million (83%) entered through the South Entrance.

The GCR proposal states that the train service from Williams would be designed and operated to serve 50% of the visitors presently arriving at the South Entrance in private vehicles. Visitors arriving in tour buses and those taking the existing historic train service were assumed to continue to travel on these services. Visitors entering the park via the East Entrance at Desert View were assumed to continue to arrive via the current mix of private vehicles and tour buses. For the period 2005 to 2008, the GCR proposal assumes that total visitor demand to and from the South Rim area on summer days will be 31,625 people per day (about 15,800 each way), with 80% entering via the South Entrance. Daily ridership on the Williams train would be 12,654 passengers (6,327 each way), or one half of the total entering via the South Entrance. [2]

Use of the train would not be mandatory for either day visitors or overnight visitors. The 50% share of visitors using the train was based on surveys of visitor's willingness to use alternative modes of travel to reach the South Rim. The surveys included a 2001 survey of 410 people by the Social Research Laboratory, University of Northern Arizona, and a 1991 survey by NPS. Visitors choosing not to ride the train could continue to drive into the park until visitation in private vehicles reached a defined level, at which time Phase 2 of the GCR proposal would be initiated.

The initial investment for the Williams train is estimated by GCR to be $114,878,876 with used rolling stock and $170,665,376 with new rolling stock. GCR's estimated total capital cost, including vehicle purchases for expansion and other investments through 2026, is $126,515,000 assuming used railroad rolling stock. With new equipment the total cost is estimated by GCR to be $214,180,000. Annual operating and maintenance costs would be $11.56 million per year initially, and would increase to $17.64 million in 2026 according to GCR. All costs are presented in year 2003 dollars. The proposal also provides estimates of the cost for major equipment overhauls. [3]

Phase 2 – Tusayan Light Rail Transit

The proposed light rail transit service from Tusayan to Mather Point follows the same route as the light rail transit option proposed by NPS in 1997 without the link to Grand Canyon Village. Light rail service would be provided over 6.2 miles of single and double track alignment between Tusayan and Canyon View Information Plaza (CVIP).[4] The GCR proposal also includes 2.65 miles of single-track line that would connect the Tusayan light rail line to the existing Williams to Grand Canyon Village line. The purpose of this connection would be to allow light rail vehicles to be taken back to Williams (a 120-mile round-trip) for maintenance. The resulting total line length for the Tusayan light rail line is 8.85 miles, or about the same as that for the NPS light rail option.

The main light rail line from Tusayan to CVIP includes two single-track sections, each about 1.6 miles long. [5] Stations are proposed by GCR at Tusayan and at CVIP (the same sites as proposed for the NPS transit options). The Tusayan station would include a large parking area to accommodate all of the day visitors who are not riding the train from Williams. The CVIP station would include train platforms similar to those proposed in the NPS light rail option. The GCR proposal for the Tusayan train includes

[2] For the other options presented in the Report to Congress, it was estimated that 13,521 visitors would enter the park through the South Entrance in private vehicles during the summer in 2006. Of these, about 10,500 were estimated to be day visitors. Although GCR assumes that 50% of all visitors would use the train, day visitors would be the most likely candidates to ride the Williams train.
[3] No difference in these costs is recognized for new versus used rolling stock, although more frequent overhauls would likely be needed with used equipment.
[4] This compares to a route length of about 8.9 miles for the NPS light rail proposal.
[5] The NPS light rail option provides double-track over the entire line.

an expansion of the Williams yard and shop facility to accommodate storage and maintenance of the light rail vehicles.

GCR proposes to operate the light rail service every 15 minutes during peak times and every 30 minutes in the early morning and late evening. Service would begin at 5:00 am and the last train would leave CVIP at 11:15 pm in the summer. Similar schedules are proposed throughout the year. This service level does not meet the NPS adopted standard of service no less frequent than every 10 minutes during peak visitation periods. This standard was selected to provide visitors with reasonably convenient transportation service that would avoid long waits. To the extent that service frequencies are altered, additional operating costs may be incurred.

GCR proposes to use diesel light rail vehicles (LRVs), the same technology as proposed for the NPS light rail option. The technology is evolving rapidly, and GCR's proposal is not clear regarding what specific vehicle is proposed. The proposal shows photos of two potential LRVs that were not available when the draft Report to Congress was prepared. The first photo of sample vehicles on page 11 is of an articulated Siemens Desiro car. This 2-unit (two units are permanently attached to one another) Desiro VT-642 to be used in the San Diego Sprinter line is 137 feet long and has 123 seats. It is estimated to carry about 205 passengers using the loading standards adopted by NPS for the Grand Canyon.

The second photo in Exhibit 2-3 is of a 175-foot long double-articulated (three units permanently attached to one another) Stadler GTW 2/8 vehicle that carries an estimated total of about 270 total passengers (seated plus standing), assuming the NPS adopted loading standard. The train length and the train capacity of the Stadler are essentially the same as described in the operating plans presented in the GCR proposal and so it is assumed that the Stadler is the vehicle that GCR used for service planning purposes. This vehicle is presently only available with electric power – a diesel option is not manufactured. The electrical catenary pickups appear to have been edited out of the photo presented by GCR.

GCR proposes that the Tusayan light rail service, when implemented, would be mandatory for all visitors not riding the Williams train. GCR claims that their proposal would eliminate all private vehicles from the South Rim area. This is inconsistent with existing plans that call for overnight visitors arriving in private vehicles to drive to and park near their accommodations. Any alteration to the plans that allow overnight visitors to park near their accommodations may have adverse effects on existing concession contracts for the operation of lodging and other visitor services on the South Rim. GCR assumes that the Williams train would continue to attract 50% of the visitors arriving via private vehicle after implementation of the Tusayan light rail line.[6]

The initial investment for the Tusayan light rail line in the GCR proposal would be $71.2 million in 2012, with service starting in 2013. The initial operating and maintenance cost for the system is estimated to be $3.5 million per year. The total capital investment over 14 years, including expanded parking to meet the forecast visitation growth, would be $77.3 million. Operating expenses would increase to $4.6 million per year in 2026 for the light rail line. All costs are presented in 2003 dollars.

Implementation

GCR proposes the creation of a "regional transportation board" to oversee design, construction, operations and finances for the proposed Regional Rail system. The "board" would be composed of the National Park Service, Arizona Department of Transportation, Federal Highway Administration (FHWA), Federal Transit Administration (FTA), Federal Railroad Administration (FRA), Grand Canyon Trust,

[6] No analysis is provided to support this assumption. If that assumption were to hold true, then the daily ridership on the Tusayan light rail line would grow to 20,905 (about 10,450 each way) in 2026.

Grand Canyon Railway and a "non-vested technical representative." The GCR proposal implies that ownership of the rail system would remain with GCR, thereby providing a potentially significant capital return to GCR in the event that its interest in the system is ever sold.

The GCR proposal assumes that the initial capital costs and the capital costs associated with system expansion (additional parking spaces and rail vehicles) would be paid with a combination of state and federal funds. The proposal assumes that 80% of the funding would come from federal sources and 20% from state sources. A menu of capital funding sources is provided in the GCR proposal. The project costs would represent a very high share of the funds available to the state of Arizona from any of these sources. The eligibility of the project to receive funds from the listed sources has not been confirmed.

The operating costs of the transit systems included in the GCR proposal are proposed to be covered by a mandatory fee charged to all visitors to the South Rim, regardless of their use of the proposed system. Under such an assumption, there is a potential visitor backlash that would be caused by levying a fee for which visitors do not consume a service. Such a backlash could have adverse effects on overall visitation, thereby necessitating the need for increased fees in the future, driving the system in a downward financial and economic spiral. Based on annual South Rim visitation of 3.78 million in 2005, GCR estimates the required transit fee to be $5.00 per person. The fee would increase to $8.00 per person in 2020. This fee is expressed in constant 2003 dollars. Inflation would push the fee higher. The fee also would be sensitive to park visitation. Lower visitation than assumed by GCR would result in higher fees. GCR's forecast South Rim visitation in 2005 is 29% higher than actual 2003 visitation, and recent visitation trends have shown flat to declining park visitation.

The GCR proposal presents a schedule for development calling for environmental compliance and funding negotiations to be complete approximately the third quarter of calendar year 2004. A period of six months was allocated for each of these key activities. The schedule does not identify when design would occur. Track construction for Phase 1 would occur over 6 months in late 2004 and early 2005. About 9 months is allocated for station construction and the proposed rolling stock would be ready for operation in early 2006. Time for testing and acceptance of the vehicles is not identified. GCR proposes construction on the Williams line during the winter only, avoiding disruption to its historic train operation during the summer.

Phase 2 construction is scheduled for 12 months from mid 2012 to mid 2013. Operation would begin in mid 2013, with vehicles being assembled over 18 months starting in 2012. No provisions for vehicle and systems testing and acceptance are shown in the schedule.

SCENARIOS FOR EVALUATION OF THE GCR PROPOSAL

Major factors that could influence the feasibility and effectiveness of any transportation solution for Grand Canyon National Park include future visitation and, in the case of voluntary transit options, the share of visitors who would ride the system. The transit options developed by NPS were evaluated assuming a "most likely" growth scenario and a no-growth scenario, in which future visitation was assumed to be equal to the average of visitation from 1992 through 2001. Because the NPS options all assumed that the transit system would be mandatory for day visitors, it was not necessary to consider differing shares of riders that might be attracted to the options.

GCR assumed a rate of growth in visitation that is far greater than the most likely growth scenario used to evaluate the NPS transit options. To provide a level playing field for comparing the GCR proposal to the other transit options, the following three visitation scenarios were analyzed. These scenarios are:

- GCR Growth – approximately 3% per year (compounded)
- Most Likely Growth – approximately 1.7% per year (compounded from 2001)
- No Growth – visitation equal to the average of 1992 - 2001

The second and third scenarios are identical to those analyzed for the NPS transit options.

GCR assumed that 50% of all visitors arriving at the South Entrance in private vehicles would choose to ride the train from Williams. Although this assumption was based on responses to surveys of visitors, in other settings such surveys have typically over-stated the potential ridership of voluntary transit systems. The Volpe National Transportation Systems Center (Volpe) conducted a study to assess the likely range for the share of visitors who would choose to ride the Williams Train, with the following major assumptions:

- Use of the service would be voluntary
- The fee to ride the train would be the same as the entrance fee for visitors in private vehicles
- Service would be provided as specified in the GCR proposal
- The competing mode of travel would be private vehicle (the competition from a possible light rail line from Tusayan was not considered)
- The current shares of visitors who stay overnight, who enter via the East and South Entrances, and who make through trips (entering at one Entrance and exiting through the other) would continue

The Volpe study did not explicitly analyze the share of trips that would be made via the Williams train versus the Tusayan light rail in Phase 2 of the GCR proposal.

The Volpe Study concluded that the likely share of South Rim visitors who would choose to ride the Williams Train was 25%, rather than 50% of the visitors entering via the South Entrance. The study further concluded that most of the riders would be day visitors. Assuming that very few overnight visitors would ride the train, about 32% of day visitors entering through the South Entrance in private vehicles would be likely riders of the train.

Two scenarios for ridership "capture" were analyzed. One scenario assumed the same share as GCR – 50% of South Entrance visitors in private vehicles. The second scenario assumed that 32% of day visitors and no overnight visitors (equal to 25% of all visitors) entering through the South Entrance in private vehicles would choose to ride the train.

To limit the scenarios to a manageable number, the following combined scenarios were analyzed:

- **GCR Assumptions** – this scenario applied the same visitation growth rate and share of visitors using the Williams train as assumed in the GCR proposal.
- **Most Likely** – this scenario assumed a slower rate of visitation growth, consistent with the analysis of the NPS transit options and that 32% of day visitors entering via the South Entrance in private vehicles would choose to ride the train from Williams.
- **No-Growth** – this scenario assumed that visitation would not grow above average levels from 1992 – 2001, and that 32% of day visitors entering via the South Entrance in private vehicles would choose to ride the train from Williams.

Under each scenario, it was assumed that 87 percent of visitors would pay a transit fee. The figure of 87 percent was used to account for visitors who are re-entering the park within a seven day period and for children under the age of five. These scenarios provide a range of potential future conditions to test the sensitivity of the GCR proposal to important factors that could affect the feasibility of the proposal.

Transit service from Tusayan to the South Rim area in the GCR Assumptions and Most Likely scenarios was assumed to conform to the standards for visitor comfort (3.5 square feet per person in standing areas) and convenience (service every 10 minutes of more frequently during primary visitation hours). Transit service on the Williams train was as proposed by GCR – with all passengers seated and service every hour, except in the winter. The No-Growth scenario includes only the train service from Williams.

EVALUATION OF GCR PROPOSAL

This evaluation of the GCR proposal provides an assessment of the following aspects of the proposal:

- Visitation characteristics and growth
- Characteristics of the facilities, vehicles and services proposed by GCR
- Costs for design, construction and procurement of vehicles
- Operating and maintenance costs
- Cash flow, funding and financing
- Implementation requirements
- Visitor experience, equity and other impacts

This evaluation presents a conceptual review of these issues, using information contained in the GCR proposal and readily available data regarding comparable transportation systems. The cost estimates for the GCR proposal have a lower level of confidence than the estimates for Options 1-5. It has not been possible to verify the feasibility of the proposed improvements through field visits or conceptual engineering based on accurate surveys of conditions along the route. The analysis supports a general assessment of the financial feasibility of the proposal. We recommend that additional conceptual engineering work be completed prior to a final decision on proceeding with the GCR proposal.

Visitation Characteristics and Growth

The GCR proposal cites two forecasts of 2010 (total park) visitation to Grand Canyon National Park – 6.0 million (Northern Arizona University, Center for Data Insight) and 6.87 million (Arizona Republic). The proposal also presents an estimate of 3.5 million visitors per year entering the South Rim in private vehicles in 2003. Actual visitation data reported by the National Park Service shows that total park visitation was 4,440,000 in 2002 and 4,464,000 in 2003. To reach 6,000,000 visitors in 2010, visitation would have to grow at a compound rate of 4.3 % per year – far above recent trends. The actual reported number of visitors entering the South Rim area in private vehicles was 2,763,000 in 2003 or 21% less than the 3.5 million reported in the GCR proposal. The *total* visitation, including people arriving via tour bus and train through both entrances serving the South Rim was 3.55 million in 2003, so that may be the source of the GCR estimate.

GCR forecasts total South Rim visitation to be 7.03 million in 2026. The Most Likely growth scenario estimates 2026 South Rim visitation at 5.40 million, with about 3.9 million arriving in private vehicles. Obviously the differences in visitation between the GCR and NPS forecasts of future visitation would lead to vastly different needs for transportation improvements and major differences in revenue that could be generated from user fees.

Visitation to the park is a critical determinant of the feasibility of any proposed transportation system that would be funded through user fees. In addition, the timing of the implementation of Phase 2 of the GCR proposal is affected by the visitation forecasts. To establish the timing for Phase 2 in each of the scenarios, this analysis assumed that Phase 2 should be operational when the projected number of visitors entering the South Rim area in private vehicles reaches 80% of the 2003 total of 2,763,000. The threshold for visitors in private vehicles for each scenario is 2,262,000 per year. Phase 2 would need to be operational in 2015 assuming GCR's visitation growth rate and share of riders on the Williams train. This is two years later than the Phase 2 start in the GCR proposal (2013). For the Most Likely scenario, Phase 2 would need to be implemented at the same time as the Williams train, for this analysis, assumed to be in 2006. For the No-Growth scenario, Phase 2 would not be implemented, even though visitation would be slightly above the defined threshold.

GCR's assumed visitation growth rate results in the need for higher overall transportation system capacity, especially on the Williams train, which GCR assumes would capture 50% of all visitors in private vehicles. Higher operating costs and a large fleet of rail vehicles are required in the GCR Proposal scenario. Because the GCR proposal assumes that all capital costs would be funded by federal, state and local grants, early stage per-visitor fees required to fund the system do not change substantially with differing forecasts of visitation. However, per-visitor fees do increase by 50 percent to 75 percent in later years in order to cover increased replacement costs. The per-visitor capital cost of the system is much higher if lower visitation is assumed, but this higher cost would not be funded from visitor fees under the GCR proposal. The per-visitor fees required to support the system would be much higher for the Most Likely and No-Growth scenarios if capital-funding options similar to those considered for the NPS transit alternatives were considered.

Facilities, Vehicles and Service

Williams Train

The proposed Williams Train would primarily follow the existing tracks from Williams to Grand Canyon Village, incorporating passing tracks to allow increased service on the line. The proposal does not provide sufficient design information to evaluate the feasibility or cost of constructing sidings in the proposed locations. We have assumed that the locations of these passing tracks are feasible and that no unusual conditions would result in higher than normal costs for these tracks. Near the Grand Canyon, GCR proposes to build a by-pass of the portion of the line that travels through Coconino Canyon. The terrain in this area is similar to the terrain covered in the first two miles of the light rail line from Tusayan to CVIP. The topography is severe, making it likely that a significant amount of cut and fill would be required to establish a new railroad grade. It can be assumed that geological conditions in this area also are similar to those on the nearby light rail route, with thin soils and a thick layer of limestone subsurface. It is likely that significant rock excavation would be required to establish the new line, at much higher cost than typical rail construction.

The original rail line probably was constructed along the circuitous route in Coconino Canyon because of physical barriers along the more direct route now being proposed by GCR. As a result, we can expect the preparation of the railbed for this new route to be at least as expensive (and possibly much more expensive) as that for the light rail line from Tusayan to CVIP. The construction cost estimate for the NPS light rail line increased substantially from the initial planning stages, which assumed typical rail construction costs, to conceptual design, which accounted for the special conditions (thin soils, some severe topography and the need for extensive rock excavation) near the canyon rim. Additional engineering work is needed to confirm the feasibility and the likely cost of the proposed alignment, but it can be assumed that the costs will be substantially higher than those estimated by GCR.

The GCR proposal assumes that the Williams Train would use the existing station at Williams (with substantial upgrades) and the Maswik Transportation Center, which was the original location assumed for Grand Canyon Village station on the light rail line. This location was originally developed for use as a train station and the tracks serving the station are currently used as a turnaround by the historic Williams train. The proposed station at Williams makes sense as the starting point for expanded service to the canyon. The station at the Grand Canyon Village end of the line should be evaluated in more detail.

A Choosing by Advantages (CBA) process was used to evaluate the Maswik station for the NPS light rail proposal against options that would bring the station closer to the rim. The CBA generated a recommendation to relocate the light rail station near the historic powerhouse next to the GCR tracks leading to the historic train station. The location of the Maswik Transportation Center at more than 4/10th

mile from the canyon rim was the primary reason for this recommendation. Most visitors would be unwilling or unable to walk from the station to the rim, resulting in the need for expanded shuttle bus service. (Urban area transit planning standards assume a maximum walking distance of 1/3-mile to/from rail stations.) Based on that evaluation, the Maswik station is currently under complete rehabilitation, and new functions will be moved into the buildings. These functions would need to be relocated, and substantial rehabilitation would need to occur should the Maswik facility be used as a station for the proposed new train service.

It appears that the Williams train could use a set of platforms near the existing historic train station or in a location closer to the powerhouse. This option for a station would likely increase the cost of the Williams train a minor amount compared to the Maswik station. The tracks in the proposed station area would need to be rehabilitated or replaced, and platforms would need to be built, along with pedestrian connections to the rim. For this evaluation, the proposed location at Maswik was assumed, along with an expanded rim shuttle bus system. The costs of relocating the functions now planned at Maswik, and additional building rehabilitation have not been estimated or accounted for.

The GCR proposal initially would provide train service on the Williams line every 60 minutes during the spring, summer and autumn seasons. With growth in visitation and ridership, the proposal includes service every 30 minutes in the summer from 2009 onward. Train service would begin from Williams at 6:00 am and the last train would leave Grand Canyon Village at 11:00 pm. The proposed winter schedule offers only five round trips per day. The estimated one-way travel time for the train is 75 to 80 minutes.

The typical travel time by private vehicle from Williams to Grand Canyon is about 60 to 75 minutes for the 59-mile trip. The average wait of 30 minutes for visitors using the proposed train (1/2 of the initial 60-minute time between trains), results in an expected total travel time by train of 120 minutes, which is much longer than that for private vehicle. With a 30-minute headway, the competitive position of the train is better (90 minutes by train, up to 75 minutes by private vehicle) but still significantly longer than by private vehicle. The winter schedule would offer service that is not competitive with private vehicle travel and it might be advisable to suspend the service during the winter.

The feasibility of operating the train service at a 30-minute headway is directly related to the share of riders attracted and the assumed growth in visitation. Under the Most Likely and No-Growth Scenarios, train service using locomotives and passenger coaches could only be operated cost-effectively at a 60-minute headway, limiting the attractiveness of the service to potential riders.

The vehicles proposed for the Williams train represent standard commuter rail technology that would be appropriate for the proposed service. The GCR proposal narrative describes the use of cab control cars, which would allow "push-pull" operation and eliminate the need to switch the locomotives from one end of the trains to the other to change directions. This also represents standard and appropriate technology. However, the cost estimates for the Williams rail fleet do not account for the higher costs of passenger coaches with cab controls. There should be about as many of these coaches as locomotives in the fleet.

The number of vehicles required for the Williams train is a function of the planned service and the ridership. The fleet proposed by GCR appears adequate to meet the demand forecast in the GCR proposal. Estimates of vehicle fleet requirements have been prepared for the Most Likely and No-Growth scenarios using GCR's operating and vehicle capacity parameters and adjusting for lower passenger demand. Compared to an initial fleet of 10 locomotives and 22 railcars for the GCR Proposal scenario, the Most Likely scenario requires 4 locomotives and 14 cars and the No Growth scenario requires 4 locomotives and 11 cars. The 2026 fleet requirement for the GCR proposal is 15 locomotives and 36 railcars. The initial fleets will meet the needs throughout the planning period for the other scenarios.

The GCR proposal provides two options for the vehicle fleet – used equipment and new equipment. The proposal acknowledges that the market for used equipment is tight and that the proposed vehicles may not be available if action is not taken immediately to secure these vehicles. However, the proposal assumes that similar used equipment would be available at similar prices to support expansion needs in the future. There is no assurance that such vehicles would be available.

The proposal also assumes that operating and maintenance costs and the costs for rehabilitation of the fleet would be the same for new or used railroad equipment. It is likely that maintenance costs would be higher and that rehabilitation would be required sooner and more frequently with used equipment, increasing the costs for these activities. It is also possible that the lower reliability of used equipment could result in the need to purchase more vehicles than would be needed with a new fleet. Although these factors would tend to increase the costs for the Williams train if used equipment were purchased, the operating cost assessment and the cash flow analysis presented by GCR have not been adjusted to account for these increased costs.

The proposed maintenance facility for the Williams train at the current maintenance yard for the historic train in Williams appears reasonable. It may be desirable to provide storage tracks at the Grand Canyon end of the line to allow a morning train to be stored overnight. There appears to be room for this function within the old rail yard adjacent to the historic train station.

Tusayan Light Rail

The GCR proposal would locate a light rail line along a portion of the route proposed in the NPS light rail option presented as Option 5. The line would travel from a station just outside the park boundary near Tusayan along a route paralleling US Highway 64/South Entrance Road to the Canyon View Information Plaza (CVIP) near Mather Point. Trains would operate back and forth along this route, serving stations at either end of the line. A combination of single and double track facilities are assumed. Two single-track sections slightly longer than 1.5 miles are located between double-track sections at the stations on either end and another double-track section along the central 2.6 miles of the line. The single-track sections would reduce costs for track installation, but the operation of the light rail line would be restricted and service delays could be expected. Furthermore, much of the work, including establishing the rail grade and railbed in challenging terrain would not be substantially easier with single-track design. Double-track treatment along the entire line would be required to deliver the service every 10 minutes during peak visitation periods, as called for in the standards for light rail service established by the NPS.

Because the proposed line follows the light rail line included in the NPS alternatives, this evaluation uses the cost estimates prepared during conceptual engineering as a starting point for review of the GCR proposal costs. That work included much more detail than the GCR proposal and can be considered much more reliable.

In addition to the 6.2 miles of track that would serve passengers, the GCR proposal includes a single-track connection from the Tusayan area to the existing rail line to Williams. This 2.8-mile connection is intended to allow light rail trains to be shuttled to Williams for overnight storage and maintenance. The proposed light rail line covers about 8.9 route miles, about the same length as the NPS light rail option.

The GCR proposal includes the same stations at Tusayan and CVIP as the NPS light rail option. The GCR proposal provides somewhat fewer parking spaces at Tusayan, reflecting the assumption that many visitors would be riding the train from Williams. The proposal does not specifically account for parking for commercial tour buses, which were assumed to stop at Tusayan in the NPS light rail option. The cost estimates for the station at Tusayan station appear to have omitted the substantial road and drainage

improvements that would be needed to provide access from the adjacent highway and accommodate the runoff from the large paved areas for parking.

The GCR proposal assumes that light rail service would be provided every 15 minutes during peak travel periods (typically 8:00 am to 9:00 pm) and every 30 minutes in the early morning and late evening. Service would start at 5:00 am and end at 11:25 pm. The NPS adopted standards for light rail service to the South Rim call for service every 10 minutes or less during peak periods. The GCR proposal would need to be modified to meet the adopted standards.

Two car trains, with each car accommodating 270 passengers (seated and standing) were assumed by GCR. The 3-unit Stadler 2/8 cars that could achieve the proposed capacity are about twice as long as the cars assumed for the NPS light rail option. The resulting train length would be about 350 feet, or 80 feet longer than the 3-vehicle trains proposed in the NPS light rail option. The CVIP station, as currently designed, cannot accommodate a train of that length. In addition, such large cars would provide more capacity than needed during off-peak hours and seasons. Furthermore, the vehicles that appear to have been assumed for the Tusayan service are available only in an electrically powered model. Since the vehicle proposed by GCR are not available as assumed, the operating plan presented in the proposal can not be delivered.

Large cars such as those proposed by GCR would have the advantage of reducing the overall fleet requirement and, possibly, operating costs. Whatever the advantages and disadvantages of any specific rail car, they would apply equally to the NPS light rail options and the light rail system proposed as part of the GCR transit system. Given recent developments in the range of available options for diesel multiple unit rail vehicles, future development plans will need to re-evaluate vehicle fleet and operating assumptions within the framework of the adopted NPS service standards. For the purposes of equal comparison between the NPS rail options and the GCR proposal, vehicles similar to those proposed for the NPS light rail option were assumed in estimating fleet costs and operating costs for this evaluation.

The GCR proposal assumes a fleet of five 270-passenger vehicles. The vehicle fleet was modified in the evaluation to assume vehicles with a capacity of about 140 passengers, consistent with the vehicles assumed for the NPS light rail option. With these smaller vehicles, a fleet of 11 light rail cars would be required to meet 2026 demand for the GCR scenario. The Most Likely scenario also would require a fleet of 11 vehicles for 2026 conditions. The No-Growth scenario would not include the light rail line. These fleet sizes were assumed in the cost comparisons for the GCR proposal.

The GCR proposal assumes that light rail vehicle maintenance would be performed at Williams. Performing maintenance in Williams would require the light rail vehicles to make a 120-mile round trip between the active rail line and the maintenance facility. This would be inefficient, costly and impractical. Any potential savings in facility construction costs obtained by sharing the facility with the railroad operation would be more than offset by higher operating costs to move the vehicles an extra 120 miles per day. With an operating schedule from 5:00 am to 11:00 pm, only six hours are available for routine vehicle maintenance. The round trip to and from Williams would consume nearly half of this time.

Normal rail transit operating practice is to have the maintenance facility adjacent to the rail line it supports. Even if vehicle maintenance could be conducted at a remote location, a facility would be needed near the light rail line to support maintenance of the track, stations, signaling systems and right-of-way in the South Rim area. For the cost assessment of the GCR proposal it was assumed that maintenance would be performed at a facility similar to that proposed for the NPS light rail option on park land south of Center Road.

Rim Shuttle Bus System

The rim shuttle bus system within Grand Canyon National Park would play an expanded role in providing for visitor circulation with the implementation of rail (or other forms) of transit as the primary means of access for day visitors. The NPS transit alternatives assume that the line haul transit service (the service bringing visitors from outside the park into the South Rim area) would serve both CVIP and Grand Canyon Village. All day visitors would have access to these popular destinations without the need to use shuttle buses. Despite this, planning for a new transportation system to serve the South Rim area has assumed that the existing rim shuttle bus system would need to be expanded since all visitors would be expected to use transit, rather than their own vehicles, to travel within the park. The costs for that expansion have been included in the analysis of transit options by NPS.

The GCR proposal ignores the need for expanded rim shuttle buses. This is a significant oversight due to the nature of the line haul services proposed by GCR. The GCR system would create a much greater need for rim shuttle buses than the NPS transit options because all of the transit users would have access to only one of the primary visitor use areas. Visitors arriving in Grand Canyon Village via train from Williams would need to ride buses to reach CVIP, which is intended to be the primary source for introductory information to support visit planning. Visitors arriving on the light rail line from Tusayan would begin their visit at CVIP, as intended in the GMP. However, these visitors would need to ride shuttle buses to reach any other location along the South Rim. We estimate that 21 additional rim shuttle buses beyond that estimated for the NPS transit options would be needed for the GCR Scenario and 16 additional rim shuttle buses would be needed in the Most Likely Scenario. The No-Growth Scenario, which would include only the Williams Train, could be accommodated with the same shuttle bus fleet provided in the NPS light rail alternative.

Capital Costs

The capital costs for developing a major project include the initial costs to design and construct the system and procure the vehicles and other equipment needed for the initial operation. As visitation and ridership increase over time, capital costs may be incurred for system expansion. Over the life of the project some of the vehicles (especially buses) will need to have major overhauls and, eventually, be replaced. These types of expenses are normally considered capital costs as well.

For the purpose of comparing alternative ways to accomplish a given objective (such as transporting visitors to the South Rim area) "total capital cost" is sometimes used as an indicator of the relative cost of each alternative. This measure is usually the estimated cost for design and construction of all facilities and the procurement of all the vehicles and other equipment that would meet the forecast demand at the end of the project. This measure is the initial cost, plus the expansion cost. This measure does not consider replacement or rehabilitation costs.

For funding and financial analysis, it is important to estimate when the various costs are likely to occur, along with their magnitudes. For Options 1-5, a detailed cash flow estimate showing the costs in each year of the project was prepared for each alternative. This cash flow analysis included initial costs, expansion costs and rehabilitation and replacement costs. GCR prepared a similar cash flow forecast for its proposed system, including a provision for an annual set aside to be used for meeting vehicle overhaul needs. Options 1-5 also have analysis for various capital financing scenarios and the effects of capital allocation decisions upon the overall transit cost borne by the visitor. The GCR proposal assumed that 100 percent of the capital costs would be funded by government sources. This is a key assumption on the part of GCR that, if not realized, would dramatically increase the per-visitor fee required to finance and operate the system.

GCR's cost estimates were reviewed to assess their completeness and reasonableness. The review determined if all of the relevant project costs were included and it also assessed whether the unit prices and quantities were reasonable considering the information available from design work for Options 1-5 and experience in other locations with similar projects. This review focussed on the "total capital cost" of the GCR proposal and it recognized that costs would be different for the three scenarios under evaluation. The tables on the following pages summarize the results of the evaluation of GCR's capital cost estimate. These tables provide our opinion regarding the probable cost of the GCR proposal for the three scenarios, along with the cost of the NPS light rail option, assuming no growth in visitation. **Table 1** shows the initial capital costs associated with building the rail lines and facilities and procuring the initial vehicle fleets. The capital costs for the GCR with Adjusted Costs and the GCR Rail Base Growth scenarios include $11.8 million for a light rail maintenance facility in the park, as assumed in the NPS alternatives.

Table 1: Initial Capital Costs for GCR Scenarios and NPS Light Rail
Initial Investment Values (2003 Dollars)

Project Element	GCR Proposal	GCR with Adjusted Costs	GCR Rail, No Growth/Volpe Capture	GCR Rail, Base Growth/ Volpe Capture	Option 5A - (No Growth)
With Assumption of Used Rail Equipment for Williams Train					
Design & Construction					
- Williams Rail	$98,510,376	$148,947,459	$148,947,459	$148,947,459	-
- Tusayan Rail	-	-	-	-	$153,531,351
Rail Vehicles					
- Williams Rail (Used Equipment)	$14,668,500	$14,668,500	$6,756,750	$7,969,500	-
- Tusayan Rail	-	-	-	-	$36,960,000
Rim Shuttle Buses	-	$18,827,600	$11,363,000	$17,606,600	$11,363,000
GCR Operating Losses	$1,700,000	$1,700,000	$1,700,000	$1,700,000	-
Total Phase One	$114,878,876	$165,315,959	$157,404,209	$158,616,959	-
Total Phase Two (including buses)	$0	$18,827,600	$11,363,000	$17,606,600	$201,854,351
Total Project w/ Used Equipment	**$114,878,876**	**$184,143,559**	**$168,767,209**	**$176,223,559**	**$201,854,351**
With Assumption of New Rail Equipment for Williams Train					
Design & Construction					
- Williams Rail	$98,510,376	$148,947,459	$148,947,459	$148,947,459	-
- Tusayan Rail					$153,531,351
Rail Vehicles					
- Williams Rail (New Equipment)	$70,455,000	$70,455,000	$31,993,500	$37,191,000	-
- Tusayan Rail	-	-	-	-	$36,960,000
Rim Shuttle Buses	-	$18,827,600	$11,363,000	$17,606,600	$11,363,000
GCR Operating Losses	$1,700,000	$1,700,000	$1,700,000	$1,700,000	-
Total Phase One	$170,665,376	$221,102,459	$182,640,959	$187,838,459	-
Total Phase Two (including buses)	-	$18,827,600	$11,363,000	$17,606,600	$201,854,351
Total Project w/ New Equipment	**$170,665,376**	**$239,930,059**	**$194,003,959**	**$205,445,059**	**$201,854,351**

Note: Costs slightly overstated - less parking needed at Williams Source: David Evans and Associates, Inc.

Table 2 presents expansion costs, including additional vehicles and expanded parking.

Table 2: Expansion Capital Costs for GCR Scenarios and NPS Light Rail (2003 Dollars)

Project Element	GCR Proposal	GCR with Adjusted Costs	GCR Rail, No Growth/Volpe Capture	GCR Rail, Base Growth/ Volpe Capture	Option 5A - (No Growth)
With Assumption of Used Rail Equipment for Williams Train					
Design & Construction					
- Williams Rail	$3,089,268	$3,089,268	-	$3,089,268	-
- Tusayan Rail	$56,190,302	$123,310,347	-	$123,542,477	-
Rail Vehicles					
- Williams Rail (Used Equipment)	$8,547,000	$8,547,000	-	$0	-
- Tusayan Rail	$21,131,250	$33,880,000	-	$33,880,000	-
Rim Shuttle Buses	-	$9,640,400	-	$8,826,400	-
GCR Operating Losses	-	-	-	-	-
Total Phase One	$11,636,268	$11,636,268	-	$3,089,268	-
Total Phase Two (including buses)	$77,321,552	$166,830,747	-	$166,248,877	-
Total Project w/ Used Equipment	**$88,957,820**	**$178,467,015**	**-**	**$169,338,145**	**-**
With Assumption of New Rail Equipment for Williams Train					
Design & Construction					
- Williams Rail	$3,089,268	$3,089,268	-	$3,089,268	-
- Tusayan Rail	$56,190,302	$123,310,347	-	$123,542,477	-
Rail Vehicles					
- Williams Rail (New Equipment)	$40,425,000	$40,425,000	-	-	-
- Tusayan Rail	$21,131,250	$33,880,000	-	$33,880,000	-
Rim Shuttle Buses	-	$9,640,400	-	$8,826,400	-
GCR Operating Losses	-	-	-	-	-
Total Phase One	$43,514,268	$43,514,268	-	$3,089,268	-
Total Phase Two (including buses)	$77,321,552	$166,830,747	-	$166,248,877	-
Total Project w/ New Equipment	**$120,835,820**	**$210,345,015**	**-**	**$169,338,145**	**-**

Note: Costs slightly overstated - less parking needed in Williams

Source: David Evans and Associates, Inc.

Table 3 shows total capital costs from project start to 2026. This initial evaluation did not include a review of the rehabilitation and replacement costs, or a detailed review of the cash flow presented by GCR.

Table 3: Cost Elements – Total Capital Cost – Project Start through 2026 for GRC Scenarios and NPS Light Rail[1] (2003 Dollars)

Project Element	GCR Proposal	GCR with Adjusted Costs	GCR Rail, No Growth/Volpe Capture	GCR Rail, Base Growth/ Volpe Capture	Option 5A - (No Growth)
With Assumption of Used Rail Equipment for Williams Train					
Design & Construction					
- Williams Rail	$101,599,644	$152,036,727	$148,947,459	$152,036,727	-
- Tusayan Rail	$56,190,302	$123,310,347	-	$123,542,477	$153,531,351
Rail Vehicles					
- Williams Rail (Used Equipment)	$23,215,500	$23,215,500	$6,756,750	$7,969,500	-
- Tusayan Rail	$21,131,250	$33,880,000	-	$33,880,000	$36,960,000
Rim Shuttle Buses	$0	$28,468,000	$11,363,000	$26,433,000	$11,363,000
GCR Operating Losses	$1,700,000	$1,700,000	$1,700,000	$1,700,000	-
Total Phase One	$126,515,144	$176,952,227	$157,404,209	$161,706,227	-
Total Phase Two (including buses)	$77,321,552	$185,658,347	$11,363,000	$183,855,477	$201,854,351
Total Project w/ Used Equipment	**$203,836,696**	**$362,610,574**	**$168,767,209**	**$345,561,704**	**$201,854,351**
With Assumption of New Rail Equipment for Williams Train					
Design & Construction					
- Williams Rail	$101,599,644	$152,036,727	$148,947,459	$152,036,727	-
- Tusayan Rail	$56,190,302	$123,310,347	-	$123,542,477	$153,531,351
Rail Vehicles					
- Williams Rail (New Equipment)	$110,880,000	$110,880,000	$31,993,500	$37,191,000	-
- Tusayan Rail	$21,131,250	$33,880,000	-	$33,880,000	$36,960,000
Rim Shuttle Buses	-	$28,468,000	$11,363,000	$26,433,000	$11,363,000
GCR Operating Losses	$1,700,000	$1,700,000	$1,700,000	$1,700,000	-
Total Phase One	$214,179,644	$264,616,727	$182,640,959	$190,927,727	$0
Total Phase Two (including buses)	$77,321,552	$185,658,347	$11,363,000	$183,855,477	$201,854,351
Total Project w/ New Equipment	**$291,501,196**	**$450,275,074**	**$194,003,959**	**$374,783,204**	**$201,854,351**

[1] Not including replacements or major overhauls

Source: David Evans and Associates, Inc.

In summary, the cost analysis revealed the following total capital costs (in millions of 2003 dollars) for the scenarios, as shown in **Table 4**. The costs presented do not include the operating losses on the historic train claimed by GCR in their proposal.

Table 4: Total Project Capital Costs by Scenario

Scenario	Facility Cost	Vehicle Cost		Total Capital Cost 2005 – 2026[1]	
		New[2]	Used[2]	New[2]	Used[2]
GCR Proposal	$157.8	$132.0	$44.3	$289.8	$202.1
GCR Proposal – Revised Costs	$275.3	$173.3	$85.6	$448.6	$360.9
Most Likely	$275.3	$97.5	$68.3	$372.8	$343.6
GCR No Growth (no LRT)	$148.9	$43.4	$18.1	$192.3	$167.0
NPS Option 5A – No Growth	$153.5	$48.3	NA	$201.8	NA

[1] Does not include vehicle replacement or major overhaul. Source: David Evans and Associates, Inc.
[2] "New and Used" refer to Williams train equipment. Includes rim shuttle buses.

As shown, our estimates of the probable costs for the GCR proposal are significantly higher than the cost estimates presented by GCR. Costs are higher for both the Williams train and for the Tusayan light rail line. The higher costs for the Williams train in our estimate are primarily due to the following factors:

- Higher costs for the construction of the proposed new track by-passing Coconino Canyon. The unit costs we used for excavation and trackbed preparation in this section were based on estimates prepared for the NPS light rail options since the terrain traversed by the new segment of rail line is similar to that for the light rail line. The excavation and trackbed costs are much higher than the estimates presented by GCR.
- Higher unit costs for other elements of the project based on typical experience in commuter rail construction for public agencies.

The higher costs for the Tusayan rail portion of the GCR proposal are primarily due to the following:

- Much higher unit costs for excavation and trackbed preparation based on estimates prepared for the NPS light rail options, which followed the same alignment. These costs were applied to the service portion of the proposed line and the proposed service track connection to the Williams rail line.
- Higher costs for the Tusayan station reflecting estimates prepared for the NPS light rail options. Major cost elements not included by GCR included roadway access, drainage improvements, landscaping and wayfinding. The station platforms and shelter structures were significantly underestimated by GCR.
- Somewhat higher costs for the CVIP station primarily related to the need to remove some of the existing improvements.
- Costs for fee/fare collection, which were ignored by GCR, were included.
- Additional light rail cars were incorporated in order to bring the proposal to the adopted NPS service standards.

Another major cost element contributing to the difference in vehicle costs between the GCR estimate and our opinion of cost is the required expansion of the rim shuttle fleet that would transport visitors from the two rail stations to other locations along the South Rim. GCR did not include any costs for the required buses. Estimates for all of the NPS transit options have recognized a need to expand the rim shuttle bus fleet. GCR's proposal requires an even greater expansion of the fleet than the NPS options. We estimate that 53 new large buses (articulated or trailer units) and 19 new 40-foot buses would be needed for visitor circulation on the rim with the GCR proposal using their assumptions for visitation growth. This

compares to 32 large buses and 19 40-foot buses needed for the NPS Options 1-5. For the GCR scenario, $23 million of the difference in vehicle costs between the GCR estimate and our revised estimate is associated with the rim shuttles. Additional costs that could be incurred, including an expanded bus maintenance facility have not been estimated.

Operating and Maintenance Costs

Operating and maintenance costs would be the primary determinant of the required per visitor fee for the GCR proposal. GCR assumes that capital costs would be covered through federal, state and local government grants and that user fees would cover operating and maintenance costs for the system.

Operating costs are most accurately estimated by building up the required staffing, supervision, materials and other costs for a complete system. The funds available for this assessment did not allow this detailed approach to be taken in evaluating GCR's operating cost estimates or in developing estimates for the Most Likely and No-Growth scenarios. We compared GCR's estimated operating costs for the Williams train to operating costs for commuter rail service from several commuter rail systems using data from the National Transit Data Base, maintained by the Federal Transit Administration. We used the reported cost per revenue vehicle hour for other systems to adjust GCR's estimated operating cost for the Williams train using GCR's assumed visitation growth. For the other two scenarios, we estimated annual vehicle hours and factored the operating cost estimate down from the GCR Proposal scenario.

We used the operating cost estimate for the NPS light rail option as a starting point for estimating operating and maintenance costs for the Tusayan light rail and rim shuttle bus systems in each scenario. The estimates for Options 1-5 were originally developed using the build-up approach and they did not provide a split of the operating cost between the light rail and rim shuttle components of the options. For this analysis we assumed a cost per hour for light rail and bus based on data from other transit systems in both urban areas and national parks to develop the required split of costs between the bus and rail modes. We used values of $52 per vehicle hour for the rim shuttles and $161 per hour for the light rail line. The NPS light rail cost per hour is significantly less than the cost per hour that can be derived from the GCR proposal - $232.00 per hour.

Table 5 provides a summary of the estimated operating costs for the Williams train, the Tusayan light rail line and the rim shuttle bus system for each scenario in 2026. The following paragraphs summarize the key aspects of our findings.

Table 5: Annual Operating and Maintenance Costs – 2026 Conditions

	GCR Proposal	GCR Proposal, Adjusted Costs	GCR Proposal, No Growth Scenario	GCR Proposal, Most Likely Scenario	Option 5A, No Growth
Williams Rail	$17,640,000	$31,490,451	$13,162,941	$15,682,311	NA
Tusayan Rail	$4,580,000	$6,153,581	-	$5,499,760	$8,652,303
Rim Shuttles	-	$15,134,242	$7,689,864	$13,913,739	$10,008,128
Total System	**$22,220,000**	**$52,778,274**	**$20,852,805**	**$35,095,810**	**$18,660,431**

Source: David Evans and Associates, Inc.

Williams Train

GCR's estimates of operating and maintenance costs for the Williams train result in a cost per hour of about $156 in 2026. Data from urban area commuter rail systems show an average cost per hour of about

$325 using the National Transit Database. We used an adjusted estimate of $279 per hour to reflect the possibility that labor costs could be lower in the rural setting of the Grand Canyon than in the large urban areas that have commuter rail systems. Even with the adjustment, our estimate of hourly operating costs is much higher than GCR's. This higher cost per hours leads to an estimate of $31.5 million in operating costs for the GCR Proposal scenario, compared to GCR's estimate of $17.6 million for 2026 conditions.

Tusayan Train

To provide a fair comparison with the NPS light rail alternatives, we assumed that the GCR light rail line would use the same vehicles as those assumed for Options 4 and 5. Further development of any of the NPS options or the GCR proposal should include an evaluation of the operating cost and design impacts of using larger vehicles such as those proposed by GCR. For example, Siemens is supplying new diesel light rail vehicles that will be used in San Diego. The *Desiro* model vehicles will accommodate more than 200 passengers while meeting the comfort standards established by NPS for the Grand Canyon service. These vehicles have been acquired by the transit agency in San Diego for $4.22 million each. This is more than the $3.08 million assumed for the light rail vehicles in NPS Option 5, but the capacity of these vehicles is about 46% greater than the capacity of the vehicles assumed in the Option 5.

While our estimate of operating costs per hour for light rail is lower than GCR's, we estimate the need for a greater number of vehicle hours per year to meet the demand in the GCR Proposal scenario. The resulting estimated operating cost is $6.1 million per year in 2026 compared to GCR's estimate of about $4.6 million per year.

Rim Shuttle Buses

The rim shuttle bus system would be a critical component of any expanded transit system for the Grand Canyon. Visitors would be required to travel among locations on the rim primarily using the rim shuttle buses. Because the GCR proposal does not provide rail service from CVIP to Grand Canyon Village and because the station in the Village is far from the rim, the GCR proposal would require significantly more rim shuttles to meet visitor travel needs. The GCR proposal ignores this element of the integrated transit system. Using $52 per hour as the estimated cost of rim shuttle bus service, we estimate that this element of the transportation system would cost $15.1 million per year in 2026 using GCR's assumptions.

The overall operating cost per year for the GCR proposal, using GCR assumptions regarding visitation growth and assuming 2026 conditions, would be $52.8 million. This compares to GCR's estimate of $22.2 million and to $18.7 million for NPS Option 5A assuming no growth in visitation.

Cash Flow, Funding and Financing

GCR assumed that visitor fees would cover the operating and maintenance costs of the transit system, including funding of a rehabilitation set aside, and provide an annual operating profit equal to 15 percent of each year's projected operating and maintenance costs. GCR's analysis indicated that an initial per-visitor fee of $5.00 would support the operation of the Williams train. The fee would ultimately grow to $8.00 per visitor, covering system expansion and the additional operating costs associated with the light rail line from Tusayan to CVIP. As shown in the previous section, GCR underestimated the unit costs for operation of the Williams train, underestimated the operating miles and hours per year for the Tusayan train and ignored the operating costs for the expanded rim shuttle bus system that would be needed. GCR also over estimated the existing number of visitors to the South Rim.

The combined effect of the differences between GCR's assumptions and likely conditions would result in the initial transit fee needing to be $12.00, or more than double, to support the operating costs for the

GCR Proposal. The fee would grow to $19.00 per person to cover the added costs for the light rail line and system expansion.

Though the scope of this analysis did not allow for a precise estimate of future vehicle and facility replacement/rehabilitation costs for each scenario, an approximation was needed to equitably compare the GCR and NPS options. The GCR estimates for set aside expenditures were used to forecast annual expenditures. It was also assumed that set-aside balances would earn an annual return of four percent. In addition, for comparative purposes, each NPS scenario assumed the same 15 percent operating profit as proposed by GCR.

As shown in **Table 6**, the No Growth and Most Likely scenarios would require lower initial transit fees per visitor, but by 2020 the fees would increase to a range of $19.00 to $22.00 per visitor for both of these scenarios. For a typical visitor group of four people, the transit fees, when combined with the current $20.00 entrance fees would result in total costs to enter the park of $48 to $64 in 2004, with much higher costs in future years. This increased cost would likely have a negative effect on park visitation, thereby reducing the number of transit-fee paying visitors and leading to a need for increased transit fees or operating subsidies from other sources.

Table 6: Transit Fee Required to Cover Operating and Rehabilitation Costs

Year	GCR Proposal	GCR Proposal, Adjusted Costs and Revenues	GCR Proposal, No Growth Scenario[1]	GCR Proposal, Most Likely Scenario
2004	$5.00	$12.00	$7.00	$11.00
2005	$5.00	$13.00	$8.00	$12.00
2006	$5.00	$14.00	$8.00	$13.00
2007	$5.00	$15.00	$9.00	$14.00
2008	$5.00	$15.00	$10.00	$14.00
2009	$6.00	$15.00	$10.00	$14.50
2010	$6.00	$15.00	$11.00	$14.50
2011	$6.00	$15.00	$11.00	$15.00
2012	$6.00	$15.00	$12.00	$16.00
2013	$7.00	$16.00	$12.00	$16.00
2014	$7.00	$16.00	$12.00	$16.00
2015	$7.00	$16.00	$13.00	$17.00
2016	$7.00	$16.00	$13.00	$17.00
2017	$7.00	$17.00	$14.00	$18.00
2018	$7.00	$17.00	$14.00	$18.00
2019	$8.00	$17.00	$14.50	$19.00
2020	$8.00	$18.00	$16.00	$20.00
2021	$8.00	$18.00	$16.00	$21.00
2022	$8.00	$18.00	$17.00	$21.00
2023	$8.00	$18.00	$18.00	$21.00
2024	$8.00	$18.00	$18.00	$22.00
2025	$8.00	$19.00	$19.00	$22.00

[1] Williams Train only. Source: PricewaterhouseCoopers LLP

Notes: Assumes 87% of estimated visitors pay fee; Assumes 2.5% per year inflation of operating costs; Assumes operating profit of 15% of operating and maintenance costs; Fees cover operating costs and ongoing replacement costs as estimated by GCR in its original proposal; Financing costs are not included

The trend in funding for major transit projects in urban areas has seen a decline in the share of projects that is funded through federal sources. Although federal law allows an 80% federal share for transit projects, FTA currently does not recommend projects to Congress for funding with more than 60% of the

funds coming from the FTA New Starts program. Funding availability is limited and competition for federal funds is intense, leading many projects to seek 50% or less of the required funds from federal sources. State and local funding sources, such as fuel, sales and property tax receipts are used to fill the gap between project capital costs and available federal funding. These sources are generally not available for use by the National Park Service to develop alternative transportation systems.

Implementation Approach

Planning and Compliance

After review (and assuming acceptance) of the proposal by NPS, the GCR schedule allows about six months for "environmental work", with funding negotiations occurring in parallel. This schedule is very aggressive considering that the proposal would represent a major departure from decisions regarding visitor access documented in the park's General Management Plan. Implementation of the proposal would significantly reduce the number of visitors approaching the park through Tusayan, potentially resulting in significant economic impacts and associated controversy. The major changes from the GMP could result in the need to prepare a supplemental environmental impact statement, which would take far longer than the time allowed in the GCR proposal.

The proposed Williams rail line includes a complex set of improvements that could have broad impacts. Impacts within Williams would need to be considered, along with impacts to natural and cultural resources at passing sidings and along the proposed new rail alignments within National Forest lands. The proposed hourly or half-hourly arrivals of passenger trains at Grand Canyon Village could have major noise and pollutant emissions impacts. A thorough analysis of impacts to the environment along the proposed new alignments (both the Coconino Canyon by-pass and the light rail service connection) would be required. The required resource studies might be constrained to specific times of the year, which could lengthen the time required to complete the environmental documents. The design of the proposed improvements would need to be advanced to approximately 30% to define project impacts with certainty and to confirm project costs with a high enough degree of confidence to allow funding negotiations to take place. It is unlikely that preparation of the final funding plan could be started until the required environmental clearances were in place. Based on experience with major rail transit projects in urban areas, the preliminary design and environmental clearance process can be expected to take at least 18 months, with two years being a more realistic duration.

Organization

The "Regional Transportation Board" proposed by GCR to provide oversight to the project would be composed of representatives from the National Park Service, Arizona Department of Transportation, Federal Highway Administration (FHWA), Federal Transit Administration (FTA), Federal Railroad Administration (FRA), Grand Canyon Trust, Grand Canyon Railway and a "non-vested technical representative". This type of organization is unprecedented. As regulatory, oversight and funding agencies, FHWA, FTA and FRA do not enter into governance agreements with other agencies. Further, the proposed organization could be covered by the Federal Advisory Committee Act, depending on which agency led the board and the specific purposes of the board meetings.

It is beyond the scope of this paper to explore the legal and institutional aspects of the proposed organization. The Yosemite Area Regional Transportation System (YARTS) and the partnership used to fund and manage the Island Explorer transportation system in and near Acadia National park provide examples of intergovernmental agreements involving NPS and local and state agencies that might provide models for a system such as Regional Rail. The GCR proposal implies that ownership of the rail system would remain with GCR. Ownership of the vehicle fleet is not clearly defined in the proposal. To the extent that real and/or personal property improvements are owned by GCR, GCR stands to reap financial

benefits that should be quantified and evaluated against government standards of reasonableness. Whether federal and state funds would be used to improve privately owned facilities has not been determined.

It is not clear what sort of contractual relationship would exist between GCR and the proposed Regional Transportation Board or between GCR and the federal government (through NPS or another federal agency). GCR currently operates under a concession contract with the NPS and if this type of relationship were to continue, it would require that the NPS competitively bid the operation of the transit system in accordance with current laws and regulations. The concession contracting process typically takes several years. Given the complex nature of the project and the interagency relationships, developing agreements could be expected to take a long time.

Other Considerations

The GCR proposal would have a major impact on visitor experience, especially for day visitors. Two major groups of day visitors would have completely different arrival experiences, with one group arriving at the Maswik Transportation Center and the other at CVIP. The proposal would make it difficult for NPS to provide a consistent entry experience and clear orientation to visitors arriving at the South Rim. Depending on the scenario, between 25% and 50% of day visitors would arrive at Maswik, while the remainder would arrive at CVIP. The GMP assumed that all day visitors would arrive at CVIP, where they would get their first glimpse of the canyon and receive in-depth orientation to support planning the remainder of their visit. Many of the facilities at CVIP would need to be duplicated near the proposed Williams rail line station in Grand Canyon Village to provide a consistent arrival experience.

Equity of visitor fees could be a significant issue for the GCR proposal. In the initial phase of the GCR Proposal and for the No-Growth Scenario (in both cases the only service would be from Williams to Grand Canyon Village), all visitors entering the South Rim area would pay a transportation fee, while only a portion of visitors would use the system. For the GCR Proposal scenario, by attracting 50% of the visitors entering through the South Entrance in private vehicles, the Williams train would serve 38% of all private vehicle visitors to the South Rim. This share of visitors would use the service (but all visitors would pay for it) until 2015, when the Tusayan light rail would be implemented.

For the No-Growth scenario, the Williams train would serve 18% of all visitors to the South Rim area in private vehicles (25% of the South Entrance visitors arriving in private vehicles). The relatively small percentage of visitors using a system that all visitors would be asked to pay for raises the issue of fairness in the allocation of user charges. However, if only users paid for the system operations and maintenance, the cost per visitor would be much higher than those presented by GCR or developed in this report.

Conclusions

Using reasonable estimates of capital and operating costs, the GCR proposal would be substantially more expensive than the transit options being considered by NPS, including light rail transit. GCR's proposal would moderately reduce the cost of the basic light rail system from Tusayan to Grand Canyon National Park by eliminating the portion of the line between the Center Road/South Entrance Road intersection and Grand Canyon Village (about 2.5 miles). The GCR proposal also includes some sections of single track, which would result in further modest savings. However, the savings in cost from these modifications to the light rail system are insufficient to pay for the upgrade of nearly 60 miles of existing rail line, the addition of 18 miles of new passing sidings for the Williams train and construction of 2.7 miles of new track to connect the proposed light rail line with the Williams train route. Considering that the GCR proposal would involve the construction of many more miles of rail and the need to equip and operate two separate rail systems, the extra costs should not be surprising. Using consistent assumptions (new

equipment, purpose built for the proposed service, most-likely growth assumptions) the GCR proposal would cost over $160 million more than the light rail option to design, build and equip. Operating costs would be $16.4 million per year higher with the GCR proposal, an increase of 88% over Option 5, assuming the most-likely growth scenario (2026 conditions).

The only benefit derived from the additional capital and operating costs associated with Regional Rail would be to reduce traffic on Highway 64 between Williams and Tusayan. This benefit would be offset by potential visitor confusion regarding the two separate services operating to the park from two locations and a diminished ability for the park to provide a consistent, high quality entry experience for all visitors.

The GCR proposal offers the potential to reduce capital costs only in the No-Growth scenario, where it is assumed that Tusayan train would not be implemented. In this scenario, the cost to design, construct and equip the Williams train with new equipment would be about $197 million, compared to about $202 million for light rail in NPS Option 5. The 2% to 3% difference in cost for the two alternatives is not significant at the level of accuracy in estimates that is possible at the current stage of planning and design. Although the capital cost of the Williams train would be similar to that for light rail, the annual operating and maintenance cost for the GCR proposal would be $2.2 million or about 11% more than the annual cost for the light rail system in NPS Option 5. The Williams train would only serve a fraction of the visitors that would use the light rail line, making the Williams train very cost-inefficient in comparison.

The GCR proposal assumes that federal and state funding sources would cover all of the capital costs and that visitor fees would be used to cover the operating costs of the system. The nearly $450 million capital cost of the GCR proposal would consume several years worth of Alternative Transportation Program funding. The state of Arizona's most recent 5-year transportation funding program totals $3.7 billion in expenditures, for an average of about $740 million per year. The GCR project would need to displace some of the priority projects in the program in order to make use of state funds. It is highly unlikely that a project of the magnitude represented by the GCR proposal could be funded as proposed.

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