Assessing Needs and Identifying Opportunities for ITS Applications in California's National Parks

Technical Memorandum #2:
Background on ITS and Candidate Parks

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GLOSSARY OF ABBREVIATIONS

ATIS	Advanced Traveler Information System
ATS	Alternative Transportation System
Caltrans	California Department of Transportation
DOI	Department of Interior
DOT	Department of Transportation
FEIS	Final Environmental Impact Statement
FOT	Field Operational Test
GGBHTD	Golden Gate Bridge Highway and Transportation District
GGNRA	Golden Gate National Recreation Area
GMP	General Management Plan
HAR	Highway Advisory Radio
ITS	Intelligent Transportation Systems
LOS	Level of Service
MOU	Memorandum of Understanding
MPO	Metropolitan Planning Organization
MTC	Metropolitan Transportation Commission
MUNI	Municipal Railway Bus System
NEPA	National Environmental Policy Act
NHP	National Historic Park
NHS	National Historic Site
NM	National Monument
NMP	National Military Park
NP	National Park
NPS	National Park Service
NRA	National Recreation Area
NS	National Seashore
SALLY	Sausalito Area Local Land Yacht
TDM	Transportation Demand Management
TTIS	Traveler and Tourist Information System
UICPSU	University of Idaho's Cooperative Park Studies Unit
VMS	Variable Message Signs

ABSTRACT

This document provides examples of ITS projects within national parks and reviews the method of classification for national parks that was used to select two of them (Golden Gate National Recreation Area and Sequoia and Kings Canyon National Parks) from the State of California as ITS test sites. This document also provides a detailed description of Golden Gate National Recreation Area and Sequoia and Kings Canyon National Parks including: their history and transportation and visitor characteristics, existing management goals within the parks, previous park studies, other transportation planning that may indirectly affect the park (such as regional planning), and a summary of the stakeholder meetings and surveys. A description of the next steps for this project is also included in this document.

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1 INTRODUCTION

According to the National Park Service (NPS), 1999 saw a total visitation to NPS-managed lands in California of 34.6 million visitors – exceeding any other state in the country. With the high visitation level in California expected to increase, the National Park Units in California are under extreme pressure to provide access and mobility to and within the Parks while still preserving the Parks' resources and environment. This is occurring at a time when there is an estimated backlog of nearly $5 billion of maintenance and repairs for NPS-managed lands, leaving limited resources to develop new systems and infrastructure.

Intelligent transportation systems (ITS) may provide solutions to access and transportation problems in California's National Park units in a more economical and perhaps more environmentally friendly way than other types of transportation system improvements. For this reason, the California Department of Transportation (Caltrans) has contracted with the Western Transportation Institute at Montana State University-Bozeman, in cooperation with Texas A&M University's Department of Recreation, Parks and Tourism Sciences and the Texas Transportation Institute, to identify ITS solutions that may have broad applicability to the NPS units within the State of California.

As shown in Figure 1-1, there is tremendous variation in the location (urban vs. rural) and size in California's National Parks. There are also variations within visitation rates and presence of visitor transportation systems at these parks. It should be clear that one ITS solution will not fit all parks. For this reason, the research project will focus on two (Sequoia and Kings Canyon National Parks and Golden Gate National Recreation Area) of the 22 Park units within the state and attempt to recommend ITS solutions that may be applicable to other parks.

This technical memorandum will provide a brief overview of National Parks that are currently using ITS, a review of how parks were selected for this project, and information on Sequoia and Kings Canyon National Parks and Golden Gate National Recreation Area such as park description and history, existing management and/or operational goals, documentation of previous park studies, relationships to other ITS initiatives, and recommendations for data that would help address visitor management through ITS. Lastly, this technical memorandum will outline the future tasks for this project.

Figure 1-1: Map of California National Park Units.

(Source: National Park Service)

2 LITERATURE REVIEW ON OTHER PARKS WITH ITS

Intelligent transportation systems (ITS) were identified as a possible solution for the access and transportation problems in the California National Parks. The idea to utilize ITS in national parks is a relatively new phenomenon. However, since 1997 when the Department of Interior and the Department of Transportation entered into a Memorandum of Understanding (MOU) to address national park visitation levels, traffic congestion, and parking issues, several intelligent transportation system (ITS) operational tests have been conducted in national parks. A few examples of how intelligent transportation systems can be used in national parks and possibly within California National Parks is listed below.

2.1 Acadia National Park

Acadia National Park, shown in Figure 2-1, is located primarily on Mount Desert Island on the Maine coast and encompasses approximately 46,000 acres. The park receives more than 2.5 million visitors per year with peak visitation between July and September. The majority of visitors are day users, as there are only two campgrounds in the park.

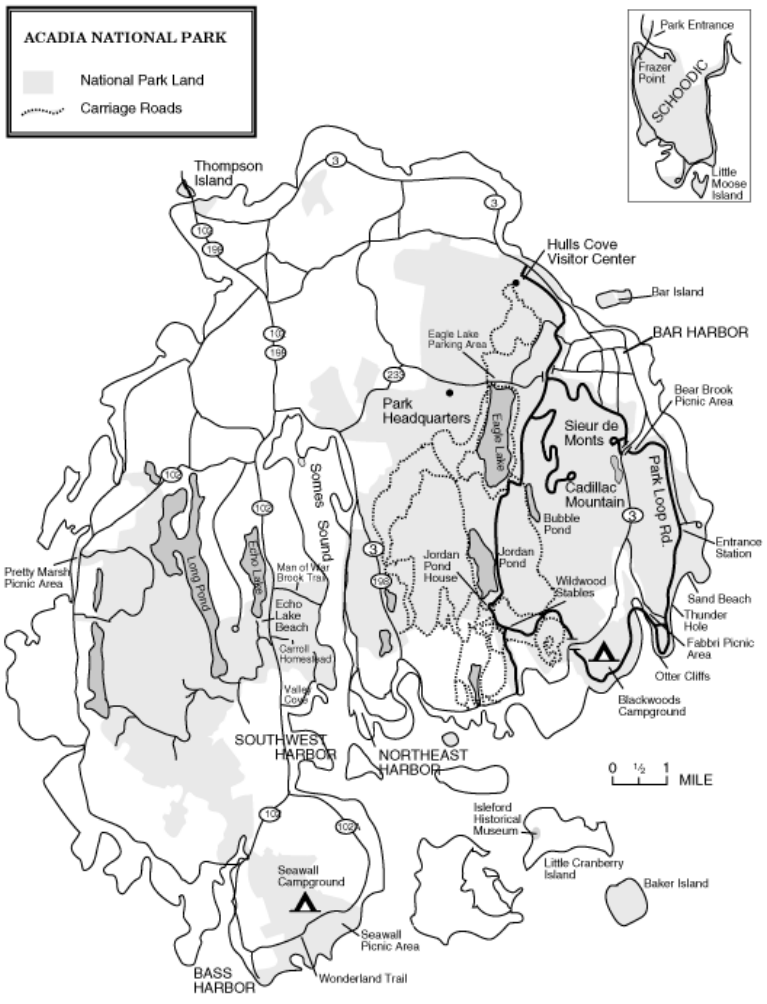

Figure 2-1: Detailed Map of Acadia National Park
(Source: National Park Service)

In 1999 a joint Department of Transportation (DOT)/Department of the Interior (DOI) panel selected Acadia National Park as the site for a Field Operational Test (FOT) of ITS (1). The operational test centered on an Advanced Traveler Information System (ATIS), which was designed to provide visitors with the type of information they want in the way they want to receive it. The goals for the ATIS include improving safety, reducing traffic congestion, improving the visitor experience, reducing parking

demand at key areas, building upon initial success of the Island Explorer transit system, and improving economic opportunity for Mount Desert Island.

A survey of park visitors and area residents in 1999 was used to devise a visitor profile and determine how visitors plan their trip to Acadia both before and after arriving at the park (2). The results showed that the information visitors want and the manner in which they choose to obtain it varies throughout the trip planning process. During pre-trip planning visitors felt the need to obtain information on what there is to do at the park as well as transportation options at the park. However, while visitors still desire information on things to do and entrance fees while en-route to the park, they do not feel transportation options are very useful. Once visitors arrive in the area, their interest in transportation issues increases. One constant in the planning process, from the pre-trip to the on-site stage, is the use of guidebooks. The results also indicated the types of media visitors would use to obtain information on the park and transportation issues. Informational radio stations and variable message signs (VMS) were the preferred methods for obtaining information en-route, while preferred types of media once in the area included

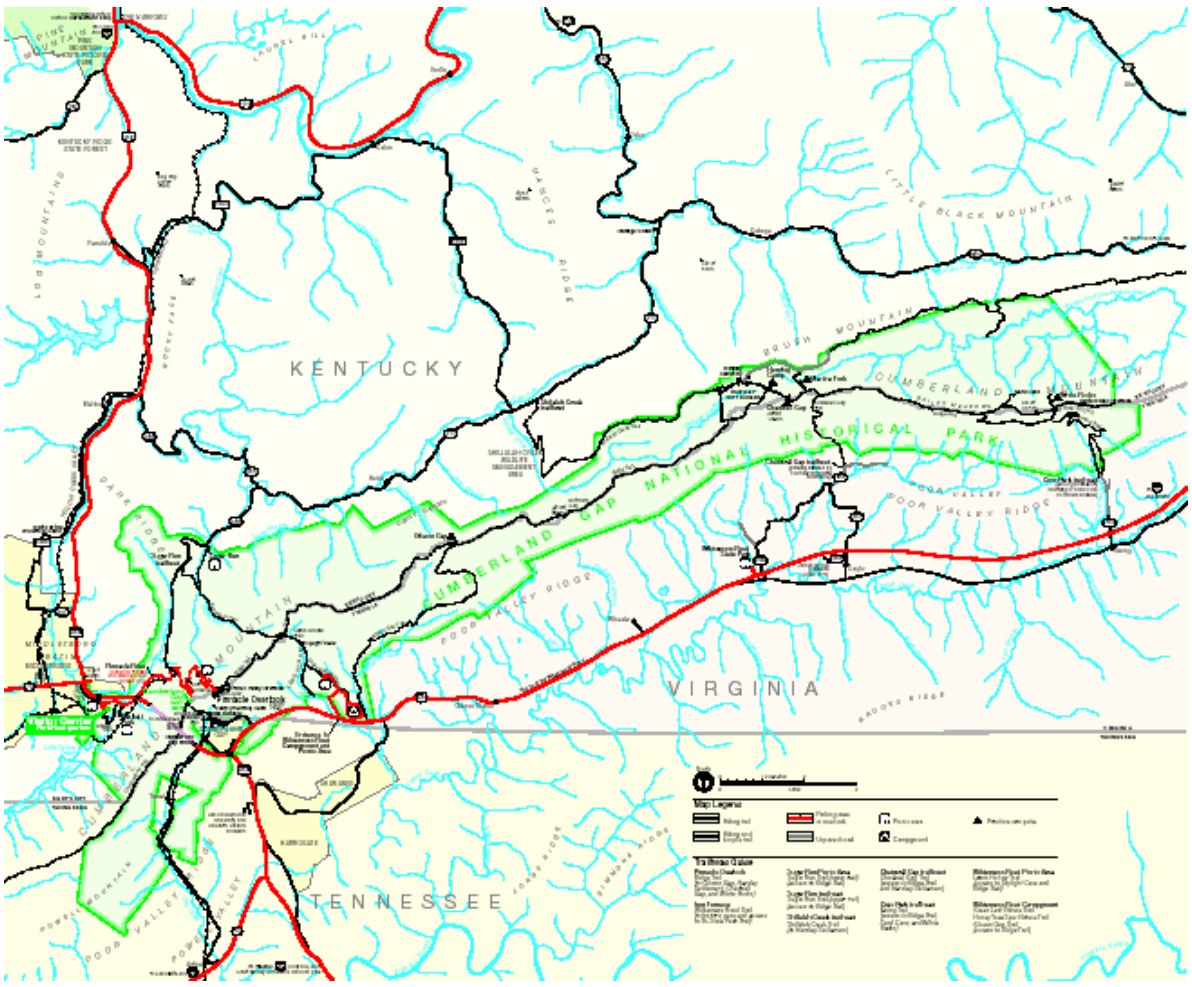

Figure 2-2: Detailed Map of Cumberland Gap National Historical Park
(Source: National Park Service)

guidebooks, visitor centers, information kiosks, Chambers of Commerce, or computers in hotel or campgrounds.

Acadia employs a number of ITS tools with the Island Explorer transit system that operates in and around the park. These tools include two-way voice communications, automatic vehicle location, real-time arrival signs, automated passenger counting and automated annunciation.

The FOT was scheduled for evaluation in 2000-2001; however, the evaluation has been delayed and therefore no results have been published yet.

2.2 Cumberland Gap National Historical Park

Located on the border of Kentucky, Tennessee and Virginia, Cumberland Gap National Historical Park (NHP), shown in Figure 2-2, includes more than 20,000 acres and welcomes

Figure 2-3: Detailed Map of Gateway National Recreation Area
(Source: National Park Service)

almost 1.5 million visitors per year. Located on Highway 25E, the Cumberland Gap Tunnel connects the Kentucky side of the park with Tennessee and Virginia. There were two main problems with the highway before the tunnel was built: the high number of traffic fatalities, and damage to the Wilderness Trail, which the highway followed over Cumberland Mountain.

The park has teamed with the Federal Highway Administration, the Kentucky Transportation Cabinet and the Tennessee DOT to improve safety in the Cumberland Gap Tunnel and eliminate the aboveground highway. Closed circuit cameras monitor traffic in the tunnel while VMSs relay important information to travelers entering the tunnel. There have not been any fatalities since the tunnel opened in 1996 (3).

2.3 Gateway National Recreation Area

Located in Monmouth County, New Jersey and Brooklyn, Queens, and Staten Island New York, this multi-site park unit is facing increased use. Gateway National Recreation Area, shown

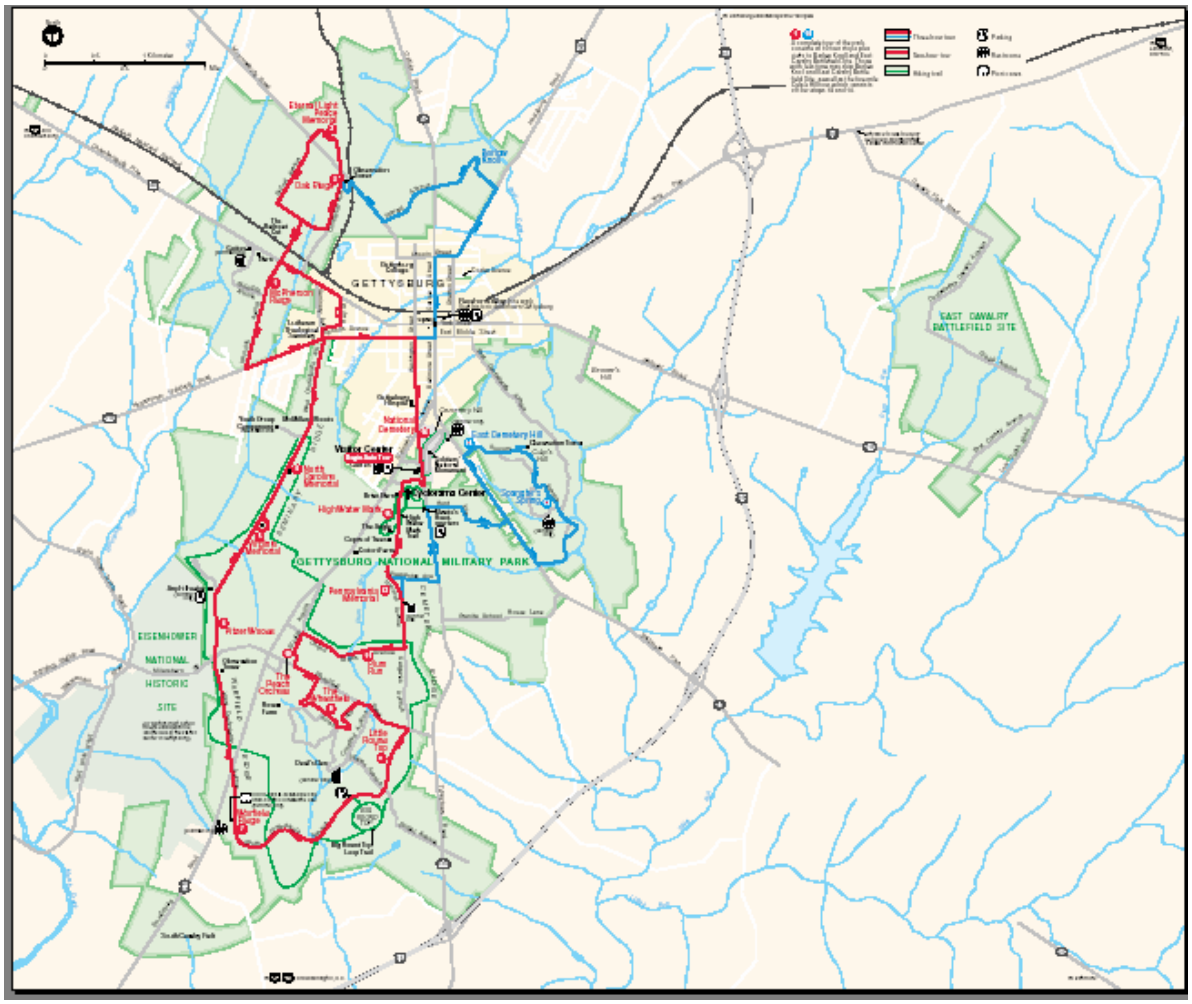

Figure 2-4: Detailed Map of Gettysburg National Military Park
(Source: National Park Service)

in Figure 2-3, contains 26,000 acres of recreation area including activities such as swimming, sailing, surfing, military site tours, organized athletics, camping, operas, and symphonies. The visitation to this park is approximately 6.8 million visitors per year.

Parking lot management is an area of particular concern at Sandy Hook, where they are considering the use of VMSs, parking lot monitoring, and a comprehensive parking management study (4). Cooperation at the state and regional level should enable traffic and travel conditions to be accessed throughout the New Jersey and New York area.

2.4 Gettysburg National Military Park

Located in Pennsylvania approximately 50 miles northwest of Baltimore, Gettysburg National Military Park (NMP), shown in Figure 2-4, encompasses just under 6,000 acres. The park also includes 26 miles of roads and more than 1400 monuments, markers, and memorials. Gettysburg National Military Park was the site of the Battle of Gettysburg which started July 1, 1862 and ended two days later. Activities within the park include battlefield tours, ranger led activities, and museum tours. Approximately 1.6 million visitors enter the park per year.

The park is in the process of building a new visitor center, and expects the number of visitors to continue to grow. Increased congestion concerns have led both park and regional authorities to call for transportation improvements, including ITS solutions. A shuttle system, along with ITS technologies such as on-board enunciators, traveler information systems, and fleet management systems, has been proposed (4).

2.5 Grand Canyon/ I-40/Northern Arizona

Grand Canyon National Park, shown in Figure 2-5, is located in the northeastern corner of Arizona, covering in excess of 1.2 million acres. One of the flagship units of the national park system, Grand Canyon receives close to 5 million visitors per year, the majority during the summer months.

Grand Canyon National Park was part of a regional study conducted in 1998 by Battelle under the auspices of DOT's National Advanced Rural Transportation Systems Program (5). The purpose of the project was to determine the improvement in mobility and access, congestion, and economic development in rural environments due to Advanced Traveler Information Systems (ATIS). The Traveler and Tourist Information System (TTIS) along the Interstate 40 corridor was one of the systems evaluated during this study. This system collects, processes, and disseminates weather, road and traveler information. Components of the system included web sites (e.g. Arizona DOT), kiosks, phone access system, and VMSs. The evaluation found that TTIS was successful in deploying ITS technology within rural areas and that a significant portion of tourists was aware of the system and had used at least one component of it (5).

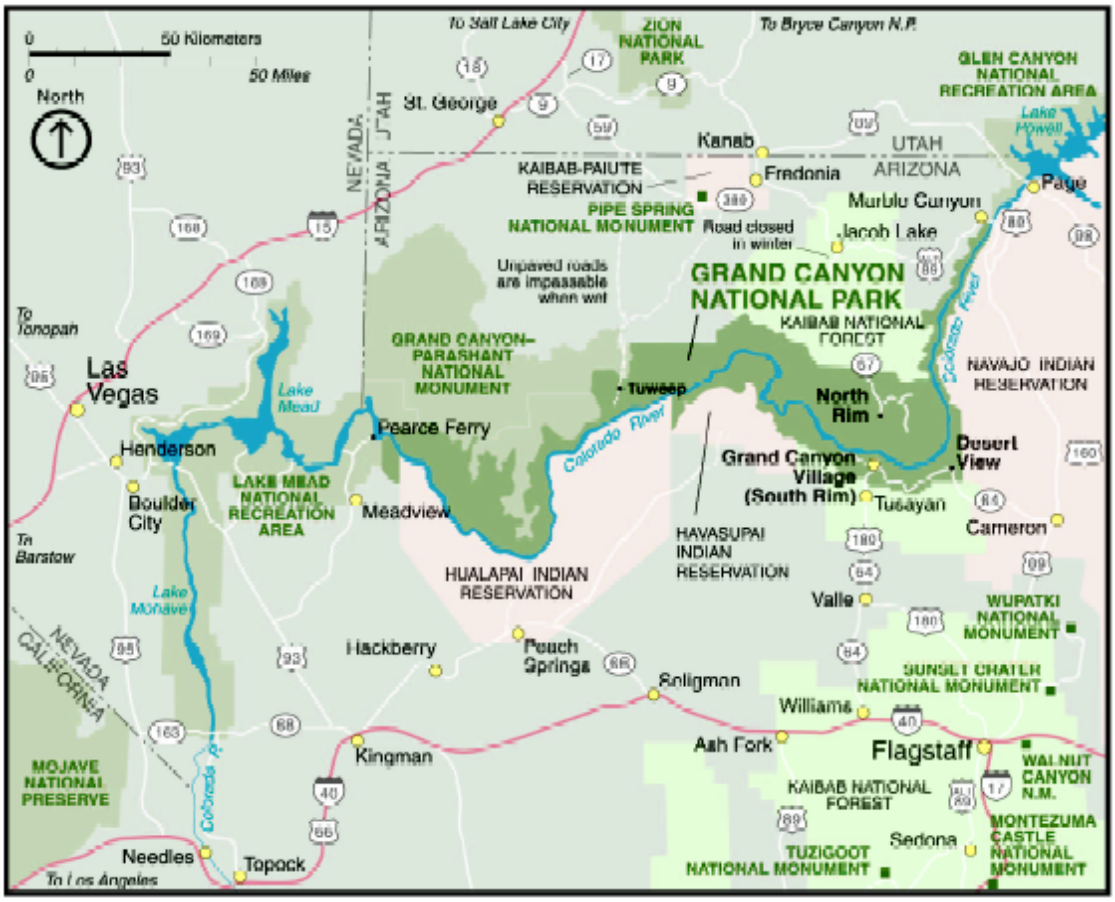

Figure 2-5: Detailed Map of Grand Canyon National Park

(Source: National Park Service)

2.6 Great Smoky Mountains National Park

The Great Smoky Mountains National Park, shown in Figure 2-6, is located on the border of North Carolina and Tennessee along the Great Smoky Mountains. The park has just over half a million acres and is open year round. It also has an extremely high visitation level – more than 10 million visitors per year. There are three main access points to the park including Cades Cove, TN; Gatlinburg, TN; and Cherokee, NC. Of these, Cades Cove is the most congested area. Each entrance point receives between two and three million visitors per year, with the peak season in the fall.

Great Smoky Mountains National Park not only has a couple of transportation planning projects underway, it also has several which have been completed. The park is currently working with the Federal Lands Highway Program to adapt ITS strategic planning for national parks (4), as well as working on a regional transportation study with the Knoxville Metropolitan Planning Organization (MPO) region and the gateway communities. The regional transportation study includes an assessment of park transportation needs and a study of the Foothills Parkway. The park has conducted a technology feasibility study in the Cades Cove area, and has implemented

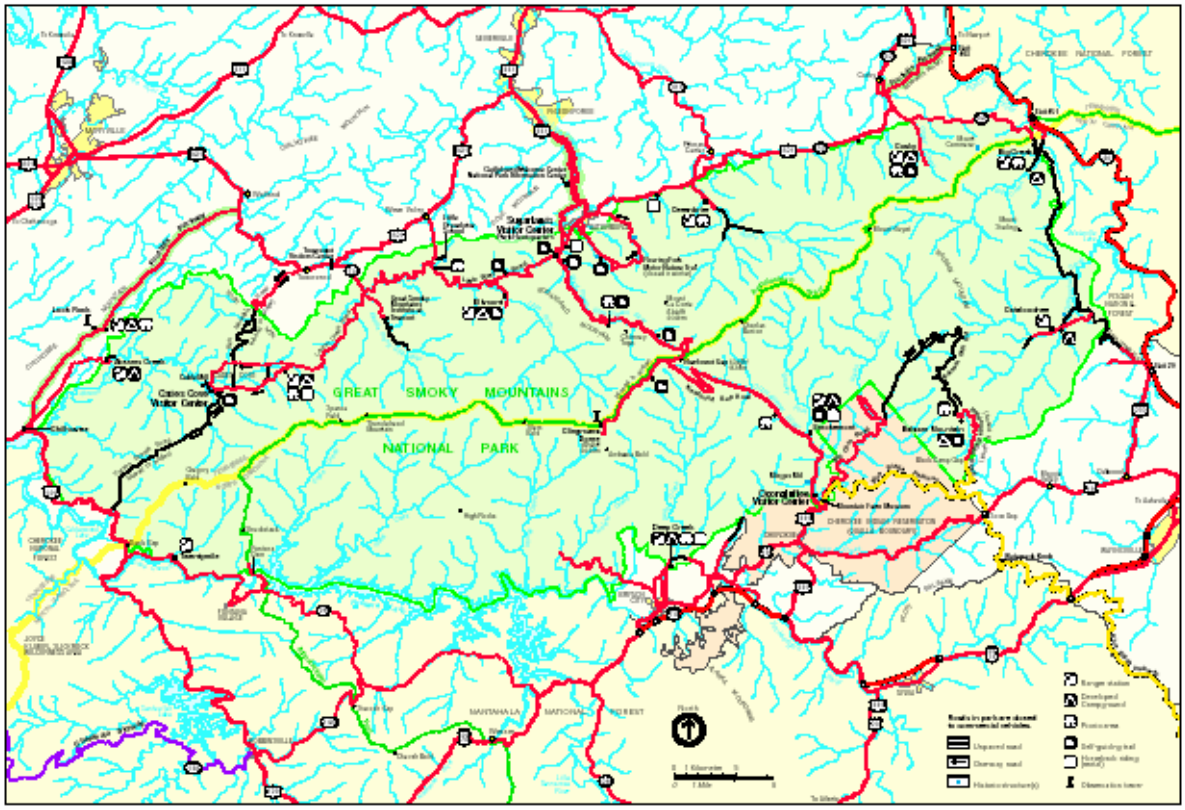

Figure 2-6: Detailed Map of Great Smoky Mountain National Park
(Source: National Park Service)

an interactive phone system for visitors to obtain road, camping, recreation, and visitor information. Road updates are also posted on the park website.

2.7 Shenandoah National Park

Shenandoah National Park, shown in Figure 2-7, is a linear park located in Virginia along the Blue Ridge Mountains. Just under 200,000 acres in size, the park welcomes close to 1.5 million visitors each year. The park is open all year, but Skyline Drive, which runs the length of the park, may be closed in winter due to hazardous driving conditions. Skyline Drive is the principal access route through the park.

In 1999 the Virginia Tech Center for Transportation Research (since renamed the Virginia Tech Transportation Institute) along with their partners, was chosen to develop a comprehensive ATIS for the park. Made available to the public in April 2000 (6), Travel Shenandoah provides traveler, road, and emergency information to the public and also helps the state police manage traffic incidents. ITS tools used in the system include the Internet, cell phones and pagers, PCS/digital wireless phones, cable television, VMS, and highway advisory radio (HAR).

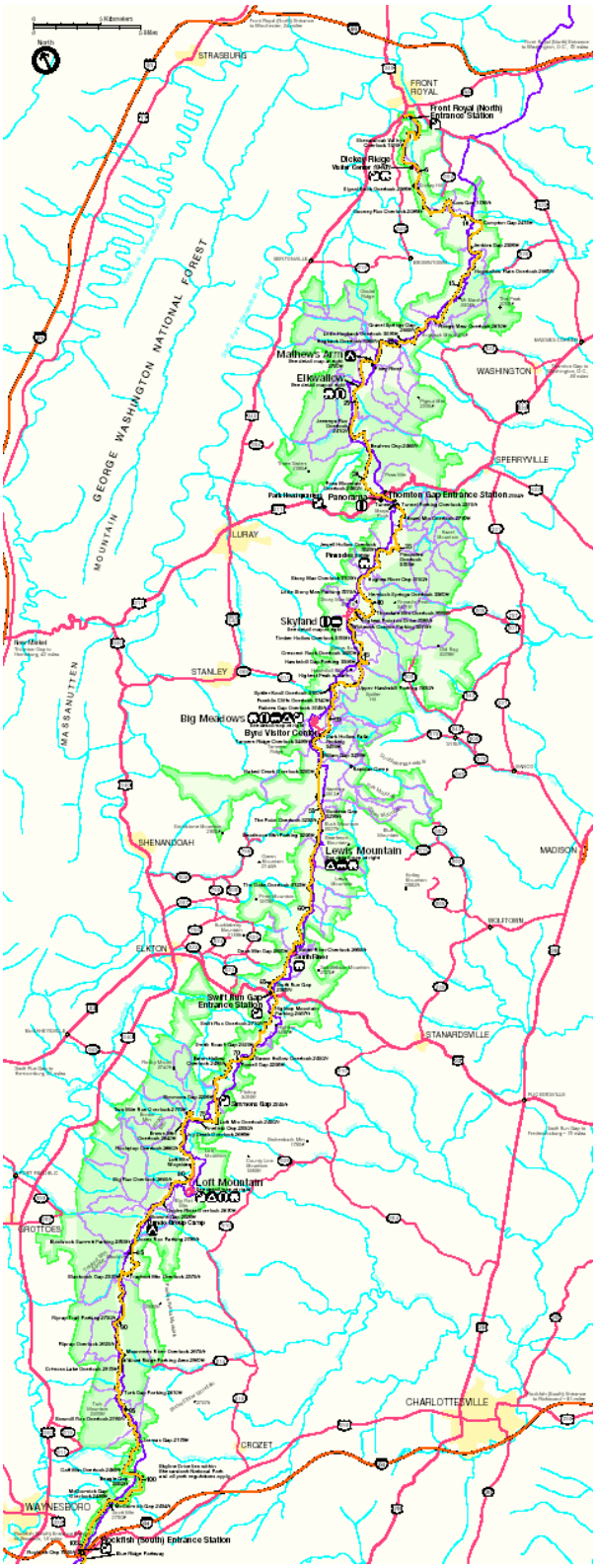

Figure 2-7: Detailed Map of Shenandoah National Park

(Source: National Park Service)

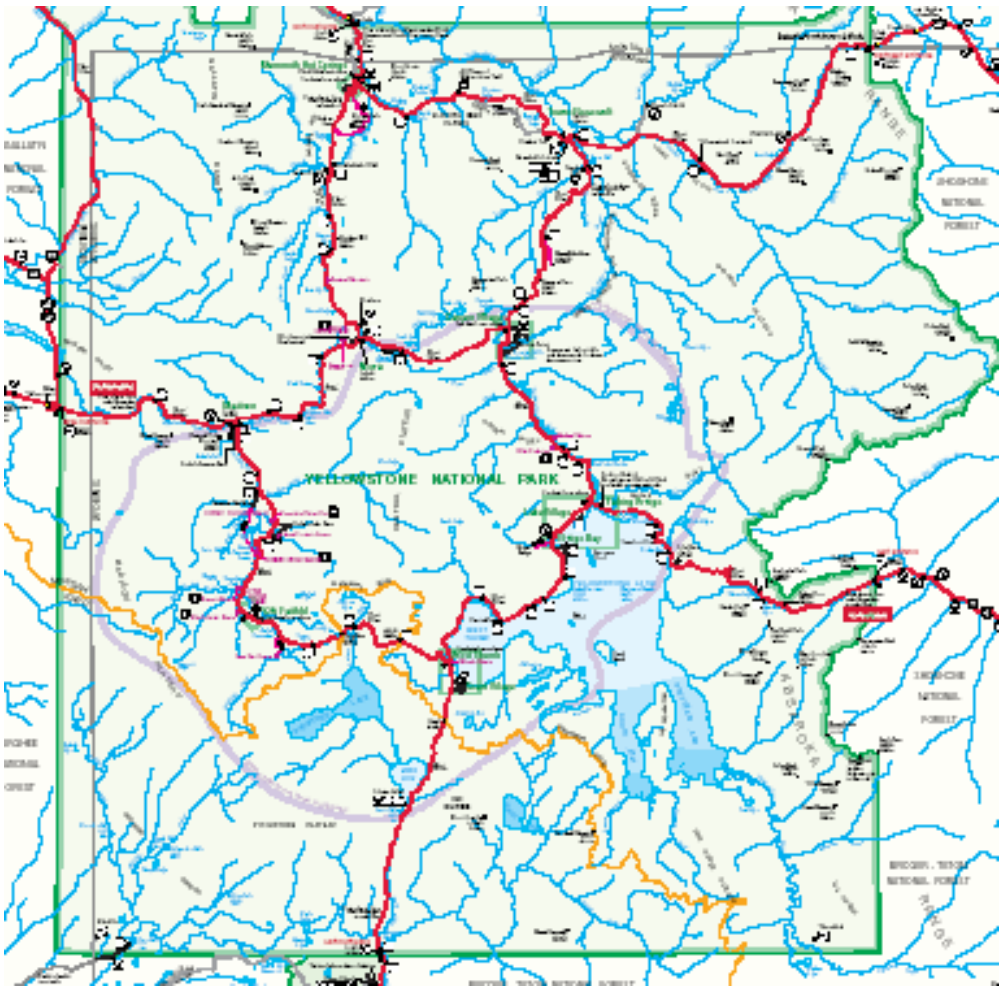

Figure 2-8: Detailed Map of Yellowstone National Park

(Source: National Park Service)

2.8 Yellowstone National Park

Located primarily in northwestern Wyoming, Yellowstone National Park, shown in Figure 2-8, covers more than 2.2 million acres. The first national park, this flagship park receives more than 3 million visitors per year. Accessible from each side of the park, some entrances and roads are closed during the winter due to weather conditions.

The Western Transportation Institute and Montana DOT have been working on regional initiatives in the Greater Yellowstone area (7). The first phase began in 1997 with the goals of developing a regional ITS strategic development plan and implementing "early winner" projects. Early winner projects that are being implemented include interactive touch-screen kiosks, dynamic warning variable message signs, automatic vehicle identification/smart cards at park entrances, and an incident management plan. Each of these projects is currently being evaluated.

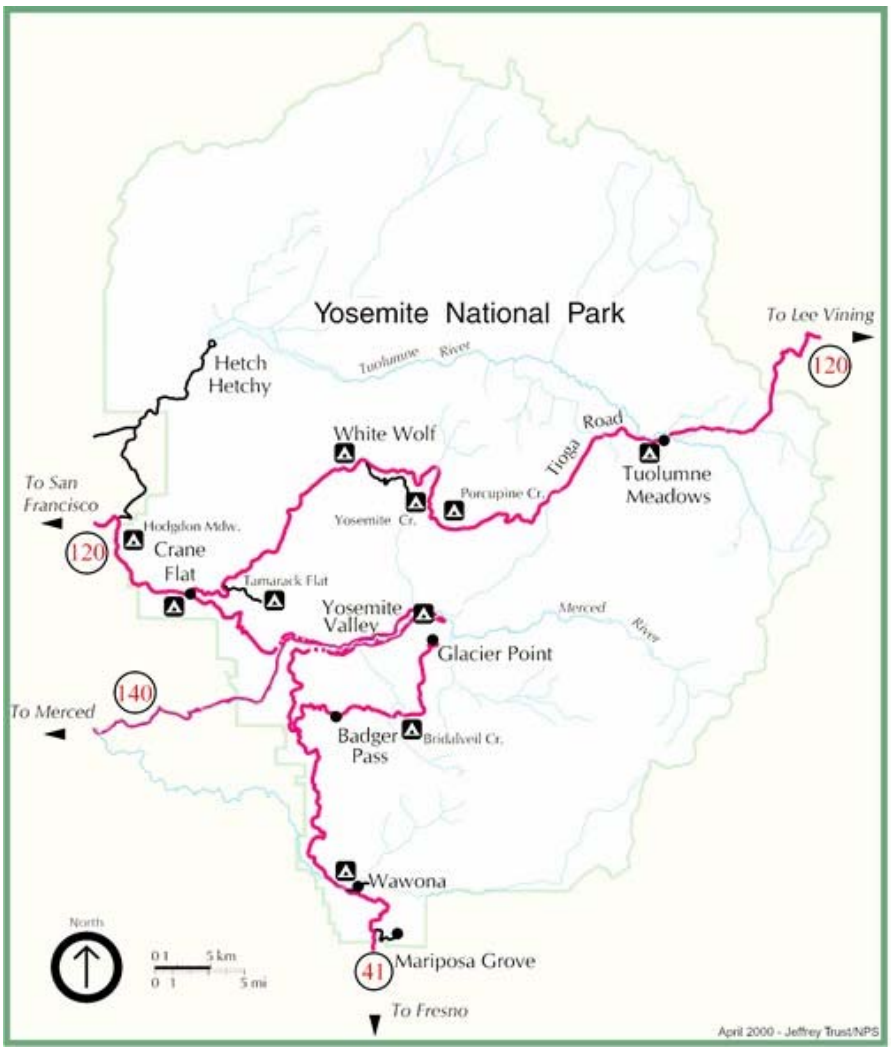

Figure 2-9: Detailed Map of Yosemite National Park

(Source: National Park Service)

2.9 Yosemite National Park

Located in the Sierra Mountains in California, Yosemite National Park, shown in Figure 2-9, is another of the flagship parks. Located on over 700,000 acres of mountains and valleys, Yosemite receives more than 3 million visitors annually, and experiences significant congestion in the summer months. As is the case at Yellowstone, some of the park roads are closed during the winter months.

Caltrans and Yosemite conducted a Field Operational Test on the Yosemite Area Traveler Information System in the mid-1990s (4). The system is designed to disseminate weather, traveler and road condition information. ITS tools used were VMSs, highway advisory radio (HAR), a traveler advisory telephone system, kiosks and the Internet.

A project called "Vehicle Management System Concept Development for Yosemite National Park" focused on researching various ITS concepts that could help to manage vehicle entry into and within the Park. Some of the system concepts included parking management, entrance gate management, traffic management/network monitoring, developing a short-term forecast model for traffic movements, a central communications center, visitor information systems, transit service expansion, fleet management, and incident/rescue management.

3 REVIEW OF PARK SELECTION PROCEDURE

Key to the success of this project is the procedure for selecting Parks. This chapter reviews the process that was used for identifying and selecting Parks for this study.

3.1 Park Classification

The National Park Service manages 23 units within the State of California, as shown in Figure 1-1. These parks exhibit considerable diversity in terms of park location, size, visitation levels and patterns, typical visitor activities, and many other factors, as shown in Table 3-1. From this diversity of parks, the research team hoped to select between one and three Parks that would be representative of many of the other Parks in the state.

An earlier technical memorandum reviewed several alternative methods for classifying National Park units within California (8). After analyzing the strengths and weaknesses of each classification method, the technical memorandum recommended that NPS designations, such as National Park, National Recreation Area and others, were useful categories to represent and encompass the diversity of the parks. The attributes of each of these classifications are described as follows.

- Historic Park/Site. The five sites in this class are all small, urban parks with limited overnight visitation. While annual visitation levels may have considerable variation, there is limited peaking in visitation through the year.

- Monuments. There is more diversity within this class than the other three. These five sites are small to medium in size, and may have some overnight visitation, but have different visitation, peaking and location characteristics.

- Parks/Preserves. All nine of the units in this group may be characterized as being medium to large units located in rural areas, with significant overnight visitation. There is variation within this class regarding annual visitation levels and land type.

- Recreation Areas/Seashores. These four units are medium in size, are located near or on the water, and are typically located near urban areas. They experience limited overnight visitation, have strong annual visitation, but show limited peaking in visitation. Whiskeytown National Recreation Area, located near Redding, is somewhat unique from the others in this category, as it does have some peaking in visitation and is classified as rural.

3.2 Project Kickoff Meeting

On July 20, 2001 in Sacramento, the research team met with staff from several organizations:

- Caltrans New Technology & Research Staff;
- National Park Service Western Regional Office;

Table 3-1: Comparison of Selected Park Attributes.

	Annual Visitation		Peak Visitation (4)			Urban / Rural (6)	VTS (7)	Size		Designation	Land Type (9)	Overnight Stays	
Park (1)	Number	Level (3)	Number	% of Year	Level (5)			Acreage	Level (8)			Ratio (10)	Level (11)
Eugene O'Neill NHS	**3,400**	**1**	**1,438**	**42%**	**2**	**Urban**	**Yes**	**13**	**Small**	**Historic Park/Site**	**Land**	**-**	**1**
Fort Point NHS	**1,682,903**	**4**	**502,945**	**30%**	**1**	**Urban**	**No**	**29**	**Small**	**Historic Park/Site**	**Land/Water**	**-**	**1**
John Muir NHS	**30,992**	**1**	**10,184**	**33%**	**1**	**Urban**	**No**	**345**	**Small**	**Historic Park/Site**	**Land**	**-**	**1**
Manzanar NHS (2)	**38,010**	**1**	**18,360**	**48%**	**3**	**Rural**	**No**	**814**	**Small**	**Historic Park/Site**	**Land**	**-**	**1**
SF Maritime NHP	**3,535,315**	**4**	**1,244,731**	**35%**	**2**	**Urban**	**No**	**50**	**Small**	**Historic Park/Site**	**Land/Water**	**0.32**	**1**
Cabrillo NM	1,167,486	4	364,876	31%	1	Urban	No	160	Small	Monument	Land/Water	-	1
Devils Postpile NM	152,642	2	101,580	67%	4	Rural	Yes	798	Small	Monument	Land	3.65	2
Lava Beds NM	135,180	2	67,665	50%	3	Rural	No	46,560	Medium	Monument	Land	2.75	2
Muir Woods NM	883,164	3	321,262	36%	2	Urban	No	554	Small	Monument	Land	-	1
Pinnacles NM	164,854	2	59,442	36%	2	Rural	No	16,265	Medium	Monument	Land	-	1
Channel Islands NP	**607,057**	**3**	**217,906**	**36%**	**2**	**Rural**	**Yes**	**249,561**	**Medium**	**Park/Preserve**	**Water**	**26.99**	**4**
Death Valley NP	**1,227,583**	**4**	**376,567**	**31%**	**1**	**Rural**	**No**	**3,367,627**	**Large**	**Park/Preserve**	**Desert**	**19.51**	**3**
Joshua Tree NP	**1,316,340**	**4**	**488,864**	**37%**	**2**	**Rural**	**No**	**1,017,748**	**Large**	**Park/Preserve**	**Desert**	**19.27**	**3**
Kings Canyon NP	**559,534**	**3**	**279,660**	**50%**	**3**	**Rural**	**Yes**	**461,901**	**Large**	**Park/Preserve**	**Land**	**43.08**	**4**
Lassen Volcanic NP	**353,756**	**2**	**220,420**	**62%**	**4**	**Rural**	**No**	**106,372**	**Medium**	**Park/Preserve**	**Land**	**23.61**	**3**
Mojave National Preserve	**391,694**	**2**	**111,855**	**29%**	**1**	**Rural**	**No**	**1,546,626**	**Large**	**Park/Preserve**	**Desert**	**1.74**	**2**
Redwood Nat'l and State Parks	**369,726**	**2**	**158,710**	**43%**	**2**	**Rural**	**No**	**112,598**	**Medium**	**Park/Preserve**	**Land/Water**	**18.91**	**3**
Sequoia NP	**873,229**	**3**	**433,726**	**50%**	**3**	**Rural**	**Yes**	**402,510**	**Large**	**Park/Preserve**	**Land**	**31.34**	**4**
Yosemite NP	**3,493,607**	**4**	**1,701,334**	**49%**	**3**	**Rural**	**Yes**	**761,266**	**Large**	**Park/Preserve**	**Land**	**44.39**	**4**
Golden Gate NRA	14,048,085	5	3,810,277	27%	1	Urban	Yes	73,690	Medium	Rec. Area/Seashore	Land/Water	0.58	1
Point Reyes NS	2,300,631	4	746,781	32%	1	Urban	Yes	71,068	Medium	Rec. Area/Seashore	Water	1.47	2
Santa Monica Mountains NRA	555,529	3	179,176	32%	1	Urban	No	153,787	Medium	Rec. Area/Seashore	Land/Water	0.03	1
Whiskeytown NRA	716,526	3	342,421	48%	3	Rural	No	42,503	Medium	Rec. Area/Seashore	Land/Water	5.38	2

(1) - NHP = National Historic Park; NHS = National Historic Site; NM = National Monument; NP = National Park; NRA = National Recreation Area; NS = National Seashore

(2) - Only partial year statistics available for Manzanar NHS (April to December 2000)

(3) - Higher numbers refer to higher visitation levels (5 = greater than 5 million visitors per year; 4 = between 1 and 3 million visitors per year; 3 = between 500,000 and 1 million visitors per year; 2 = between 100,000 and 500,000 visitors per year; 1 = less than 100,000 visitors per year)

(4) - Peak three consecutive months

(5) - Higher numbers refer to higher peak visitation percentages (4 = at least 55 percent of annual visitation occurs in peak three consecutive months; 3 = between 45 and 55 percent of visitation; 2 = between 35 and 45 percent of visitation; 1 = between 25 and 35 percent of visitation)

(6) - Urban - located within 50 miles of the Los Angeles, San Diego or San Francisco metropolitan areas.

(7) - Visitor transportation system.

(8) - Large = greater than 320,000 acres (500 sq. mi.); Medium = between 16,000 and 320,000 acres (25 - 500 sq. mi.); Small = less than 16,000 acres (25 sq. mi).

(9) - Desert = the Park is located in a desert setting; Land = the Park is landlocked but not in a desert setting; Land/water = part of the unit is on land and the other part includes or is bordered by water; Water = all or a majority of the unit is surrounded by water.

(10) - The number of annual overnight stays divided by annual visitation.

(11) - Higher numbers refer to higher ratios (4 = greater than 25; 3 = between 10 and 25; 2 = between 1 and 10; 1 = less than 1)

Source: National Park Service - visitation statistics, 2000; land size statistics, July 2001.

Table 3-2: Criteria for Selection of Parks.

	Requirements	Very Helpful	Helpful
Support from NPS Unit for Research	X		
Availability for Meetings in September	X		
Support for Phase 2 of Project (Demonstration of ITS)	X		
Existence of Recent General Management Plan (last 5 years)		X	
Concurrent Transportation Planning Efforts		X	
Active Supporting Stakeholders (e.g. Park associations, cities, counties, etc.)		X	
Availability of Recent Visitor Surveys (last 10 years)		X	
Travel Patterns Data (e.g. origin-destination information, traffic counts, etc.)		X	
Infrastructure Data (e.g. roadway and parking capacity estimates, availability of transit, level of degradation of roadway system, etc.)			X
Park Engagement in Other ITS Initiatives			X

- National Park Service Units (Channel Islands NP, Golden Gate NRA, Yosemite NP); and
- Federal Highway Administration, Central Federal Lands Highway Division.

One of the goals of this meeting was to initiate the park selection process. As a result of the discussion, the research team was tasked with developing a list of criteria that would be required or helpful in ensuring successful work at a given park. The list of criteria developed is shown in Table 3-2.

3.3 NPS Review

NPS regional staff reviewed the criteria and researched parks that would be applicable for this project. On the basis of this review, there were initial recommendations to pursue surveys at three parks: Golden Gate National Recreation Area, Joshua Tree National Park, and Sequoia and Kings Canyon National Park. In order to better focus study resources, it was recommended that two Parks – Golden Gate and Sequoia/Kings Canyon – serve as the case studies for this project. These parks will be discussed in more detail in Chapters 4 and 5.

4 SEQUOIA & KINGS CANYON NATIONAL PARKS

4.1 Description of Park & History

Sequoia and Kings Canyon National Parks are often referred to as California's best-kept secret and are open year-round to visitors. Within these parks visitors may see the largest tree on earth or hike to the highest point in the contiguous United States. Consisting of nearly 900,000 acres, Sequoia and Kings Canyon National Parks allow activities such as cross-country skiing, snowshoeing, hiking, camping, and informative educational programs.

According to the General Management Plan, the primary purposes of the Sequoia and Kings Canyon National Parks are to:

- protect forever the greater Sierran ecosystem and its natural evolution,
- provide appropriate opportunities to present and future generations to experience and understand park resources and values,
- protect and preserve significant cultural resources, and
- champion the values of national parks and wilderness (9).

4.1.1 Geography and History

Sequoia and Kings Canyon National Parks are located on the eastern side of the San Joaquin Valley in the Sierra Nevada Mountains. The parks are west of Death Valley National Park and east of Fresno, as shown in Figure 4-1. To the north of Sequoia and Kings Canyon National Parks are Sequoia and Sierra National Forests and Yosemite National Park. To the south, Inyo and Sequoia National Forests border the park. The park is located in Fresno and Tulare counties, through which the only highway access to the park comes. Inyo County borders the park on the east and provides access to backcountry users. Fresno and Visalia are the two principal cities located nearest the Park entrances, with Squaw Valley and Three Rivers serving as the gateway communities.

Sequoia National Park was established on September 25, 1890 and is the second-oldest national park in the United States. The initial legislation established Sequoia to be "a public park, or pleasure ground, for the benefit and enjoyment of the people." Within one week of establishing Sequoia National Park, Congress increased the park's size threefold and created General Grant National Park to preserve Grant Grove. Kings Canyon National Park was later created on March 4, 1940, which absorbed General Grant National Park (10).

Sequoia National Park contains 402,510 gross acres and includes some prominent national treasures. The Giant Forest, named in 1875 by explorer and conservationist John Muir, is the park's most famous attraction. This forest consists of a giant sequoia grove and large, beautiful meadows. Contained within the Giant Forest is the General Sherman Tree that is considered the largest living tree in the world by volume. Believed to be approximately 2,100 years old, the General Sherman Tree weighs nearly 2.7 million pounds and has a base circumference of 102.6 feet. Other significant park attractions include Moro Rock, Crescent Meadow, Tharp's Log, Auto Log, Tunnel Log, and Crystal Cave.

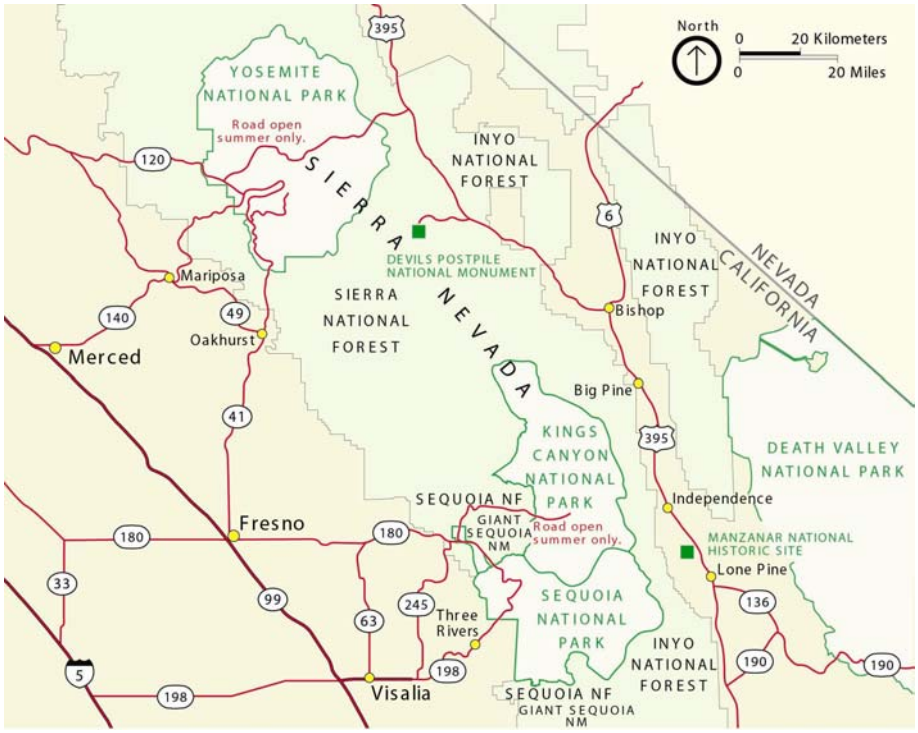

Figure 4-1: Area Map of Sequoia and Kings Canyon National Parks.
(Source: http://www.nps.gov/carto)

Kings Canyon National Park is adjacent to Sequoia National Park and contains 461,901 gross acres. Once described by Muir as "a rival to the Yosemite," Kings Canyon National Park has many great attractions. Grant Grove and the General Grant Tree were discovered by Joseph Hardin Thomas in 1862 and named to honor Ulysses S. Grant. The General Grant Tree is the earth's third-largest tree by volume and is dubbed "The Nation's Christmas Tree" by many. Other great attractions within the park include Big Stump Trail, Panoramic Point, Cedar Grove, Boyden Cave, and Zumwalt Meadow.

In addition to the specific visitor locations listed, Sequoia and Kings Canyon National Parks are also unique because they have:

- an extraordinary continuum of ecosystems arrayed along the greatest vertical relief (1,370 to 14,495 feet elevation) of any protected area in the lower 48 states;
- the highest, most rugged portion of the high Sierra Mountains, which is part of the largest contiguous alpine environment in the lower 48 states;
- magnificent, deep, glacially carved canyons, including Kings Canyon, Tehipite Valley and Kern Canyon;
- the core of the largest area of contiguous designated wilderness in California, the second largest in the lower 48 states;
- the largest preserved southern Sierran foothills ecosystem;

- almost 200 known marble caverns, many inhabited by cave wildlife that is found nowhere else; and
- a wide spectrum of prehistoric and historic sites documenting human adaptations in

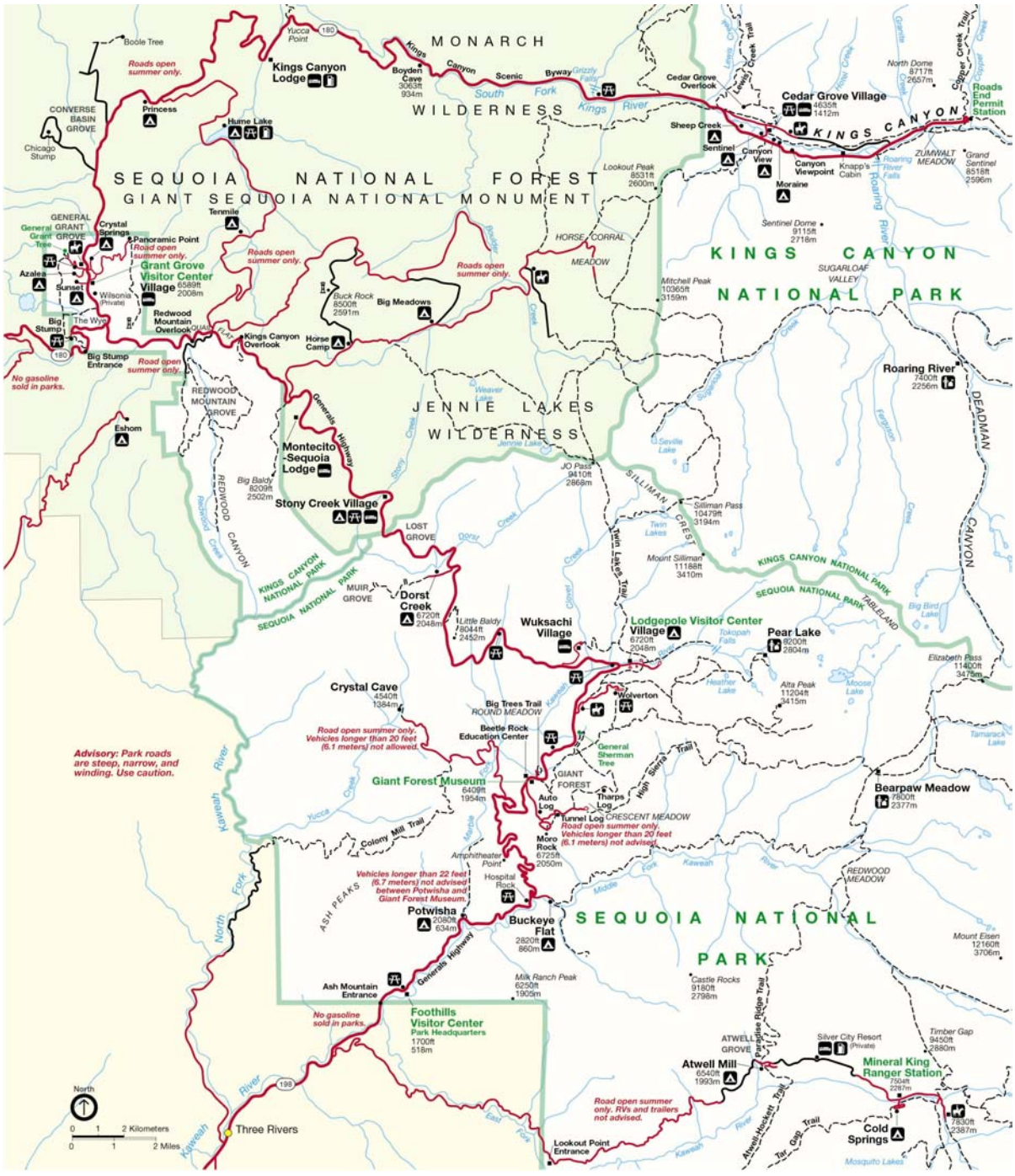

Figure 4-2: Detailed Map of Sequoia and Kings Canyon National Parks.
(Source: http://www.nps.gov/carto)

their historic settings throughout the Sierran environments (9).

A more detailed map of the Park is provided in Figure 4-2. While the two Parks were created under different congressional legislation with slightly different statutory objectives, they are managed as one. The adjoining National Forests are under the administration of the U.S. Department of Agriculture Forest Service. President Clinton created Giant Sequoia National Monument out of 327,769 acres of Sequoia National Forest in April 2000 (11). The designation mandated the development of a management plan for the monument within three years, a plan that shall include "a transportation plan for the Monument that provides for visitor enjoyment and understanding about the scientific and historic objects in the monument, consistent with their protection." (12) The designation leaves the land under the management of the Forest Service, but restricts the character of multiple-use management that was previously in place.

4.1.2 Visitation

Figure 4-3 shows NPS statistics for annual visitation at Sequoia and Kings Canyon National Parks. Park staff has indicated that these statistics are of questionable credibility, and that visitation has been either stagnant or increasing slightly for a number of years[1]. Visitation during 2000 was approximately 1.4 million visitors[2].

Many visitors to Sequoia and Kings Canyon - more than 33 percent in 2000 - stay at the park overnight; Figure 4-4 shows the accommodations used by these visitors during their stay in

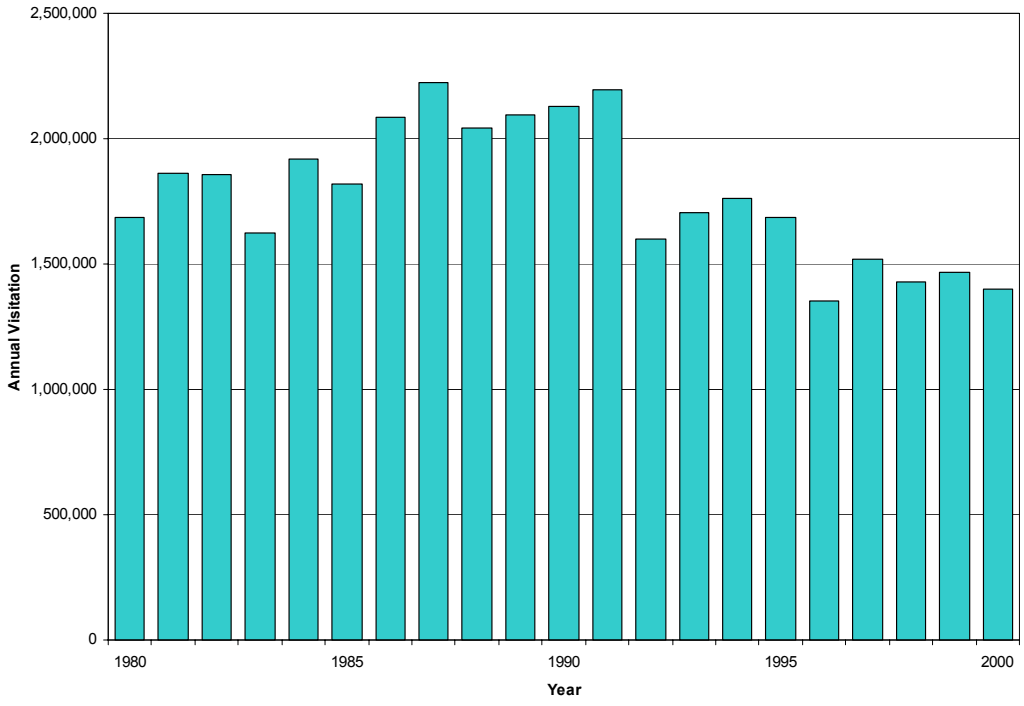

Figure 4-3: Annual Visitation Statistics at Sequoia and Kings Canyon National Parks. (Source: National Park Service)

[2] Total park visitation is the sum of visitation to Sequoia and visitation to Ki
both parks during one visit, they are double counted in the " annual visitation" total.

the park. More than 75 percent of overnight visitors camp: in tents (35 percent), the backcountry (27 percent) or RVs (15 percent).

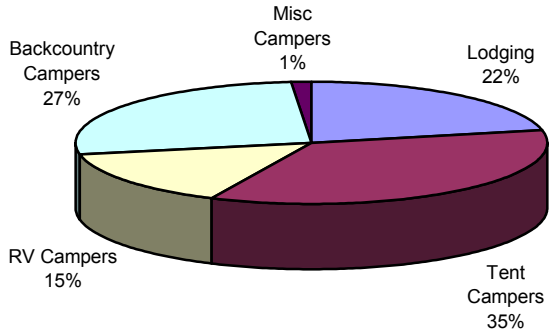

Figure 4-4: Accommodations for Overnight Visitors at Sequoia and Kings Canyon National Parks.

(Source: National Park Service)

Visitors to Sequoia and Kings Canyon National Parks can still find a raw, roadless wilderness that is not plagued by crowds and over-development. Hikers may hike the Pacific Crest-Trail, summit Mount Whitney, or wander through Cedar Grove. Rock climbers will find high quality climbing rock and very few other climbers. The Charlito Dome and Charlotte Dome are great areas to climb with multi-pitch possibilities. During their stay, most visitors drive the Generals Highway from Ash Mountain to Hospital Rock, which was originally built by the Mt. Whitney Power Company. Hospital Rock is a site on the Middle Fork of the Kaweah River where visitors may learn about a sub-group of the Monache, or Western Mono, Indians who settled in the area as early as 1350. The Amphitheater Point is an exceptional location to see the active wildlife of the Sequoia and Kings Canyon National Parks. Wildlife found in the three river systems, alpine lakes, waterfalls, canyons, glaciated valleys, mountain meadows, conifer forests and groves of sequoias include black bears, mule deer, mountain lions, martens, fishers and wolverines. From the four in-park pack stations, visitors may take horseback trips that range from hourly to overnight excursions. These trips allow visitors to access the further corners of the park without exhausting themselves.

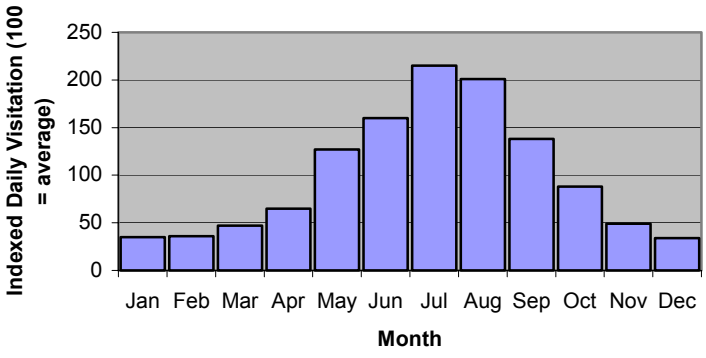

Figure 4-5: Seasonal Patterns in Visitation at Sequoia and Kings Canyon National Parks.

(Source: National Park Service)

While visitation peaks in the summer, as shown in Figure 4-5, the park also offers winter recreation opportunities. Skiing and snow sports are also popular in Sequoia and Kings Canyon National Parks where 75 miles of marked trails exist.

Results from a national survey conducted by University of Idaho's Cooperative Park Studies Unit (UICPSU) in 1998 indicate that people visit Sequoia and Kings Canyon National Parks because they enjoy these less crowded experiences and would like to see the park maintain that atmosphere. However, these

parks are receiving a greater influx of people who are searching for the non-crowded areas. According to UICPSU's survey, 91 percent of respondents were satisfied with the overall quality and opportunities present within the parks (9). While this survey indicates a high level of public satisfaction, park officials feel that the types and numbers of park users will greatly change in the next 30 years resulting in lower public satisfaction (9). Broken into three separate categories, the park survey indicates the visitors' satisfaction for park facilities, visitor services, and recreational opportunities.

- Park Facilities. Visitors' overall satisfaction level was rated for the visitor center (91 percent satisfied); exhibits (85 percent satisfied); restrooms (64 percent satisfied); walkways, trails, and roads (91 percent satisfied); campgrounds and picnic areas (90 percent satisfied). The combined park facilities satisfaction measure was 83 percent.

- Visitor Services. Under the broad topic of visitor services, visitors were asked to rate assistance from park employees (95 percent satisfied); park map or brochure (91 percent satisfied); ranger programs (89 percent satisfied); and commercial services in the parks (60 percent satisfied). The combined visitor services satisfaction measure was 84 percent.

- Recreational Opportunities. Under the broad topic of recreational opportunities, respondents were asked to rate learning about nature, history, or culture (89 percent satisfied); outdoor recreation (87 percent satisfied); and sightseeing (92 percent satisfied). The combined visitor services satisfaction measure was 90 percent (9).

4.1.3 Transportation System

Sequoia and Kings Canyon National Parks have two primary paved roads that access the parks on the west: Highway 198 and Highway 180. Highway 198 runs from Visalia in the central valley to the southern entrance of the park, where it becomes Generals Highway. Generals Highway passes through the Northwest corner of Sequoia National Park, part of Sequoia National Monument, and then intersects with Highway 180 near General Grant Tree at Wilsonia. To the west, Highway 180 connects to Fresno. To the east, Highway 180, also known as Kings Canyon Highway, enters Kings Canyon National Park and turns into a secondary road within the heart of Kings Canyon National Park. Kings Canyon Highway is open only during the summer. Two other roads access Sequoia National Park from the southwest; however they dead-end and are not open year-round. Generally the roads within Sequoia and Kings Canyon National Parks are mountainous, being both steep and windy. Few turnouts and inattentive drivers cause large lines of vehicles to backup from 10 am to 5 pm during the summer months.

In past summers the Giant Forest Shuttle, a concessionaire-operated shuttle, provided public transportation in Sequoia and Kings Canyon National Parks; however, due to financial shortages, it is no longer operational. Before losing funding, the shuttle ran from the Wuksachi Lodge to Lodgepole, General Sherman Tree, and Crescent Meadow. The future of the Giant Forest Shuttle is questionable until some additional funding can be found.

There are few transportation options available for those who either cannot or choose not to use a personal automobile. Several tour bus companies connect the Park to nearby communities,

especially from Fresno, since Highway 180 is designed with better turning radii to handle larger vehicles. There has been a resurgence of interest in developing high-speed passenger rail service in the San Joaquin Valley, which could eventually be connected to feeder bus service to the park. For those who choose to fly, the closest commercial airports are in Fresno and Visalia. Bicycles are not allowed on any of the trails in Sequoia and Kings National Parks, and due to the windy and steep terrain, they are generally advised not to ride on the highways. Also, there are no separate bike lanes within the park.

Generals Highway is currently being rebuilt as a slightly wider two-lane road with additional pullouts and redesigned overlooks. The purpose of this reconstruction is to improve safety and driving conditions, while maintaining the historic character and alignment of the roadway. Kings Canyon Highway has also seen some recent repair on nine miles of Forest Service road damaged by storm drainage. These repairs have restored access to the park.

4.2 Existing Management Goals

Since 1998, Sequoia and Kings Canyon National Parks have been working on a new comprehensive planning effort to determine its future while protecting and preserving the magnificent resources available. The last general management plan (GMP) for Sequoia and Kings Canyon National Parks was completed in 1971. The purpose of the new GMP is to provide goals and vision for the parks' future as well as provide guidance in the continuation of wildlife and resource management. Visitor surveys, transportation studies, and stakeholder feedback were obtained as part of the development process for the GMP. In addition to these studies, a National Register of Historic Places determination of eligibility study for the Mineral King area was performed, which resulted in the Mineral King area being added to the National Register of Historic Places.

The new GMP will not be completed until 2002 or 2003. It will reflect a combination of actions prescribed in four different management strategies:

- maintaining the current management strategy;
- managing to limit visitation growth;
- guiding visitation growth while trying to preserve the current visitor experience; and
- guiding growth while allowing for a changed visitor experience.

4.2.1 Visitor Experience, Congestion, and Crowding Goals

During the development of the GMP, feedback was requested from the stakeholders regarding their concerns and preferred future management of the park. A vast majority of respondents replied they do not want the experiences that the parks provide to change. However, a management plan is needed to preserve the visitor experience as visitation increases. Different management options were then drafted to fully explore the benefits and drawbacks of each plan. Additional stakeholder input was requested on whether the park should focus on day-use or extended-stay visitor experiences.

The GMP has developed some general guidelines for visitor experience for the frontcountry and backcountry. The frontcountry is broken into subgroups and given general management prescriptions.

- Low-Use Frontcountry. These areas are accessed by day-visitors, but are off the highly beaten path. These are natural areas that are accessed by trail or roads and have high-quality features. Visitors can have a relatively uncrowded experience compared to what they might find in higher-use areas and main attractions. They have the option of taking trails that lead away from roads and high use visitor areas. On these trails, visitors can find information about the trail, surrounding area and conditions.

- High-Use Frontcountry. These areas include natural areas with trails, roads, or recreational opportunities that attract many day visitors because of high-quality features and easy access. These areas are generally within a mile of a road corridor. Examples of these areas include Giant Forest trail system, Tokopah trail, and Big Stump. The general desired visitor experience for these areas is to allow visitors to get off the road and experience some solitude away from many of the sights and sounds of the nearby roadways.

- Features. Features are the main attractions of the parks and experience a high number of visitors. The level of use for features may be managed at certain sites to enhance the quality of the experience for visitors. Some thought is being given to providing seasonal shuttle service to and within these feature areas to decrease parking and other traffic concerns. Examples of features include General Grant Tree, Moro Rock, and Crystal Cave. Visitors in these areas can expect to be in a more social environment where crowding is common during the summer season. Solitude at these locations is not common except during low-use times. Visitors can expect to find information through educational activities, guides, and information booths. All visitors including the disabled will easily access these sights. Features such as Moro Rock, which cannot be accessed by the handicapped, will have other methods of helping the disabled understand the experience.

- Park Development. Park development includes villages, campgrounds, park operation areas, and residential areas. Depending upon the location and the type of village or campground, visitor experience ranges from a rustic, natural setting with few people to slightly crowded areas that offer educational, recreational, and other services. Campgrounds, for example, range from primitive self-serve campgrounds to campgrounds with amenities. Respectively, each of these will offer a different experience.

Similar to the frontcountry, the backcountry is also broken into subgroups as follows.

- Backcountry Threshold. The threshold for the backcountry includes areas close to trailheads that may be heavily used. Visitors using these areas are day hikers or overnight travelers passing through the area on highly maintained trails. These areas provide visitors with some opportunities for solitude away from the sights and sounds

of nearby roads and other users. Camping in these areas is prohibited and stock may be permitted in some areas.

- Major Trail Corridors. These trails extend beyond the backcountry threshold and provide maintained trails for large parties and stock. Trails such as Pacific Crest Trail, John Muir Trail, High Sierra Trail, and Rae Lake Loop are considered to be major trail corridors. Visitors have a moderate to high probability of encountering others while camping or traveling through the area.

- Secondary Trail Corridor. Secondary trail corridors are trails that can be accessed from occasionally maintained trails; however they cannot sustain heavy use due to the fragility of the surroundings. Colby Pass to Kern Kaweah, Tehipite to Pacific Crest Trail, and Martha Lake north to the Pacific Crest Trail are examples of secondary trail corridors. Visitors are overnight campers and can expect very few encounters with others and see little evidence of previous visitors in the area.

- Cross-Country Areas. Described as remote, low-use areas that have no maintained areas, the cross-country areas of the backcountry exhibit very little human impact or intervention by humans. Generally these areas are more difficult to travel in because there are no maintained trails. Examples of these areas are Rock Creek-Miter Basin and Dusty Basin. Most visitors to these areas are at least overnight users while many must spend a minimum of two nights out to reach these areas. Visitation to these areas is very low and encounters with others are unlikely.

4.2.2 Transportation Planning and Management Goals

The roads in and near the parks are being prescribed a general management plan similar to the surrounding areas. However, stakeholder comments have made it evident that the experience provided by Generals Highway is an important part of a visit to Sequoia and Kings Canyon (9). Accordingly, this type of experience should be preserved as much as possible. Additionally others valued the ability to drive some of the backroads in the area and would like to see that experience preserved also. Thus the park decided to break the area into two separate groups.

- High-Use Scenic Driving. These roads are generally paved roads in good condition that provide sightseeing opportunities of the natural environment as well as great vistas and panoramas. Generals Highway is an example of such a road. The desired experience on these roads is to provide a safe and pleasant driving environment. The parks would like to see these roads kept well-maintained and moderate speeds (45 mph) enforced. It is desired that the traffic in these areas is free flowing; however, it is expected that congestion will occur during midday, when parking areas are filled, and where wildlife may be viewed from the roads.

- Backroad Driving. Low-speed, low-use, narrow roads that follow the natural terrain characterize backroad driving. These roads may be paved or unpaved and may sometimes have restrictions or designated use. Vehicle sizes may also be limited for safety reasons. Mineral King Road, Crescent Meadow Road, and Redwood Mountain are example of roads that would be designated for backroad driving. For visitors, the

goal is to provide motorists, bicyclists, or others with the opportunity to traverse at lower speeds with less crowding. Because these roads are narrow, curvy and have steep grades, motorists will need to be very alert.

4.3 Documentation of Previous Park Studies

In March 1999, a transportation study was completed on Sequoia and Kings Canyon National Parks (13). This study focused on collecting data and formulating a forecast for future conditions and presenting recommendations for the GMP. Some of the data collected during this study includes traffic counts; parking occupancy, duration and turnover; visitor entry and exit patterns; length of stay; and areas visited. A level of service (LOS) analysis for major intersections and roadways was also performed. Some of the major findings of this report include the following.

- Roads. During the summer months, several park roadways are currently operating at level of service D. This level of service means that traffic flow is restricted and unstable, and there is limited ability for vehicles to maneuver. Locations with this level of service include several on Generals Highway (south of Moro Rock, south of Lodgepole, north of Lost Grove, east of Kings Canyon Highway and east of Redwood Mountain Road), as well as Kings Canyon Highway near the Big Stump entrance and Grant Grove, Moro Rock Road, and Lodgepole Road. Other park roads operate at LOS C or better during the summer, which is the peak traffic season.

- Intersections. The highest traffic volumes for any intersection in the park are experienced at the General Highway/Kings Canyon Highway intersection. A level of service analysis indicated that this stop-controlled intersection performs at level of service B, which indicates generally stable flow. All other intersections operate at LOS B or better.

- Parking. Some of the areas where parking is at or near capacity during the summer season include the Ash Mountain Visitors Center, Moro Rock, Crescent Meadow, the Sherman Tree, the Lodgepole Visitor Center, Grant Grove, and Grant Tree. Big Stump has parking capacity issues during the winter season. Surplus parking was observed year-round at Wolverton, and at most parking areas during the winter and spring seasons.

- Visitation Growth. NPS forecasts used in this study indicated an expected increase in visitation of 23 percent from 1997 to 2010. Visitation growth is expected to degrade roadway level of service to D for several roadways in the Park, and would result in parking shortages at the areas described in the previous section.

The study noted that the parks plan to implement a shuttle system, which will help alleviate parking shortages at Moro Rock and Sherman Tree. This shuttle would connect these destinations to day-use parking at Wolverton and overnight-use parking at Wuksachi. Using parking, traffic, and forecasted conditions, the study included the following recommendations for the parks:

- Generals Highway/Kings Canyon Highway Intersection. In the event of future reconstruction in this area, a modified design of this intersection should be considered to change the geometry to a T-intersection to decrease the possibility of head-on collisions.

- Generals Highway/Moro Rock Road Intersection. An unfamiliar layout of this intersection creates confusion for many drivers. Planned modifications of the intersection and possible closure of the existing parking area at the Giant Forest Store and the possibility of closing Moro Rock Road to public vehicles would improve the geometry of the intersection[3].

- Mineral King Road. Mineral King is a narrow, winding road with sharp curves and poor pavement conditions. Although data does not show any vehicles of extended lengths using this road, it is recommended that a maximum vehicle length of 22 feet be set for this road.

- Level of Service. Kings Canyon Highway between Big Stump and Grant Grove Visitor Center experiences the heaviest traffic of anywhere in the park. Traffic data predicts that this area will see a LOS D by the year 2010. Some roadway improvements or new roadway alignments in this area may be appropriate if a LOS D is found undesirable in the park. Moro Rock Road is the second location to be predicted to have a LOS D by 2010; however, if Moro Rock Road is closed to public vehicles, this problem will be eliminated.

- Guardrail. Some of the existing guardrail within the park does not conform to current specifications, which presents a potential hazard. The transportation study recommends that an analysis of the existing and potential guardrail be completed throughout the park.

- Potential Parking Shortages. Parking shortages are currently realized at Crescent Meadow and Sherman Tree during the summer months. Since opportunities to expand parking are limited by potential resource impacts, the report cites the underutilized Wolverton lots and new shuttle service as potential solutions.

- Visitor Shuttles. As visitor use increases in the next few years, the use of a shuttle will become more appropriate as visitor parking spaces become more limited. Particular areas that may be well served by having a shuttle include Sherman Tree, Giant Forest, Moro Rock Road, and Grant Grove. Recommendations were made to complete additional studies to assess the costs and benefits of each shuttle.

In June 1998, the University of Idaho's Cooperative Park Studies Unit conducted a visitor satisfaction survey. Initiated by the Government Performance and Results Act, the purpose of this survey was to measure the park performance related to goals for visitor satisfaction and visitor understanding and appreciation. Visitors were asked to rate the park facilities, services,

[3] Modifications to this intersection have recently been completed.

and recreational opportunities. The results of this visitor satisfaction survey show that 91 percent of park users are satisfied with the overall quality and experience the parks provide (9).

4.4 Relationship to Other Transportation Plans

This section addresses other transportation planning that is occurring in the vicinity of Sequoia and Kings Canyon National Parks to identify whether or not these planning initiatives include transportation problems and solutions for the parks. Three planning efforts are occurring within this area. They include the Tulare County Regional Transportation Plan, Fresno County Regional Transportation Plan, and San Joaquin Valley ITS Strategic Deployment Plan. Their relationship to Sequoia and Kings Canyon National Parks transportation problems is described below.

4.4.1 Tulare County Regional Transportation Plan

Tulare County does not address specific goals or initiatives related to the Sequoia and Kings Canyon National Parks within its Regional Transportation Plan (14). However, it does recognize that highways within Tulare County experience the highest traffic volumes on weekends when long distance travelers are headed to the National Parks, forests, wilderness areas, and lakes. The Regional Transportation Plan notes that careful planning and implementation of improvements on mountain roads leading into the recreational areas is justified to keep these facilities safe and efficient.

4.4.2 Fresno County Regional Transportation Plan

The 2001 Regional Transportation Plan developed by the Council of Fresno County Governments (15) notes that Tulare County opportunities include providing safety along routes that provide access to the National Parks system. In addition, Tulare County has the opportunity to improve traveler information.

4.4.3 San Joaquin Valley ITS Strategic Deployment Plan

The San Joaquin Valley ITS Strategic Deployment Plan (16), which covers eight California counties including both Fresno and Tulare Counties, includes a project recommendation for an advanced traveler information system project focused on National Parks in the area, including Sequoia and Kings Canyon National Parks, as well as Yosemite National Park.

4.5 Summary of Stakeholder Outreach

A stakeholder meeting occurred on November 14, 2001 at Sequoia and Kings Canyon National Parks. The goals of this meeting were to introduce this project to the parks' stakeholders, listed in Appendix A, to identify potential stakeholders that are absent from the meeting, and to gather stakeholders' opinions on transportation needs and challenges within the parks.

As a follow-up to this meeting, surveys, shown in Appendix B, were sent to stakeholders – both those who attended the meeting and those identified as missing – to gain additional

feedback and more detailed information about stakeholders' knowledge of intelligent transportation systems (ITS) and the possible use of ITS within the parks. Table 4-1 shows the list of stakeholder organizations, how many surveys were sent out to each stakeholder organization, and how many surveys were received back. In total 59 surveys were sent out and 10 were returned.

Based on the stakeholder meeting and the surveys, the following were cited as potential solutions to specific transportation challenges within Sequoia and Kings Canyon National Parks.

1. Construction/Work Zone Coordination. This would allow maximum use of roadways while construction is occurring and would limit the amount of extra congestion that generally goes along with a work zone. Better coordination of projects would help gain public support for construction of roads in need, such as Crescent Meadow and Crystal Cave.

2. Incident Management. This would allow better coordination between emergency vehicles and emergency agencies. It would allow for integrated emergency management and lessen the long response times for emergencies, which was cited as a current challenge.

3. Parking Management. This system would allow for electronic monitoring and management of parking facilities. Coordination between parking management and pre-trip information would help decrease parking congestion at certain locations within the park, such as Lodgepole, Grant Village, Beetle Rock Education Center,

Table 4-1: Sequoia and Kings Canyon National Park Stakeholders.

Stakeholders	# Surveys Sent	# Surveys Returned	Stakeholders	# Surveys Sent	# Surveys Returned
NPS Park Staff	2	0	State DOT District Staff	4	2
Gateway Communities	1	0	State DOT Headquarter Staff	0	0
Concessionaires	1	0	Federal Highway Administration	2	2
USDA Forest Service	1	0	State Patrol	1	1
Forest Service Land Users	1	0	Transit Agencies	2	0
Bureau of Land Management	1	0	Tour Bus Companies	20	0
County Officials	1	0	Airports	1	0
County RTPA	10	1	Regional Tourism Organization	4	2
Park Partners	2	1	City Officials	3	1
USGS	1	0	Air Quality District	1	0
Totals	**21**	**2**	**Totals**	**38**	**8**

and Grant Forest.

4. Road/Weather Information. This system would collect information on weather within the area of the park, road conditions, and road closures. It would allow for dissemination of this information through the pre-trip information system to provide real-time information about park conditions to visitors. This system would help improve traveler safety especially in areas such as State Route 198, which is dangerous for RVs and buses. In these areas, traveler information about icy conditions or high winds could be disseminated to tourists so they could proceed with caution.

5. Pre-trip Information (Traffic Information Dissemination). From this system real-time information on parking, weather, road conditions, and construction could be disseminated to tourists to improve safety and visitor experience. This type of information could be distributed via Internet or phone systems, such as 511.

6. Traffic Management. This system would communicate with the equipment distributed along the roadway that monitors and controls the traffic to manage traffic flow. It would help to manage the congestion at places within the park such as Big Stump.

7. Transit Management. Communication between the organizations responsible for moving people to and within the parks would be the objective of this system. It would allow for multi-modal schedule coordination. This would improve the management of the current transportation and would make new transit that is implemented into the park work more efficiently.

Along with discussing the challenges at Sequoia and Kings Canyon National Parks, several data collection needs were identified in the meeting and surveys. These include the following.

1. More Accurate Visitation Statistics. Currently visitors are being double counted as most visitors enter both Sequoia National Park and Kings Canyon National Park on the same day and therefore are counted twice in the daily statistics for the parks. More accurate statistics would allow the park service to gain a better grasp of the number of materials needed to pass out per day and would help in transportation planning.

2. Linked Trip and Trip Pattern Data. Currently there is no information on the origin and destination of visitors to see if they are arriving from other tourist areas or are traveling to them. Information on trip patterns within the park is also nonexistent. This type of information would be useful for park staff to understand how visitors generally move around the park. It would give insight into whether most visitors visit certain attractions within the park in a certain order and would allow for better traffic management and would help determine possible transit routes.

3. Visitors' Length of Stay and Origin. This information would allow concessionaires to better understand their customers and their food and lodging needs. This information would also be useful in identifying transit routes based on the origins of travelers. It would also be beneficial in developing concepts for transit in the park based on visitors' length of stay and in order to enhance their comfort.

4. Mode of Travel Information. Information on what mode of travel tourists currently use, whether or not they like their current mode, and their reasons for using that mode would help in assessing visitors' transit needs. This would also identify visitors' willingness to try a new mode if one were implemented.

5. Real-Time Transit Arrival Information. If transit is chosen as an option for Sequoia and Kings Canyon National Parks, real-time transit arrival information should also be made available to travelers. Timely information such as when transit will arrive at the next stop would make transit more reliable and therefore decrease the number of vehicles within the park, improving parking congestion as well.

6. Real-Time Parking Information. Up to date parking information would allow for parking management and distribution of alternate parking information to visitors before they arrive at a full parking lot. This would decrease the congestion within the parking areas and therefore increase visitor experience by eliminating wait times and help natural resources by eliminating roadside parking.

5 GOLDEN GATE NATIONAL RECREATION AREA (GGNRA)

5.1 Description of Park & History

The Golden Gate National Recreation Area (GGNRA) is one of the largest urban parks in the world, and is the most popular within the national system. This park is nearly two and a half times the size of San Francisco and contains more than 28 miles of coastline within its boundaries. Encompassing approximately 75,400 acres of land and water, popular park activities include hiking, biking, visiting historic military facilities, horseback riding, going to the beach, and engaging in ocean sports.

5.1.1 Geography and History

The complex compilation of the Golden Gate National Recreation Area is located on two peninsulas between the Pacific Ocean and the San Francisco Bay in western California, and is connected by the Golden Gate Bridge, as shown in Figure 5-1. The GGNRA is located both north and south of San Francisco and lies in San Francisco, Marin, and San Mateo Counties.

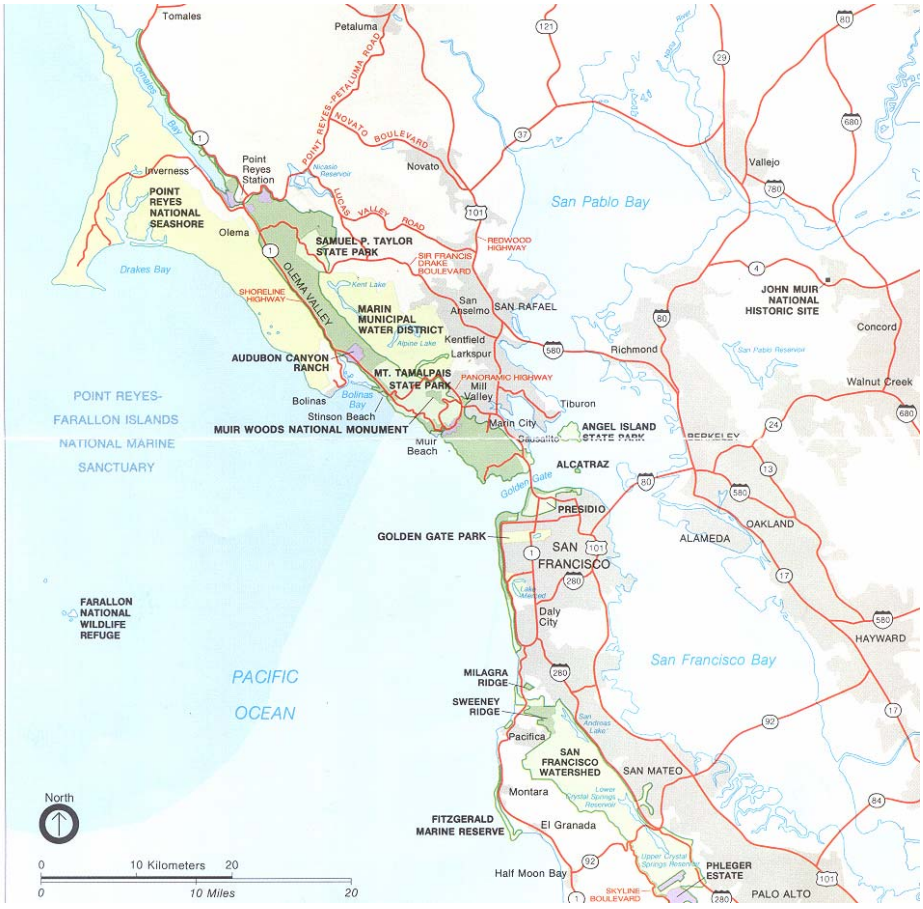

Figure 5-1: Area Map of Golden Gate National Recreation Area.
(Source: National Park Service)

North of the Golden Gate Bridge within Marin County, GGNRA extends northward from the San Francisco Bay to Tomales Bay. The park nearly surrounds Mount Tamalpais State Park, and shares its eastern boundary with the Marin County Municipal Water District and its western boundary with Point Reyes National Seashore.

GGNRA was established October 27, 1972. Most of the original national recreation area lands are located north of San Francisco and encompass a substantial portion of the northern peninsula. (Forty-two percent of Marin County is considered open space, from the combination of federal, state and county parklands.) GGNRA includes well-known national treasures such as Alcatraz Island and the Marin Headlands. Also included within the GGNRA are Fort Mason, Fort Funston, Fort Point, Crissy Field, Baker Beach, China Beach, Ocean Beach, Land's End, and Sutro Heights/Cliff House.

Alcatraz Island is probably the most well known former military post. It was phased out as a federal penitentiary in 1963, and was included in the original GGNRA lands. On the island, visitors can view an introductory slide show about the island, rent an audio tour of the cell house, as well as participate in programs about the military, cultural, and natural history of the island. Alcatraz Island attracts more than 3,000 visitors each day, who reach the island by catching a ferry from Fisherman's Wharf in San Francisco (17, 18).

The Marin Headlands portion of the park extends 20 miles northward, and includes rugged hills and headlands, grasslands, sandy beaches, and old military fortifications. Some of the most notable attractions include Stinson, Muir, and Rodeo Beaches, Point Bonita Lighthouse, Vista Point, and Fort Baker. There are more than 100 miles of trails accessible to hikers and bikers, and five camping sites (19).

There have been a number of boundary expansions since the GGRNA was originally founded in 1972. Some of the most recent additions to the national recreation area include the Presidio of San Francisco, transferred to the National Park Service as a National Historic Landmark District in October 1994, and the Rancho Corral de Tierra, added in August 2001 under the Rancho Corral De Tierra Golden Gate National Recreation Boundary Adjustment Act by the Senate Energy Committee (20).

The Presidio of San Francisco was built by the Spanish in 1776 and served as a Spanish fort from 1776-1822, a Mexican fort from 1822-1848, and finally a fort of the United States from 1848 to 1994. In 1989, Congress decided to close the Presidio as a military base. The Presidio is a National Historic Landmark District containing more than 500 buildings of historic value. The Presidio is 1,480 acres in size and has more than 11 miles of hiking trails, and 14 miles of paved roads, which cyclists can access. The park also includes a golf course, exhibition hall, conference center, chapel, several visitor centers, multi-cultural community education center, two historic cemeteries, bowling alley, tennis courts and athletic fields (21).

Rancho Corral De Tierra, one of the only remaining ranchos from the Spanish land grant era, added 4,262 acres to the GGNRA in San Mateo County, south of San Francisco. This mountainous property, surrounding the coastal towns of Moss Beach and Montara, includes two of the peaks of Montara Mountain, agricultural land, private horse stables, grassland, distinctive

coastal scrub, and endangered animal species such as the peregrine falcon, the San Bruno elfin butterfly, the San Francisco garter snake, and the red-legged frog (22).

Another entity included within the GGNRA boundaries is Muir Woods National Monument. Declared a national monument in 1908, Muir Woods is located 12 miles north of the Golden Gate Bridge. Surrounded almost completely by Mount Tamalpais State Park, Muir Woods is 560 acres and heavily forested with coastal redwoods. Visitors can walk on six miles of paths through the woods and see such places as Cathedral Grove (23, 24).

A more detailed map of the National Recreation Area is provided in Figure 5-2.

Although Muir Woods National Monument is considered a separate entity in the National Park System because it charges an entrance fee (GGNRA is not allowed to charge a fee), the monument is included in the general management of the GGNRA. Muir Woods does, however,

Figure 5-2: Detailed Map of Golden Gate National Recreation Area.
(Source: http://www.presidiotrust.gov/park/)

have a separate administration from the GGNRA for money related matters and collects visitation statistics separate from the rest of GGNRA. Another entity in the GGNRA that has a different management is the Presidio. Area A, the coastal areas of the Presidio, is managed by the NPS, while Area B, the interior 80 percent of the Presidio including nearly all of the historic structures, is managed by the Presidio Trust, a public-private governmental agency. This arrangement is due to the mandate that Area B of the Presidio must be self-sufficient by 2013 or it will be sold (25). The locations of Area A and B are shown in Figure 5-3.

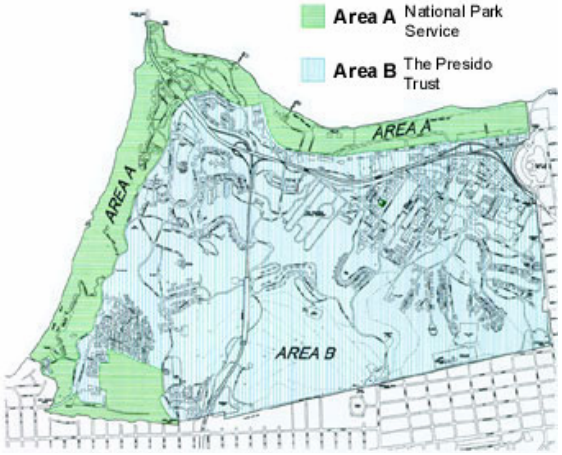

Figure 5-3: Management Areas of the Presidio.

(Source: Presidio Trust)

5.1.2 Visitation

Figure 5-4 shows NPS statistics for annual visitation to the Golden Gate National Recreation Area. Visitation during 2000 was approximately 15 million. Figure 5-5 shows NPS statistics for annual visitation to Muir Woods National Monument. Visitation at the park averaged approximately 1.5 million visits a year until the implementation of an entrance fee of $2 for adults in May 1997. Since the implementation of the fee, annual visits have averaged between 800,000 and 900,000 per year. Visitation during 2000 was approximately 900,000.

Most areas within the park are no more than an hour drive from San Francisco; therefore

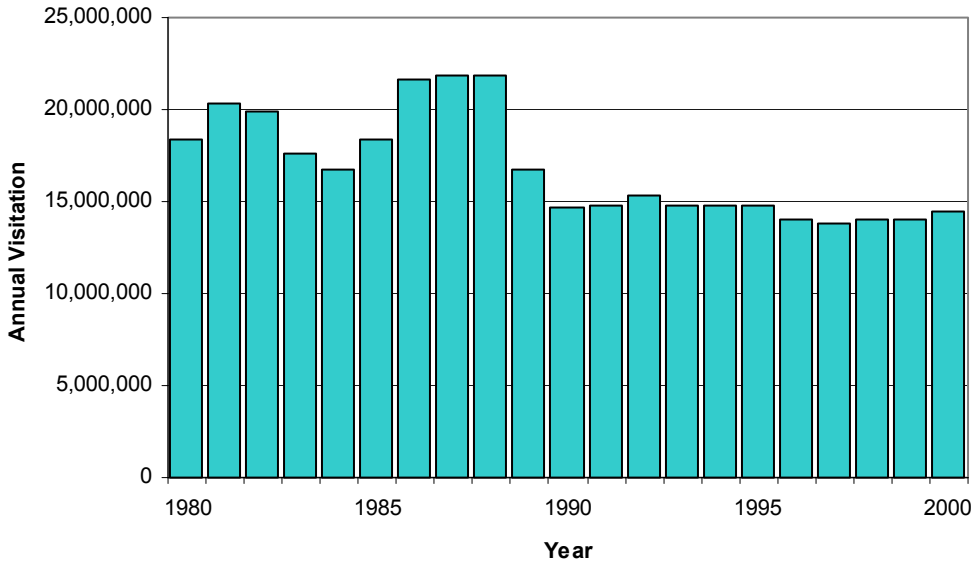

Figure 5-4: Annual Visitation Statistics at Golden Gate National Recreation Area.

(Source: National Park Service)

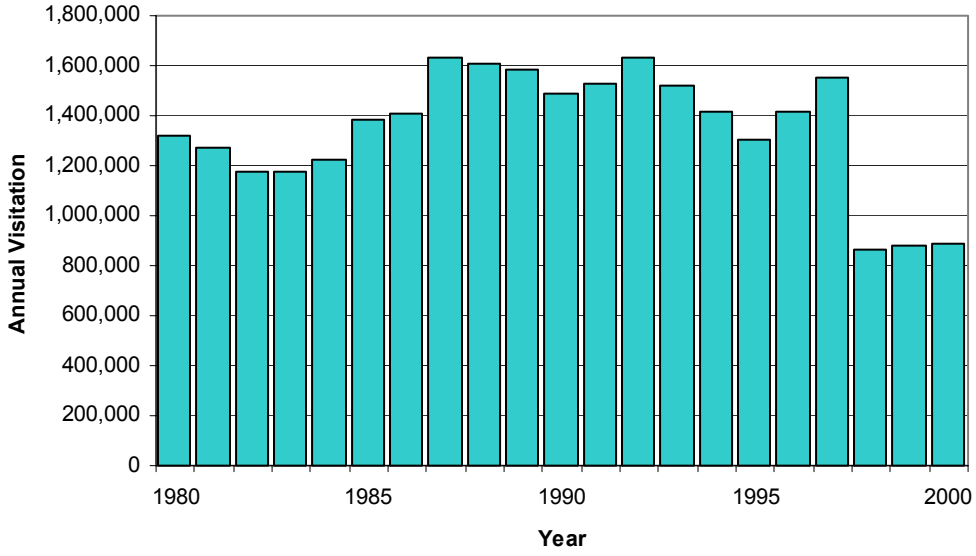

Figure 5-5: Annual Visitation Statistics at Muir Woods National Monument.
(Source: National Park Service)

the GGNRA is a popular destination for Bay Area residents. Figure 5-6 shows the accommodations used by the overnight visitors (less than 10 percent of visitors) to GGNRA in 2000. These statistics show few campers (26 percent), none of which are RV campers. The majority of overnight visitors stayed in lodges (74 percent). Results from a survey conducted in summer 2000 and spring 2001 to support the development of the Transportation Management Plan for the Marin Headlands and Fort Baker indicate that more than two-thirds of all visitors to the Marin Headlands and Fort Baker are from the Bay Area (26). Acknowledging that four of the five campgrounds in GGNRA, along with the Golden Gate Youth Hostel, are located in the Marin Headlands, the small number of overnight stays within GGNRA can be attributed to two-thirds the visitors being locals. Muir Woods National Monument had no recorded overnight visitors in 2000, as camping and picnicking are not allowed.

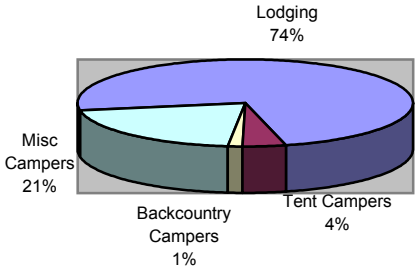

Figure 5-6: Accommodations for Overnight Visitors at Golden Gate National Recreation Area.
(Source: National Park Service)

Visitors to Golden Gate National Recreation Area can find diversity unlike any other national park. The largest urban national park boasts historic, natural, scenic, and urban features. The diversity in this park offers redwood forests, grassy hillsides, marshes, rocky shorelines, mountains, and beaches. Muir Woods offers hiking among the redwoods while the Golden Gate Promenade allows for walking and biking in a 3.5-mile section. Visitors will find many beaches within the GGNRA

including Stinson, Ocean, and China beaches. If visitors are looking for history, GGNRA has educational programs pertaining to the historical buildings, forts, and ships such as a tour of Alcatraz. Camping and picnicking can be found in the Marin headlands while the Rancho Corral de Tierra boasts horse stables, agricultural land, and rare species of animals.

While visitation at GGNRA remains fairly constant throughout the year, as shown in Figure 5-7, the visitation at Muir Woods National Monument tends to peak in the summer months, as shown in Figure 5-8.

5.1.3 Transportation System

Due to the GGNRA's proximity to San Francisco and other urban areas, there are several different transit agencies that provide service from metropolitan areas to the GGNRA. The Municipal Railway Bus System (MUNI) provides service throughout San Francisco to shoreline destinations and also connects to other Bay Area transit systems. The MUNI currently has a route that services Battery Spencer daily, along with Rodeo Beach and Battery Alexander on

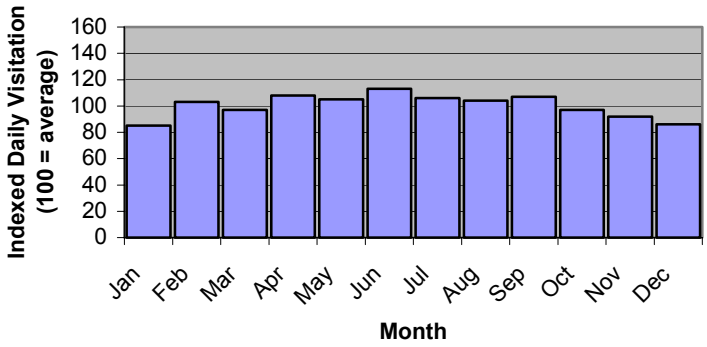

Figure 5-7: Seasonal Patterns in Visitation at Golden Gate National Recreation Area.
(Source: National Park Service)

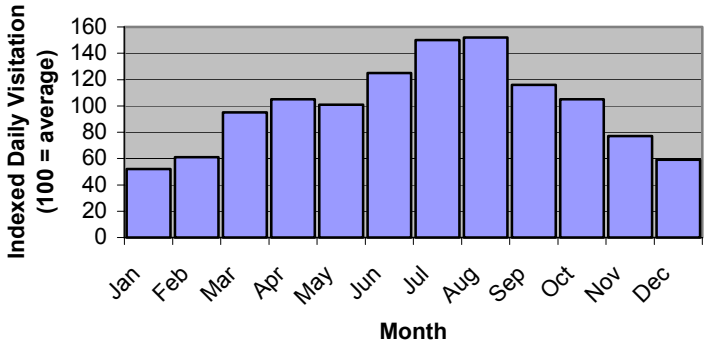

Figure 5-8: Seasonal Patterns in Visitation at Muir Woods National Monument.
(Source: National Park Service)

Sundays and holidays (Route 76). MUNI also provides service to/through the Presidio, Cliff House/Sutro Heights, Fort Mason and numerous points of interest in and around the GGNRA south of the Golden Gate Bridge (Routes 28, 29, 43, and 82X) (27, 28).

Along with access to the Presidio via the MUNI system, there is an extensive system of roadways, parking lots, biking and hiking trails with which to gain access to this area. Hundreds of visitors access the park by bicycle daily. Besides locals using their own bicycles - over 60 percent of the households in San Francisco do NOT own a car (29) - private bike rental companies do a brisk business. On warm days, rental bikes by the dozens are observed crossing the Golden Gate Bridge towards Fort Baker after touring Crissy Field and other spots in the Presidio.

The Golden Gate Bridge Highway and Transit District (GGT) provides services near the Marin parklands of the GGNRA. Route 63 provides service to Stinson Beach as well as Mount Tamalpais on weekends and holidays, and carries approximately 200 riders a day. This route also provides service to the Muir Woods area; however, the nearest bus stop is approximately a 2 mile walk away on narrow, winding roads. The GGT also provides ferry service to the City of Sausalito and Larkspur which cyclists can use to access Fort Baker and other Marin parklands (28, 30). The City of Sausalito began operating a shuttle called the Sausalito Area Local Land Yacht (SALLY) in the summer of 2000. This shuttle runs on weekends through the winter and both weekdays and weekends during the summer.

The Alcatraz Island ferry service operated by the Blue and Gold Fleet provides daily access to the island. During the peak season the ferry makes 14 trips per day, and during the off-season the ferry makes 10 trips per day. The ferry leaves from Fisherman's Wharf, which is outside of the GGNRA (28, 31).

According to the Marin Headland and Fort Baker Transportation and Management plan surveys, 88 percent of all visitors entered Marin Headlands/Fort Baker areas in an automobile. Of the remaining entering visitors, 5 percent arrived by bicycle, 4 percent by public transit, and 3 percent by other means. Of those visitors surveyed, 70 percent said that they would try some alternative form of transportation other than driving if cars were prohibited. Forty-two percent of visitors would consider renting a bicycle at a transit station adjacent to the park. Nineteen percent of the visitors encountered problems getting to the park, or getting around inside, and poor signage was the most noted problem (26).

5.2 Existing Management Goals

The general management plan (GMP) for the GGNRA was adopted in 1980 (32), created during a process of intense public involvement after Congress created the park in 1972. The GMP has been amended in minor ways over time through boundary changes and National Environmental Policy Act (NEPA) documentation related to new/changed uses. For example, park partner environmental education organizations have master plans for their facilities with environmental assessments.

Following the 1997 Memorandum of Understanding between the Secretary of Interior and Secretary of Transportation to improve transportation facilities to and within national parks,

GGNRA was designated as one of the five demonstration parks for further development of alternative transportation. This helped other planning activities or studies underway that relate to the management and operational goals of the GGRNA including:

- Highway 1 Corridor Comprehensive Transportation Management Plan (33),
- GGNRA Ferry Study (34),
- Marin Headlands/Fort Baker Transportation Management Plan (26),
- Presidio Trails Master Plan (35), and
- Redwood Creek Watershed Management Concept Plan.

These studies seek to decrease traffic congestion while enhancing resource preservation and the quality of the visitor experience in and around the GGNRA by encouraging the use of alternate transportation modes.

5.2.1 Visitor Experience, Congestion, and Crowding Goals

According to a study done by Cambridge Systematics, the NPS initiated its recent studies in GGNRA to:

- reduce future visitor vehicle traffic traveling to and from GGNRA units that suffer increased traffic congestion and reduced traffic safety on local, two-lane roadways in Marin County;
- reduce future employee vehicle traffic to the proposed new land uses in the Presidio by providing Alternative Transportation Systems (ATS) and Transportation Demand Management (TDM) alternatives to driving personal vehicles to their place of employment; and
- improve the overall quality of the tourist visit to GGNRA attractions by providing easy to use and integrated transportation services within individual units (Presidio) and integrated with a number of units (GGNRA units in Marin County and the Presidio to other San Francisco GGNRA units) (28).

Along with visitor experiences based on transportation, the Presidio Trust has defined educational visitor experience goals in their Draft Implementation Plan. These goals include:

- providing easily accessible orientation and information that would permit visitors to choose from available experiences such as outdoor interpretive panels and information at the William Penn Mott, Jr. Visitor Center;
- developing a Presidio Interpretive Plan that will provide interpretive themes and stories along with a range of services to be used at the Presidio;
- enhancing access to the Presidio, its facilities, and its interpretive programs for visitors of all ages, backgrounds, and abilities;
- encouraging park tenants to participate in the life of the Presidio by providing programs and activities for visitors; and
- supporting activities that would encourage people to visit such as festivals, educational programs, and military pageantry (36).

5.2.2 Transportation Planning and Management Goals

The process of developing the Marin Headlands/Fort Baker Transportation Management Plan has outlined a number of recommended goals for those areas of the GGNRA, including creating multi-modal access to the park, considering alternate parking facilities, addressing the roadway supply, and improving the signage both outside and inside the park boundaries (26).

The "Highway 1 Corridor Comprehensive Transportation Management Plan" is researching solutions to traffic issues in the Highway 1 corridor, including access to Tennessee Valley, Muir Beach, Muir Woods, Stinson Beach, and Mount Tamalpais State Park. Some initiatives being considered include a reservation system for Muir Woods and a visitor intercept/commuter parking facility, which would provide a shuttle staging area for park visitors, a parking facility for visitor cars and expanded parking facilities for commuters currently parking along Shoreline Highway (33).

In addition to land transit services, increased ferry services are under consideration by the National Park Service. Three locations within the GGNRA (Fort Mason, Presidio and Fort Baker) were identified as possible water shuttle intercepts. Currently, an 18-month study is underway to determine the market demand of the potential service with consideration of linking future land transit with a new ferry service. These sites are included in the Bay Area Water Transit Authority's analysis of potential ferry service expansion. Fort Baker is the last military installation to be closed within the park, and was transferred to GGNRA in 2001. A planning process for the re-use of the historic buildings began in 1996 and the Fort Baker Plan Final Environmental Impact Statement (FEIS) Record of Decision was issued in June 2000. Currently Fort Baker is under construction and an opening date for the public has not been announced. Extensive analysis of traffic impacts and potential mitigations was conducted during the preparation of the plan and the selection of the preferred alternative: a retreat and conference center. Transportation demand management and an emphasis on "maximum car reduction" are key features of the plan's implementation (34).

The Parklands Transportation Task Force was created and continues to be coordinated by, the Metropolitan Transportation Commission (MTC), the Metropolitan Planning Organization (MPO) for the San Francisco Bay Area. The Task Force is made up of representatives from NPS, the Federal Highway Administration, MTC, Caltrans, Department of Fish and Game, California State Parks, Golden Gate Bridge Highway and Transportation District (GGBHTD), Marin County and the City of Sausalito. The purpose of this group is to oversee studies and implementation of regional transportation solutions for parklands in Marin County (34).

5.3 Documentation of Previous Park Studies

The Golden Gate Recreational Travel Study was published in 1977 (37), and the Golden Gate/Point Reyes General Management Plan was published in 1980 (32). These park studies were the first of their kind for GGNRA. Much of the information in the numerous technical documents to support the travel study is more than 20 years old, and the relevance of these studies to current ideas, travel patterns, and management plans is unknown.

More recently, the "Marin Headlands and Fort Baker Existing Conditions Report" was published in 2000 reporting on data collected during the summer of 2000 (peak season); additional data collected during the shoulder season (April 2001) is about to be released (26). The Marin Headlands/Fort Baker report has the most recent information that might support the development of ITS applications within the northern parklands of GGNRA. The traveler and park partner surveys provide useful information pertaining to average visitor activities, the forms of transportation used to reach the park, problems encountered in reaching destinations within the park, and goals as stated by the park partners.

The preliminary draft of the Muir Woods Master Plan from 1972 outlines goals of shifting parking areas, redirecting traffic flows to use alternative entrances to the park, and regulating visitor use (38). Additional park studies conducted for Muir Woods include the Natural Resources and Management Plan published in 1974 (39), and the Muir Woods Access Feasibility study of 1999 (40).

The Fort Baker Plan Final Environmental Impact Statement (FEIS) has at least eight studies and technical memoranda documenting traffic conditions and modeling the effectiveness of TDM and mitigations after implementation of the Fort Baker Plan (41).

The Presidio Trust of San Francisco is drafting the Presidio Trust Implementation Plan (36) that will replace the General Management Plan Amendment done in 1994 by the NPS. The plan for the Presidio calls for preserving and protecting the parks resources as well as bringing together organizations to focus on finding solutions to environmental, cultural and social issues of global significance. Congress established the Presidio Trust in 1998, with the goals of making the park financially self-sufficient by 2013. The Presidio Trust is a special public-private governmental agency established for managing most of the buildings of the Presidio, which would be too expensive for the NPS alone to maintain.

5.4 Relationships to Other Transportation Plans

This section addresses other transportation planning that is occurring in the vicinity of GGNRA to identify whether or not these planning initiatives include transportation problems and solutions for the parks. Two planning efforts are occurring within this area. They include the Intelligent Transportation Systems Early Deployment Plan for the San Francisco Bay Area and the 2001 Regional Transportation Plan for the San Francisco Bay Area. Their relationship to GGNRA's transportation problems is described below.

5.4.1 ITS Early Deployment Plan for the San Francisco Bay Area

The Intelligent Transportation Systems Early Deployment Plan for the San Francisco Bay Area was published in 1996 (42). This document does not include improvement plans for the GGNRA area because its primary goal is to improve commuter travel.

5.4.2 2001 Regional Transportation Plan for the San Francisco Bay Area

The 2001 Regional Transportation Plan for the San Francisco Bay Area is currently in print (43). Like the document listed above, this one does not include information or improvement plans for any area within the GGNRA such as U.S. Route 101. However, the primary goal of

most initiatives in this document is to improve commuter travel rather than addressing traffic related to the GGNRA.

5.5 Summary of Stakeholder Outreach

Stakeholder meetings occurred on November 15 and 16, 2001 at Fort Mason. The goals of these meetings were to introduce the project to GGNRA stakeholders, listed in Appendix A, to identify potential stakeholders that were absent from the meeting, and to get stakeholders opinions on transportation needs and challenges within the parks.

As a follow-up to this meeting, surveys, shown in Appendix B, were sent to stakeholders – both those who attended the meeting and those identified as missing – to gain additional feedback and more detailed information about stakeholders' knowledge of intelligent transportation systems (ITS) and the possible use of ITS within the parks. Table 5-1 shows the list of stakeholder organizations, how many surveys were sent out to each stakeholder organization, and how many surveys were received back. In total 36 surveys were sent out and 8 were returned.

Based on the stakeholder meeting and the surveys, the following were cited as potential solutions to specific transportation challenges within GGNRA.

1. Construction/Work Zone Coordination. This would allow maximum use of roadways while construction is occurring and would limit the amount of extra congestion that generally goes along with a work zone. This would be beneficial due to the park being an urban entity and the roadways within the park being used for local commutes as well as for travel to GGNRA sites.

2. Incident Management. This would allow better coordination between emergency

Table 5-1: Golden Gate National Recreation Area Stakeholders.

Stakeholders	# Surveys Sent	# Surveys Returned	Stakeholders	# Surveys Sent	# Surveys Returned
NPS Park Staff	1	0	Federal Highway Administration	2	1
NPS Regional Staff	1	0	Regional Tourism Organization	3	1
Gateway Communities	7	1	Transit Agencies	5	1
Metropolitan Planning Organization	2	1	Bicycle Coalitions	3	0
Congestion Management	1	1	Community-based Organizations	3	1
Park Partners	5	1	Other Transportation Organizations	1	0
State DOT District Staff	2	0			
Totals	**19**	**4**	**Totals**	**17**	**4**

vehicles and emergency agencies within the urban area. It would allow for integrated emergency management and decreased response times for emergencies.

3. Parking Management. This system would allow for electronic monitoring and management of parking facilities. Coordination between parking management and pre-trip information would help decrease parking congestion at certain locations within the park, such as Stinson Beach, Muir Woods, Conzelman, Rodeo Beach, Vista Point, State Route 1, and Fort Baker.

4. Road/Weather Information. This system would collect information on weather within the area of the park, road conditions, and road closures. It would allow for dissemination of this information through the pre-trip information system to provide real-time information about park conditions to visitors. This system would help improve traveler safety and improve the visitor experience.

5. Pre-trip Information (Traffic Information Dissemination). From this system real-time information on parking, weather, road conditions, and construction could be disseminated to tourists to improve safety and visitor experience. This type of information could be distributed via Internet or phone systems, such as 511.

6. Traffic Management. This system would communicate with the equipment distributed along the roadway that monitors and controls the traffic to manage traffic flow. It would allow for the congestion at places within the park such as U.S. Route 101, 19th Avenue, Park Presidio Blvd, State Route 1, Crissy Field, and the south end of the bridge to be managed.

7. Transit Management. Communication between the organizations responsible for moving people within the parks would be the objective of this system. It would allow for multi-modal schedule coordination such as bus prioritization and fleet management.

Along with discussing the challenges at GGNRA, several data collection needs were identified in the meeting and surveys. These include the following.

1. More Accurate Visitation Statistics. This would allow GGNRA to calculate how many visitors went to each portion of GGNRA per day, and would also let them give a count of the number of tourists to GGNRA per day without double counting those visitors who went to more than one site within GGNRA. More accurate statistics would allow the park service to gain a better grasp of the number of materials needed to pass out per day and would be useful in transportation planning efforts to show how transit may more effectively serve park visitors.

2. Linked Trip and Trip Pattern Data. Currently there is limited information on the origin and destination of visitors to see if they are arriving from other tourist areas or are traveling to them. Information on trip patterns within the park is also nonexistent. This type of information would be useful for park staff to understand how visitors generally move around the park. It would give insight into whether most visitors visit

certain attractions within the park in a certain order and would allow for better traffic management and would help determine possible transit routes.

3. Distinction Between Visitors vs. Travelers and Recreational Trips vs. Non-recreational Trips. This information will not only help improve the visitation statistics and provide more accurate information to the park, but will also help with transit management and traffic management. This information will ensure that transit routes and schedules accommodate the users – commuters for work would need different transit times and routes then visitors to the park, but getting both commuters and visitors to use transit would decrease congestion in the area. Knowing information about commuters may also identify other routes that could be used or identify companies that could possibly set-up transit for their employees.

4. Mode of Travel Information. Information on what mode of travel tourists currently use, whether or not they like their current mode, and their reasons for using that mode would help in assessing visitors' transit needs. This would also identify visitors' willingness to try a new mode if one were implemented.

5. Real-Time Transit Arrival Information. Timely information such as when transit will arrive at the next stop would make transit more reliable and therefore may increase transit ridership and decrease the number of vehicles within the park, improving parking congestion as well.

6. Real-Time Parking Information. Up to date parking information would allow for parking management and distribution of alternate parking information to visitors before they arrive at a full parking lot. This would decrease the congestion within the parking areas and therefore enhance the visitor experience by eliminating wait times and help protect natural resources by eliminating roadside parking.

7. Non-motorized Travel Count. This would allow for management of non-motorized traffic such as pedestrians on bike or foot. It would also help in the development of trail maps for the park.

6 NEXT STEPS

The next step in this project is to survey the park visitors to assess visitation patterns and measure visitor attitudes to the possible use of intelligent transportation systems (ITS) within the parks. The Texas Transportation Institute of the Texas A&M University System and the Department of Recreation, Park and Tourism Sciences at Texas A&M University are in charge of this phase of the project. Four subtasks are associated with this step.

- Developing, Pilot Testing, and Refining the Survey Instrument. A survey for each of the parks (Golden Gate National Recreation Area and Sequoia and Kings Canyon National Parks) was developed to identify: visitor type, visitor experience, how they plan for a trip, visitors' attitudes toward recreational use and natural resources, types of technologies visitors may use, transportation types they may use, how they obtain travel information, and demographics. The survey questions and scales will be tested in two classes at Texas A&M University. This pilot test will lead to a final revision of the survey.

- Developing a Sampling Plan. A sampling plan for the National Parks is currently being developed. This plan will determine how many surveys should be distributed, where in the park the surveys should be distributed, and the approximate mix of demographics that we are trying to achieve.

- Contacting Visitors On-site to Administer the Surveys. It is tentatively planned that visitor surveys will be distributed at Muir Woods and Stinson Beach parking lots at Golden Gate National Recreation Area, and at the Foothills visitor center, Grant Grove visitor center, Lodgepole visitor center, Giant Forest museum, and Sherman Tree parking lots at Sequoia and Kings Canyon National Parks. The survey distribution will take place in three rounds per park to ensure that the opinions of visitors during different seasons (peak, shoulder, and off-season) are collected.

- Inputting and Analyzing the Survey Data. Inputting and analyzing the data will be an ongoing production that will begin when the first group of surveys is received. The surveys will be analyzed based on demographics and on visitor types. Following the analysis of the final group of surveys, a technical memorandum will be created.

REFERENCES

1 Alternative Transportation in the National Parks: Field Operational Test Status. www.nps.gov/transportation/alt/fotstatus.htm. Accessed June 20, 2001.

2 Davidson-Peterson Associates. Visitors to Acadia National Park/Mount Desert Island Look at Information Systems. October 1999. www.itsdocs.fhwa.dot.gov//JPODOCS/REPTS_TE/8W301!.PDF. Accessed July 12, 2001.

3 Cumberland Gap Tunnel. 170.183.221.81/middlesboro/attractions/tunnel/tunnel.htm. Accessed July 12, 2001.

4 Plosky, Eric J., Cynthia Maloney, and Gary Ritter. *The State of Intelligent Transportation Systems in the National Park System*, U.S. Department of Transportation and John A. Volpe National transportation Systems Center, 2001.

5 Advanced Traveler Information Services in Rural Tourism Area: Branson Travel & Recreation Information Program and Interstate 40 Traveler and Tourist Information System, Battelle, June 2000, www.itsdocs.fhwa.dot.gov/jpodocs/repts_te/@3201!.pdf. Accessed July 12, 2001.

6 Travel Shenandoah.com. 198.82.190.21/travelva/production/travel_shenandoah.cfm. Accessed October 26, 2001.

7 Greater Yellowstone Rural Intelligent Transportation Systems Corridor. www.coe.montana.edu/wti/Projects/gyrits%20phase%20one.htm. Accessed October 26, 2001.

8 Strong, Christopher and Sam Simmons, "Assessing Needs and Identifying Opportunities for ITS Applications in California's National Parks, Technical Memorandum #1: Recommendations for Classifications of National Parks." Western Transportation Institute, Montana State University-Bozeman, July 2001.

9 Sequoia and Kings Canyon General Management Plan. www.nps.gov/planning/seki/gmp. Accessed Sept. 7, 2001.

10 Mackintosh, Barry, *The National Parks: Shaping the System.* www.cr.nps.gov/history/online%5Fbooks/mackintosh1/. Accessed July 24, 2001.

11 U.S. Department of Agriculture Forest Service, "Giant Sequoia National Monument Management Plan." www.r5.fs.fed.us/giant_sequoia/. Accessed December 7, 2001.

12 The White House, Office of the Press Secretary, "Establishment of the Giant Sequoia National Monument," April 15, 2000. www.usda.gov/special/proclamation.htm. Accessed December 7, 2001.

13 BRW, Inc., in association with Lee Engineering, Inc. *Transportation and Visitor Use Data Summary for Winter/Spring 1998 and Transportation Condition Assessment.* Prepared for Sequoia and Kings Canyon National Parks, March 1999.

14 Tulare County Association of Governments, *The 2001 Regional Transportation Plan.* Tulare County Association of Governments, June 2001.

15 Council of Fresno County Governments, *The 2001 Regional Transportation Plan.* Council of Fresno County Governments, August 2001.

16 URS and BRW et al, *San Joaquin Valley Intelligent Transportation Systems (ITS)*

Strategic Deployment Plan (draft). Prepared for the San Joaquin Valley ITS Technical Advisory Committee and Steering Committee et al, July 13, 2001.
17 Golden Gate National Recreation Area Press Release. www.sfvisitor.org/travelmedia/html/GoldenGate.html. Accessed Oct. 19, 2001.
18 Golden Gate National Recreation Area – San Francisco. www.gorp.com/gorp/resource/Us_nra/ca/sf_gg.htm. Accessed Oct. 19, 2001.
19 Golden Gate National Recreation Area Map. National Park Service and the U.S. Department of the Interior, 1993.
20 Golden Gate National Recreation Area. www.nps.gov/goga. Accessed Sept. 14, 2001.
21 Presidio of San Francisco in Golden Gate National Recreation Area. www.nps.gov/prsf/index.htm. Accessed Oct. 26, 2001.
22 Post Lands – Rancho Corral de Tierra. www.openspacetrust.org/POST_Lands/rancho_corral.htm. Accessed Jan. 23, 2002.
23 Muir Woods National Monument. www.nps.gov/muwo/index.htm. Accessed Oct. 26, 2001.
24 Destinations – Muir Woods National Monument. www.gorp.com/gorp/resource/us_nm/ca_muir.htm. Accessed Oct. 19, 2001.
25 The Presidio Trust. www.presidiotrust.gov/park. Accessed Jan 23, 2002.
26 Nelson/Nygaard Consulting Associates, Fehr & Peers, and BRW. *Transportation Management Plan for the Marin Headlands and Fort Baker-Existing Conditions Report.* Prepared for the Golden Gate National Recreation Area, National Park Service, November 2000.
27 MUNI Transit Information. www.transitinfo.org/muni. Accessed Jan. 23, 2002.
28 Krechmer, Daniel, Lewis Grimm, Daniel Hodge, Diana Mendes, and Frank Goetzke. *Federal Lands Alternative Transportation Systems Study-Volume 3-Summary of National ATS Needs.* Report FTA-TPL10-2000.1 and FHWA-EP-00-024. Federal Transit Administration and FHWA, U.S. Department of Transportation, 2001.
29 1990 Census Households by Vehicles in Households. www.mtc.ca.gov/datamart/forecast/ao98/TableA1.htm. Accessed Jan 24, 2002.
30 Golden Gate Bridge Highway and Transit District Information. www.transitinfo.org/GGT. Accessed Jan. 23, 2002.
31 Blue and Gold Fleet Transit Information. www.transitinfo.org/BlueGoldFleet. Accessed Jan 23, 2002.
32 National Park Service. *Golden Gate, Point Reyes General Management Plan/Environmental Analysis.* The Golden Gate National Recreation Area, National Park Service, Department of the Interior, 1980.
33 Route 1 Corridor Comprehensive Transportation Management Plan/ Visitor Access to West Marin Parklands. www.nps.goga.admin/transportation. Accessed October 12, 2001.
34 Fact Sheets and Articles Transportation Planning. www.nps.gov/goga/admin/transportation/mctranb.htm. Accessed October 12, 2001.
35 Presidio Trust Draft Implementation Plan - Principle 17: Multi-modal Transportation Options. www.presidiotrust.gov/ptip/Draft_Implementation_Plan/ptip_files/chapter_2.htm. Accessed January 28, 2001.

36 Presidio Trust Draft Implementation Plan. www.presidiotrust.gov/ptip/Draft_Implementation_Plan/. Accessed Jan 28, 2002.
37 Golden Gate Recreational Travel Study, Summary Report. July 1977.
38 Nadeau, G. Douglas, Leonard Frank, Ronald H. Treabess, and David K. Morris. *Muir Woods Master Plan.* Prepared for Muir Woods National Monument, Golden Gate National Recreation Area, National Park Service, 1972.
39 Muir Woods National Monument, National Park Service, and Department of the Interior. *Natural Resources Management Plan Muir Woods National Monument California*. Prepared for Department of the Interior, June 1974.
40 Pittman and Hames Associates and Wilbur Smith Associates. *Muir Woods Transportation Study, Alternative Access Feasibility Report.* Prepared for Muir Woods National Monument, Golden Gate National Recreation Area, National Park Service, March 1999.
41 Fort Baker Final Environmental Impact Statement (FEIS). www.nps.gov/goga/mahe/foba/project/eis.htm. Accessed October 12, 2001.
42 DKS Associates, Moore Iacofano Goltsman, Inc, Rockwell International Corporation, and Apogee Research, Inc. *Intelligent Transportation Systems Early Deployment Plan for the San Francisco Bay Area.* Prepared for Metropolitan Transportation Commission, August 1996.
43 2001 Regional Transportation Plan. www.mtc.ca.gov/projects/rtp/overview.htm. Accessed Sept. 20, 2001.

APPENDIX A

Attendees at Sequoia and Kings Canyon National Park Stakeholder Meeting (11/14/01)

Name	Agency	Address	Phone	E-Mail
William Tweed	NPS	47050 Generals Hwy, Three Rivers 93271	559/565-3130	william_tweed@nps.gov
Kris Fister	NPS	47050 Generals Hwy, Three Rivers 93271	559/565-3131	kris_fister@nps.gov
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Tony Boren	Fresno COG	2100 Tulane St., #619	559/233-4148	tboren@fresnocog.org
Scott Shafer	Texas A&M		979/845-3837	sshafer@rpts.tamu.edu
Shawn Turner	Texas Trans. Inst.	3135 TAMU	979/845-8829	shawn-turner@tamu.edu
Chris Strong	WTI/Montana St. U	416 Cobleigh, P.O.Box 173910, Bozeman 59717	406/994-7351	chriss@coe.montana.edu
Ginni Dilworth	Texas A&M	2261 TAMU	979/845-5349	gdilworth@rpts.tamu.edu
Susan Harrington	Caltrans	1127 O St., Sacramento 95814	916/654-7482	susan_harrington@dot.ca.gov
Bill Haas	FHWA-California Division	980 9th St., Ste 400, Sacramento 95814	916/498-5013	william.haas@fhwa.dot.gov
Curt & Laurie Nutter	Three Rivers/Lemon Cove Business Association	P.O.Box 1014, Three Rivers 93271	559/561-3652	seqviln@theworks.com
Mary Allison	Sequoia National Forest	35850 E. Kings Canyon Rd., Dunlap 93621	559/338-2251	malison@fs.fed.us
Anthony Lopez	Caltrans D6-TMC	1352 W. Olive, Fresno 93728	559/445-6980	anthony.r.lopez@dot.ca.gov
Thomas McFadden	DNPS-Sequoia	P.O. Box 89, SNP 93262	559/561-0135	tmcfadde@dncinc.com
Andrew Kubik	Caltrans D6-Planning	1352 W. Olive Ave., Fresno 93728	559/488-4175	andy_kubik@dot.ca.gov
Scott Williams	Caltrans	1127 O St., Sacramento 95814	916/654-9581	K_Scott_Williams@dot.ca.gov

Attendees at Golden Gate National Recreation Area Stakeholder Meeting (11/15/01)

Name	Agency	Address	Phone	E-Mail
Susan Harrington	Caltrans, New Tech	1227 O St., Sacramento 95814	916/654-7482	susan_harrington@dot.ca.gov
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Shawn Turner	Texas Trans. Inst.	3135 TAMU	979/845-8829	shawn-turner@tamu.edu
Paul Olson	FHWA	201 Mission Street	415/744-2659	paul.olson@fhwa.dot.gov
Erik Alm	Caltrans D4 Planning	P.O.Box 23660, Oakland 94623	510/286-6053	erik_alm@dot.ca.gov
Janie Page	MTC	101 8th St., Oakland	510/464-7839	jpage@mtc.ca.gov
Lisa Klein	MTC	101 8th St., Oakland	510/464-7832	lklein@mtc.ca.gov
Amy Van Doren	NPS	1111 Jackson St., Ste 700	510/817-1382	amy_van_doren@nps.gov
Judy Chen	Caltrans D4 Operations	111 Grand Avenue	510/286-4559	judy_chen@dot.ca.gov
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Mike Savidge	GGNRA	Upper Ft. Mason Bldg. 201, San Francisco 94123	415/561-4725	michael_j_savidge@nps.gov
Cheryl Liu	SF DPT	25 Van Ness Ave., Ste 345, San Francisco 94102	415/554-2312	cheryl_liu@ci.sf.ca.us
Scott Shafer	Texas A&M	Dept. of Rec., Parks and Tourism	979/845-3857	sshafer@rpts.tamu.edu
Jody McCullough	FHWA-CFLHD	Denver	303/716-2272	jody.mccullough@fhwa.dot.gov
Cristina Calderon	SF DPT	25 Van Ness Ave., St. 345, San Francisco 94102	415/554-2350	cristina-calderon@ci.sf.ca.us
Art Brook	Marin DPW/CMA	P.O. Box 4186, San Rafael, 94913		abrook@marin.org
Alan Zahradnik	Golden Gate Bridge and Highway Dept	1011 Andersen Dr., San Rafael 94901	415/485-3893	azahradnik@goldengate.org

Attendees at Golden Gate National Recreation Area Stakeholder Meeting (11/16/01)

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Mark Helmbrecht	Presidio Trust	34 Graham St. 94129	415/561-5438	mhelmbrecht@presidiotrust.gov
Kathleen Cruise	Fort Mason Foundation	Fort Mason Center	415/345-7560	Kathleen@fortmason.org
Scott Williams	Caltrans, New Tech	1227 O St., Sacramento	916/654-9851	scott_williams@dot.ca.gov
Chris Strong	WTI/MSU	P.O.Box 173910, Bozeman, MT 59717	406/994-7351	chriss@coe.montana.edu
Scott Shafer	Texas A&M	Dept. of Rec., Parks and Tourism	979/845-3857	sshafer@rpts.tamu.edu
Carol Prince	Golden Gate National Parks Association	Fort Mason Building 201, San Francisco 94123	415/561-3030 ext 2237	cprince@ggnpa.org
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