ASSESSING NEEDS AND IDENTIFYING OPPORTUNITIES FOR ITS APPLICATIONS IN CALIFORNIA'S NATIONAL PARKS

Final Technical Report

By

Christopher Strong and Jaime Eidswick
Western Transportation Institute
College of Engineering
Montana State University - Bozeman

and

Scott Shafer and Ginni Dilworth
Dept. of Recreation, Parks and Tourism Sciences
College of Agriculture
Texas A&M University

and

Shawn Turner
Texas Transportation Institute
Texas A&M University System

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GLOSSARY OF ABBREVIATIONS

AHS	Automated Highway System
ATIS	Advanced Traveler Information System
ATS	Alternative Transportation System
AVI	Automatic Vehicle Identification
AVL	Automatic Vehicle Location
BRT	Bus Rapid Transit
CAD	Computer-Aided Dispatch
Caltrans	California Department of Transportation
CARS	Condition and Accidents Reporting System
CCTV	Closed-Circuit Television
CHP	California Highway Patrol
CMS	Changeable Message Signs
CVO	Commercial Vehicle Operator
DOI	Department of Interior
DOT	Department of Transportation
DRI	Division of Research and Innovation
DSRC	Dedicated Short-range Communication
EM	Emergency Management
FBI	Federal Bureau of Investigation
FEIS	Final Environmental Impact Statement
FHWA	Federal Highway Administration
FOT	Field Operational Test
FTA	Federal Transit Administration
GGBHTD	Golden Gate Bridge Highway and Transportation District
GGNRA	Golden Gate National Recreation Area
GMP	General Management Plan
GPS	Global Positioning System
HAR	Highway Advisory Radio
HCRS	Highway Conditions Reporting System
HOV	High Occupancy Vehicle
HTCRS	Highway Travel Conditions Reporting System
ISP	Information Service Provider
ITS	Intelligent Transportation Systems
LOS	Level of Service
MCM	Maintenance and Construction Management
MCMS	Maintenance and Construction Management Subsystem
MCV	Maintenance and Construction Vehicle
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
PDA	Personal Digital Assistant
PSAP	Public Safety Answering Point
RFP	Request for Proposals
RTPA	Regional Transportation Planning Agency
RV	Recreational Vehicle
RWIS	Road Weather Information System
SALLY	Sausalito Area Local Land Yacht
SEKI	Sequoia and Kings Canyon National Parks
SF	San Francisco
SJVAPCD	San Joaquin Valley Air Pollution Control District
TDM	Transportation Demand Management
TM	Traffic Management
TMC	Traffic Management Center
TMS	Traffic Management Subsystem
TTIS	Traveler and Tourist Information System
UICPSU	University of Idaho's Cooperative Park Studies Unit
VSP	Visitor Services Project
WTA	San Francisco Bay Area Water Transit Authority

ABSTRACT

National parks are under increasing pressure to preserve their unique resources while providing for a meaningful experience to an increasing volume of visitors. With increasing visitation comes an increase in transportation challenges. Since many traditional transportation solutions are inappropriate in a national park environment, intelligent transportation systems (ITS) may provide a more viable means of addressing these challenges. This report describes a research project that sought to understand the transportation needs within California's national parks by looking at two case study parks: Golden Gate National Recreation Area (GGNRA) and Sequoia and Kings Canyon National Parks (SEKI). After identifying the transportation needs for these parks through outreach meetings and visitor surveys, potential ITS solutions or themes were developed in a manner that is consistent with the National ITS Architecture. These themes are presented, along with others that may be applicable to other national parks in the state. Checklists were developed to help parks implement ITS solutions. Next steps in this project and future research needs are identified.

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EXECUTIVE SUMMARY

The State of California contains 23 lands that are managed by the National Park Service (NPS). According to NPS statistics, 2003 saw a total visitation to NPS-managed lands in California of nearly 34 million visitors – exceeding any other state in the country. Park visitation levels are expected to continue to increase in the future, and the corresponding transportation system impacts may adversely affect both visitor experience and resource protection issues at the parks unless actions are taken. The parks depend on this “three-legged stool” of visitor experience, resource protection and the transportation system to fulfill their purpose. If any one of these legs breaks, the entire system will deteriorate. 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) – systems which use advanced computer, sensing and communications technology to help improve the operation of the transportation system – 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. Several national parks – including Acadia, Cumberland Gap, Gateway, Gettysburg, Grand Canyon, Great Smoky Mountains, Shenandoah, Yellowstone and Yosemite – are planning or have implemented ITS projects. For this reason, the California Department of Transportation (Caltrans) Division of Research and Innovation 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 applicability to California’s NPS units.

To reflect the diversity of California’s parks, this project focused on two parks – Golden Gate National Recreation Area (GGNRA) (an urban park) and Sequoia and Kings Canyon National Parks (SEKI) (a rural park). Park planning documents and regional transportation plans were reviewed to understand how each park developed its transportation vision, and how that vision fits in the larger context. Meetings with and surveys of key park stakeholders – including NPS staff, Caltrans district staff, county and local officials, concessionaires, transit agencies and local tourism councils – were used to provide more detailed information about current transportation needs and how ITS could meet those needs.

Visitor surveys were also conducted at each park, yielding over 200 responses from two sites within GGNRA and over 400 responses at SEKI. These surveys examined current visitor usage of transportation modes and information sources, and their perceptions of and likelihood to use various transportation alternatives, including ITS. These surveys provided some indication of visitors’ willingness to accept and use ITS solutions in National Parks. For example, survey responses show an increasing use of the Internet for obtaining park information, which suggests the potential for expanding the use of the Internet to disseminate park information and updates. Visitors also indicated a willingness to use optional, free shuttles as a form of alternative transportation in National Parks, although other options such as mandatory or fee-based shuttles continue to be met with resistance.

These meetings and surveys revealed several categories of transportation problems at each park; these are summarized in Table ES-1. While GGNRA and SEKI represent only two parks, their problems may be indicative of other heavily used parks in California.

While ITS cannot address all of a park's transportation challenges, it can be used as part of the solution. In order to help define what ITS may be able to do in a national park setting, a set of ITS objectives were developed. These objectives were divided into three groups corresponding to the three-legged stool that supports the national park mission: visitor experience, resource protection, and transportation system management, as shown in Table ES-2.

ITS theme recommendations were developed for GGNRA and SEKI to address one or more transportation challenges and to achieve one or more of these ITS objectives. Table ES-3 and Table ES-4 list the themes for GGNRA and SEKI, respectively, indicating which transportation challenges they might address and which ITS objectives they might achieve. Additional themes were identified that may have applicability to other national parks in California to realize different ITS objectives. These are listed in Table ES-5. More detailed information about all these themes, including descriptions, identification of stakeholders, scenarios, potential technology implementations, and technical and institutional issues, is provided later in this report. In each case, the themes were developed to be consistent with the National ITS Architecture, a nationally adopted framework that helps to guide ITS deployment. This will help to ensure that ITS projects in the parks can be integrated into the larger regional context, providing the maximum benefit to park managers and the visiting public.

The variety of ITS theme recommendations suggests that ITS, while not a panacea, may potentially address many transportation challenges at a number of California's national parks. While the recommended themes could be implemented in GGNRA and SEKI without further exploration, further study would be needed to implement ITS at other parks in California. Therefore, several checklists were developed to help parks complete this exploration and reach the same level of ITS understanding as the case study parks (GGNRA and SEKI). These checklists are as follows:

- Develop relationship with local regional transportation planning agency (RTPA) or metropolitan planning organization (MPO) (see Figure ES-1)
- Conduct a transportation needs assessment (see Figure ES-2)
- Identify ITS Themes for Park (see Figure ES-3)
- Develop ITS projects from ITS themes (see Figure ES-4)

The research project is now proceeding into phase 2. Deliverables in this phase will include a park outreach video, a review of ITS measures of effectiveness, an ITS architecture and integration case study, and early-winner projects in GGNRA and SEKI.

Table ES-1: Summary of Transportation Problems at Case Study Parks.

Golden Gate National Recreation Area	Sequoia and Kings Canyon National Parks
• **Roadway congestion** during high visitation times at many locations throughout the recreation area • **Inadequate access**, especially for transit, bicycle and pedestrian modes, to various park sites • **Limited parking** causes overflow conditions at several GGNRA locations, which is aggravated by a lack of real-time parking information • There are unmet needs to **coordinate transit service and improve transit information** to better serve park lands and visitors • A **lack of planning data** regarding visitation patterns and non-motorized traffic in order to improve transportation planning • Visitors need improved **traveler information** about parking, congestion, transit availability and weather prior to their visit • There is a need for better **coordination on work zones and special events** between various agencies • With the Golden Gate Bridge frequently cited as a terrorist target, the park must be sensitive to **evacuation and emergency response** needs on its lands	• **Parking lots** at popular destinations fill quickly and become congested • If the park pursues a **transit system** as planned, there will be a need for shuttle information • Snow, ice, and fog are common **weather concerns** in the park during certain times and can lead to hazardous road conditions • Excessive **queues at entrance stations** during high visitation times create delay and safety concerns • **Incidents or forest fires along Generals Highway** could threaten public safety and impact the flow of traffic to and from Giant Forest • There will be ongoing **work zones** over the next 10 or more years that will impact visitor travel on park roads. • Tourists need more **information about campgrounds and reservations** • This park has **air quality issues** that are caused by activities to the west • **Roadway congestion** occurs during high visitation times at many locations throughout the park • **Park roadways** have steep grades and are narrow, which has led to dangerous conditions for recreational vehicles and buses

Table ES-2: ITS Objectives for National Parks.

Goal 1	**Enhance the visitor experience**
1.1	*Provide real-time, accurate, convenient and relevant information to visitors to help them make travel decisions*
1.1.1	Develop predictive information that will help visitors plan their trips better
1.1.2	Provide visitors with appropriate information at major transportation decision points
1.1.3	Provide information to help visitors avoid congested locations and times
1.1.4	Provide weather, road condition, and chain requirement information
1.1.5	Provide construction and work zone information
1.1.6	Provide information on parking availability
1.1.7	Provide information at various park sites about transit arrivals and schedules
1.1.8	Provide air quality information
1.2	*Improve visitor safety*
1.2.1	Improve the safety of vehicles at or approaching congested entrance stations
1.2.2	Improve the safety of vehicle travel on park roadways
1.2.3	Improve the safety of vehicle travel through work zones in the park
1.2.4	Improve the safety of bicyclists and pedestrians approaching popular destinations
1.3	*Enhance visitor access to the variety of natural, cultural, recreational and educational opportunities available at the park and surrounding areas*
1.3.1	Improve access options for visitors without automobile access
1.3.2	Provide transit service that enables visitors to see attractions that may not have been possible because of unavailability of parking
1.4	*Improve visitor convenience*
1.4.1	Reduce the delay to visitors waiting in long lines at entrance stations
1.4.2	Decrease the difficulty in finding available campsites
1.4.3	Allow visitors to make reservations for experiencing certain park activities
1.4.4	Provide customized and enhanced interpretation through in-vehicle or handheld systems
Goal 2	**Assist in resource protection**
2.1	*Encourage use of alternative modes of transportation to, from or within the park*
2.1.1	Increase usage of transit, pedestrian and bicycle modes for park access
2.1.2	Increase usage of alternative transportation systems within park
2.1.3	Promote information about non-automobile alternatives
2.2	*Monitor and reduce vehicle emissions*
2.2.1	Reduce emissions of idling vehicles in parking areas
2.2.2	Reduce emissions of idling vehicles at entrance gates
2.2.3	Improve the monitoring of air quality in the park
2.3	*Protect the road infrastructure as a park resource*
2.3.1	Re-direct oversize vehicle traffic to reduce roadway impacts
2.3.2	Reduce time required for snow removal and other roadway maintenance
Goal 3	**Improve management of the park's transportation system**
3.1	*Manage congestion within the park*
3.1.1	Predict occurrence and duration of congestion based on historical and real-time information
3.1.2	Monitor transportation operations and congested areas
3.1.3	Reduce congestion on park roadways
3.2	*Manage incidents to reduce their impact on the park's transportation system and promote visitor safety*
3.2.1	Improve the response time to incidents along park roadways
3.2.2	Provide for prompt and efficient evacuation of visitors during major emergencies
3.3	*Manage construction and work zone activities and special events to minimize visitor inconvenience*
3.3.1	Enhance interagency coordination and communication regarding work zones and special events
3.3.2	Reduce the vehicle delay through work zones within the park
3.3.3	Use archived data to help to promote improved planning for the impacts of special events on the local transportation system
3.4	*Manage parking facilities within the park*
3.4.1	Reduce congestion in and around parking areas
3.4.2	Reduce parking outside of designated parking areas
3.4.3	Improve management of existing parking facilities to optimize parking usage
3.5	*Manage transit systems providing access to park sites*
3.5.1	Improve efficiency and level of service of transit operations within the park
3.5.2	Enhance the monitoring and coordination of various transit operations serving the park
3.6	*Manage data to promote better transportation planning in the park*
3.6.1	Enhance the reliability, accuracy, and timeliness of visitation statistics
3.6.2	Collect additional statistics to help in transportation planning (e.g. distinguish between travelers and visitors, determine linked trips and trip patterns, count non-motorized travel)
3.7	*Manage the transportation impact of the park's visitation on surrounding communities*
3.7.1	Manage adverse traffic impacts on local communities while preserving the economic benefits of tourist activity
3.7.2	Promote sharing of information regarding tourist activities between the park and local communities

Table ES-3: ITS Themes for GGNRA.

Theme	Transportation Problems: Roadway Congestion	Inadequate Access	Limited Parking	Transit Coordination and Information	Lack of Planning Data	Traveler Information	Work Zone/Event Coordination	Emergency Response	ITS Objectives
Roadway Congestion Forecasting	✓		✓		✓	✓	✓		1.1.1, 1.1.3, 3.1.1, 3.1.2, 3.3.3
Data Collection and Storage					✓				3.6.1, 3.6.2
Parking Management and Information	✓		✓		✓	✓			1.1.1, 1.1.6, 1.2.4, 3.1.1, 3.4.1, 3.4.2, 3.4.3, 3.7.1
Parking Intercept	✓	✓	✓	✓		✓			1.1.2, 1.1.3, 1.1.6, 1.1.7, 2.1.1, 2.1.3, 3.1.2, 3.4.1, 3.4.3
Pre-trip Traveler Information	✓	✓	✓	✓		✓	✓		1.1.1, 1.1.3, 1.1.4, 1.1.5, 1.1.6, 1.1.7, 2.1.3, 3.7.2
Transit Trip Planner	✓	✓		✓		✓			1.1.1, 1.1.2, 1.1.7, 1.3.1, 1.3.2, 2.1.1, 2.1.2, 2.1.3, 3.3.3, 3.5.2
Major Emergency Response								✓	3.2.2

Table ES-4: ITS Themes for SEKI.

Theme	Transportation Problems: Limited Parking	Transit Service	Weather Forecasts and Road Conditions	Queues at Entrance Stations	Safety Challenges due to Incidents	Work Zone Coordination	Campground Information and Reservations	Degradation of Air Quality	Roadway Congestion	Road Infrastructure	ITS Objectives
Parking Management and Information	✓								✓		1.1.2, 1.1.3, 1.1.6, 1.2.4, 2.2.1, 3.4.1, 3.4.2, 3.4.3
Transit Service and Traveler Information	✓	✓							✓		1.1.2, 1.1.7, 1.3.1, 1.3.2, 2.1.2, 2.1.3, 3.1.3, 3.4.1, 3.4.2, 3.5.1
Weather and Road Condition Information			✓								1.1.2, 1.1.4
Electronic Entrance Fee Collection				✓							1.2.1, 1.4.1, 2.2.2
Road Monitoring and Incident Management					✓				✓		1.2.2, 3.1.2, 3.2.1
Road Construction Information and Coordination						✓			✓		1.1.2, 1.1.5, 1.2.3, 3.3.1, 3.3.2
Campground Reservations and Information							✓				1.1.1, 1.4.2
Emissions Monitoring								✓			1.1.8, 2.2.3
Oversize Vehicle Detection									✓	✓	1.2.2, 2.3.1, 3.1.3

Table ES-5: Other ITS Themes for California National Parks.

Theme	ITS Objectives
Park Reservation System	1.4.2, 1.4.3
Park Vehicle Capacity Management	2.1.1, 3.1.3, 3.4.1
Winter Road Opening	1.1.4, 2.3.2, 3.3.1
NPS/Gateway Community Smart Card	3.7.2
Virtual Ranger	1.4.4

Develop relationship with local RTPA/MPO

- ☐ The local RTPA/MPO is: ________________________________
  See Figure 7-6
- ☐ A good contact person there is: ___________________________
- ☐ The park is in Caltrans District(s) __________________________
  See Figure 10-3
- ☐ A good contact person there is: ___________________________

Figure ES-1: Checklist for Developing Relationship with RTPA/MPO.

<u>Conduct a transportation needs assessment</u>

- ☐ <u>Park Planning Documents</u>
  - The last park GMP was conducted in ____________________________
  - ☐ Review the transportation needs identified in that GMP
  - Other transportation studies conducted in the last ten years include:
    - ☐ ____
    - ☐ ____
    - ☐ ____
- ☐ <u>Local Planning Documents</u>
  - ☐ Regional ITS Strategic Deployment Plan
    - *See Figure 7-5 to identify the appropriate plan*
  - ☐ Local Regional Transportation Plan
  - Other transportation documents recommended by RTPA/MPO
    - ☐ ____
    - ☐ ____
    - ☐ ____
  - Gateway Community/City Transportation Plans
    - ☐ ____
    - ☐ ____
- ☐ <u>Meet with local transportation officials</u>
  - ☐ RTPA/MPO staff ____
  - ☐ Caltrans District staff ____
  - ☐ California Highway Patrol _______________________________________
  - ☐ Local law enforcement ____
  - ☐ Local emergency response ______________________________________
  - ☐ Local Air Quality Management District ___________________________
- ☐ <u>Meet with other affected partners</u>
  - ☐ Local tourism agency ____
  - ☐ Local chambers of commerce ____________________________________
  - ☐ Park concessionaires ____
  - ☐ Park partner support organizations ______________________________
- ☐ <u>Survey park visitors</u>
  - ☐ Review most recent visitor services project (VSP) survey
  - ☐ Review other recent surveys
  - ☐ Identify critical survey questions
  - ☐ Conduct park survey (VSP, park staff, or contractor)

Figure ES-2: Checklist for Conducting a Transportation Needs Assessment.

Identify ITS Themes for Park

- [ ] Develop a transportation vision for the park
  - [ ] Develop draft vision statement
  - [ ] Solicit comments from key park stakeholders
    - [ ] Park interpretation staff
    - [ ] Park maintenance staff
    - [ ] Park visitors
    - [ ] Park partner organizations
    - [ ] Gateway community government officials
    - [ ] County government officials
    - [ ] Other stakeholder ____
    - [ ] Other stakeholder ____
  - [ ] Revise vision statement
- [ ] Develop an ITS vision for the park
  - [ ] Craft draft ITS vision from overall transportation vision
  - [ ] Solicit comments from key ITS stakeholders
    - [ ] RTPA/MPO staff
    - [ ] Caltrans district staff
  - [ ] Revise ITS vision statement
- [ ] Refine the ITS vision into ITS objectives
  - [ ] Review draft ITS objectives
    See Table 8-1
  - [ ] Add objectives as needed to meet park needs
    Aim for specific, measurable objectives
  - [ ] Remove non-critical objectives
- [ ] Develop ITS themes to match ITS objectives
  - [ ] Review existing themes to see which ones address park transportation problems
    See Table 10-1
  - [ ] Review existing themes to see which ones address park ITS objectives
    See Table 10-2
  - [ ] Remove themes that are not appropriate for park goals
  - [ ] Identify pieces of ITS Architecture to make new themes
    - [ ] Review market packages from ITS National Architecture
      See <u>http://itsarch.iteris.com/itsarch/</u>
    - [ ] Identify market packages which would help to address park needs
    - [ ] Review equipment packages associated with each market package to identify relevant pieces
    - [ ] Combine selected equipment packages to form self-contained ITS themes
    - [ ] Review information flows for completeness
    - [ ] Develop diagrams of ITS themes
    - [ ] Develop description of ITS theme
      Identify primary functions
      Develop order of functions
      Identify key stakeholders

Figure ES-3: Checklist for Identifying ITS Themes for Parks.

Develop ITS Projects from ITS Themes

- [ ] Develop ITS projects from ITS themes
  - [ ] Identify potential project phasing
  - [ ] Compare themes to identify common elements for larger, integrated ITS
  - [ ] Develop discrete projects from themes
  - [ ] Prioritize projects
- [ ] Identify project champions
  - [ ] Identify park champion for each project
  - [ ] Identify involved stakeholders for each project
  - [ ] Identify contact person with each stakeholder
- [ ] Develop project architecture
  - [ ] Review and combine theme diagrams
  - [ ] Define all subsystems and terminators for each project
  - [ ] Define all information flows
  - [ ] Compare project to regional architecture and amend as necessary
    - *Coordinate with RTPA/MPO*
- [ ] Develop concept of operations
  - [ ] Identify roles and responsibilities of stakeholders
  - [ ] Identify location and environment of operations
  - [ ] Summarize information inputs and outputs
  - [ ] Identify system users and their expectations/needs
  - [ ] Quantify performance requirements (e.g. speed, reliability, capacity, life cycle, etc.)
  - [ ] Identify measures of effectiveness
- [ ] Develop project requirements
  - [ ] Set-up system walkthrough
  - [ ] Review draft requirements
  - [ ] Finalize requirements
- [ ] Obtain stakeholder buy-in
  - [ ] Develop agreements or memoranda of understanding with all stakeholders
    - *Information-sharing*
    - *Interoperability*
    - *Ownership*
    - *Operations and Maintenance*

Figure ES-4: Checklist for Developing ITS Projects from ITS Themes.

1. INTRODUCTION

According to the National Park Service (NPS), 2003 saw a total visitation to NPS-managed lands in California of over 34 million visitors (1) – exceeding any other state in the country. With this visitation 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) Division of Research and Innovation 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.

There is tremendous variation in the location (urban vs. rural) and size of California's 23 National Parks. There are also variations in 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 focused on two of the 23 park units within the state – Golden Gate National Recreation Area and Sequoia and Kings Canyon National Parks – and attempted to recommend ITS solutions that may be applicable to other parks in California as well.

This report completes the first phase of this Caltrans-sponsored research project. It reviews the background for this project, and provides a brief overview of national parks that have ITS in them. The report describes how the two case study parks were selected for this project, and summarizes key background information for each park, including park history and documentation of recent transportation planning efforts. The report presents key findings of visitor surveys that were conducted during 2002 at each park. The findings from the visitor surveys, the background research at each park, and park outreach meetings were integrated to develop a list of transportation needs for each park; these are summarized in this report. Based on these needs, recommendations for ITS themes are developed for each study park, along with other themes that may have broader applicability to other parks in the state. The report concludes with recommendations for how parks may proceed with ITS implementation, and recommendations for future research in this area.

2. BACKGROUND

2.1. Project Background

National parks entice millions of people to visit them every year. Each of these visitors is looking for a wonderful visitor experience, although they expect the park service to accomplish this while protecting the park resources so that future generations can enjoy the park as well. The park service has recognized this and has made it their mission.

California's national parks include some of the jewels of the National Park Service system, including the towering coastal redwoods in Redwood National Park and giant sequoia trees in Sequoia and Kings Canyon National Parks, the breathtaking splendor of the Yosemite Valley in Yosemite National Park, and the striking desert scenery in Death Valley National Park. In addition to protecting unique natural resources, these parks protect archeological, cultural and historic resources, and provide outstanding recreational and educational opportunities for California's residents and visitors from other states and nations.

National parks have a significant economic and transportation impact on the State of California. The parks are an economic engine attracting tourists who benefit not only the parks, but also the adjacent communities known as gateway communities. Along with visiting the national parks, tourists tend to stay in nearby communities and go to other attractions in the area. While visitation statistics at many of California's more famous national parks have shown limited growth over the last several years, visitation at other park units within California is increasing, as the following statistics indicate:

- Mojave National Preserve – 64 percent increase from 1998 to 2003,
- Whiskeytown National Recreation Area – 67 percent increase from 1993 to 2003,
- Channel Islands National Park – 174 percent increase from 1988 to 2003, and
- Joshua Tree National Park – 91 percent increase from 1983 to 2003.

As visitation has grown, there has been increased economic benefit to California, while there have been increased demands on the transportation system.

Park visitation levels are expected to continue to increase in the future, and the corresponding transportation system impacts may adversely affect both visitor experience and resource protection issues at the parks unless actions are taken. The parks depend on this "three-legged stool" of visitor experience, resource protection and the transportation system to fulfill their purpose. If any one of these legs breaks, the entire system will deteriorate.

The transportation system plays a key role in both of the previously mentioned "legs." In order to have a pleasant visitor experience, people expect that they can go through the park without waiting in congestion, that they will be able to drive their own vehicles, and that there will be a parking spot waiting for them when they arrive. Unfortunately, with visitation increasing, these demands are becoming harder to fulfill and widening park roadways and expanding parking lots would be detrimental to park resources; therefore, a solution other than construction needs to be considered.

Intelligent transportation systems (ITS) may provide relief to some access and transportation problems in California's national park units in a more economical and perhaps more environmentally friendly way than new construction. Intelligent transportation systems are a way to manage and operate roadways by providing drivers with up-to-date, real-time information so that more efficient decisions can be made. One example of ITS in a park setting would be a changeable message sign that allows park staff to inform drivers that a road is closed in the park and to provide them with an alternate route.

In view of the beneficial role that national parks play in California from quality of life and economic vitality perspectives and the potential that ITS offers to address transportation challenges at these parks, the California Department of Transportation (Caltrans) Division of Research and Innovation sponsored a research project to explore how ITS can help California's national parks. In July 2001, Caltrans contracted with the Western Transportation Institute at Montana State University-Bozeman, in cooperation with Texas A&M University's Department of Recreation, Park and Tourism Sciences and the Texas Transportation Institute, to undertake this research. Key research activities included the following:

- select parks to highlight as case studies for this project,
- conduct park outreach and visitor surveys at each of the case study parks,
- develop ITS themes that would be suitable for the case study parks, and
- document the findings in a fashion that would help the case study parks and other California parks consider ITS solutions to address their transportation challenges.

This research project seeks to understand the transportation needs within the California National Parks by looking at two case study parks: Golden Gate National Recreation Area (GGNRA) and Sequoia and Kings Canyon National Parks (SEKI). After identifying the transportation needs for these parks, potential ITS solutions or themes will be recommended along with how to follow national guidelines for the planning and implementation of these themes or solutions. This report will also include solutions or themes that were not identified for the two case study parks, but those that show promise for other California parks. The goal of this project is that any park in California, knowing their transportation needs, will be able to find a solution/theme in this document and use the documentation included to plan and implement the solution in their park.

2.2. Literature Review on Other Parks with ITS

ITS has been 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 are listed below.

2.2.1. 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.

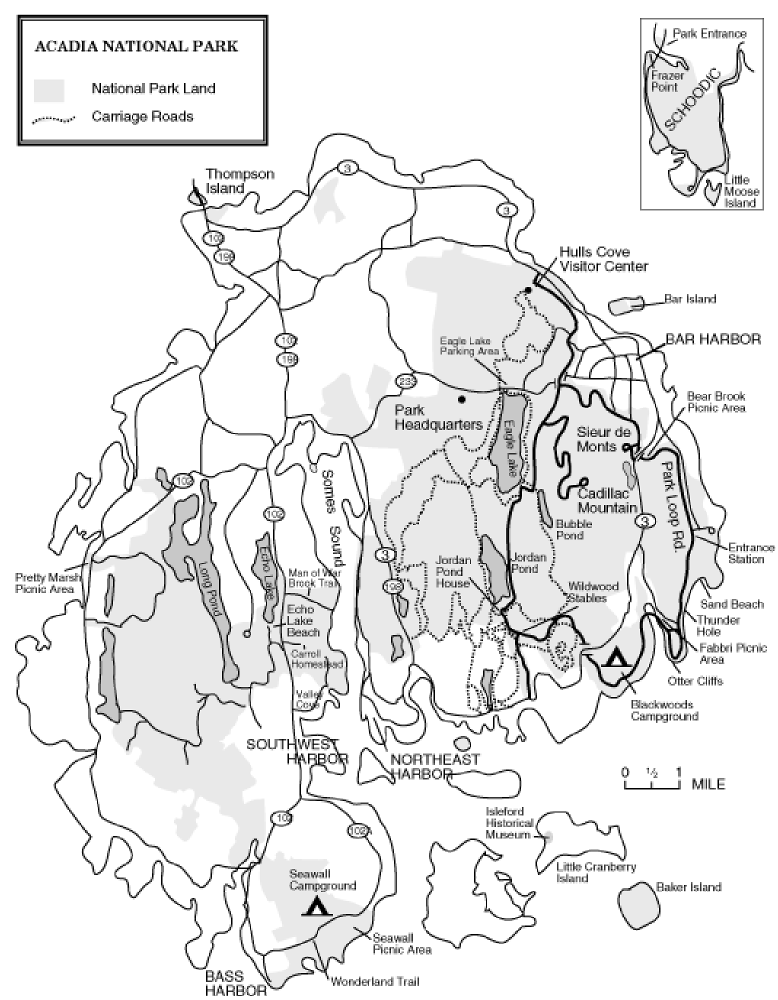

Figure 2-1: Detailed Map of Acadia National Park

(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 (2). 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 (3). 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 changeable message signs (CMS) were the preferred methods for obtaining information en-route, while preferred types of media once in the area included guidebooks, visitor centers, information kiosks, Chambers of Commerce, or computers in hotels 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 originally scheduled for evaluation in 2000-2001; however, initial operations of ITS elements were delayed until summer 2002.

2.2.2. 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 (see page 6), includes more than 20,000 acres and welcomes 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 CMSs relay important information to travelers entering the tunnel. There have not been any fatalities since the tunnel opened in 1996 (4).

2.2.3. 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 in Figure 2-3 (see page 7) 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 park planners have started parking lot monitoring as part of a parking management system (5). Cooperation at the state and regional level should enable traffic and travel conditions to be accessed throughout the New Jersey and New York area.

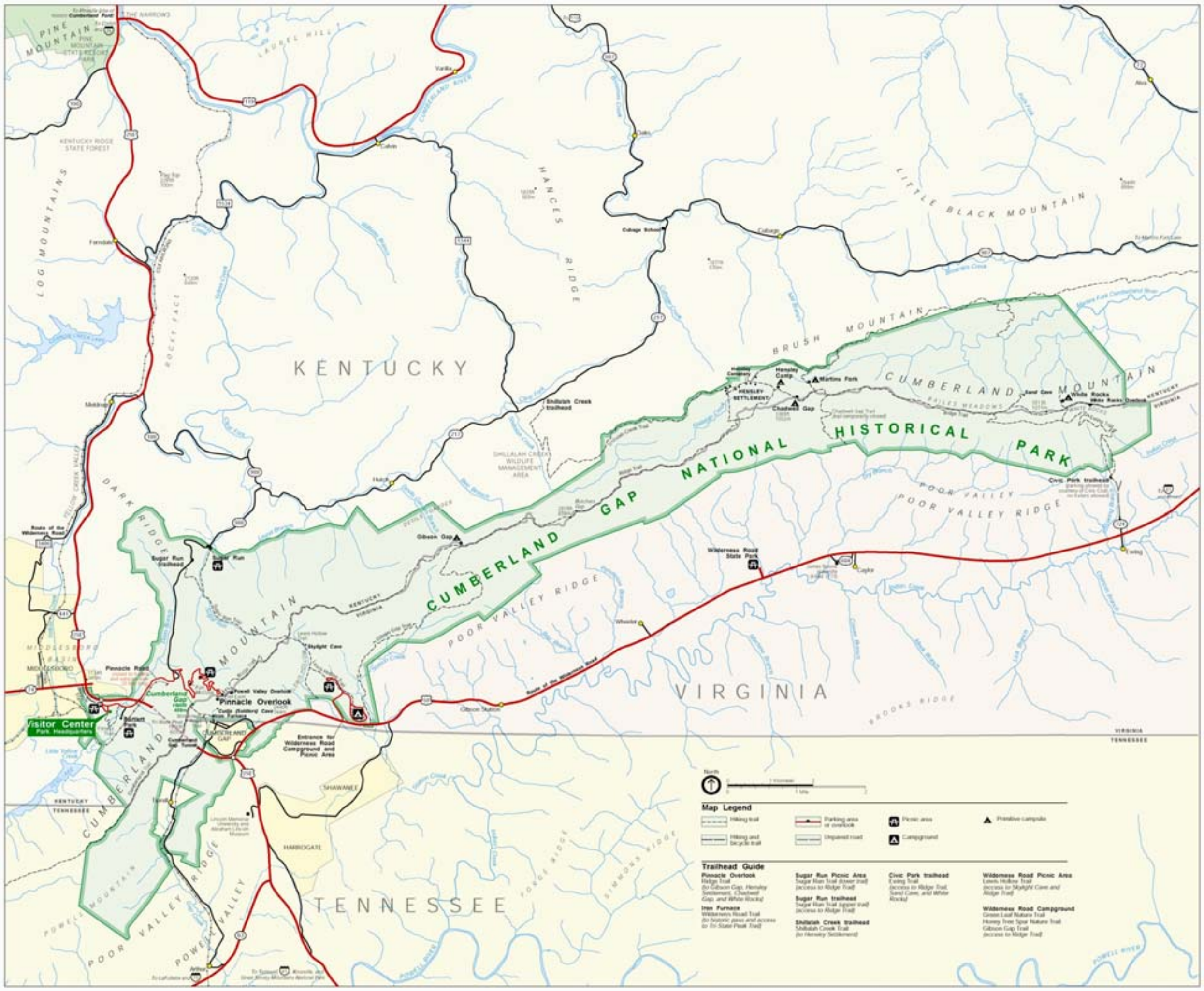

Figure 2-2: Detailed Map of Cumberland Gap National Historical Park

(Source: National Park Service)

Figure 2-3: Detailed Map of Gateway National Recreation Area

(Source: National Park Service)

2.2.4. 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 1,400 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

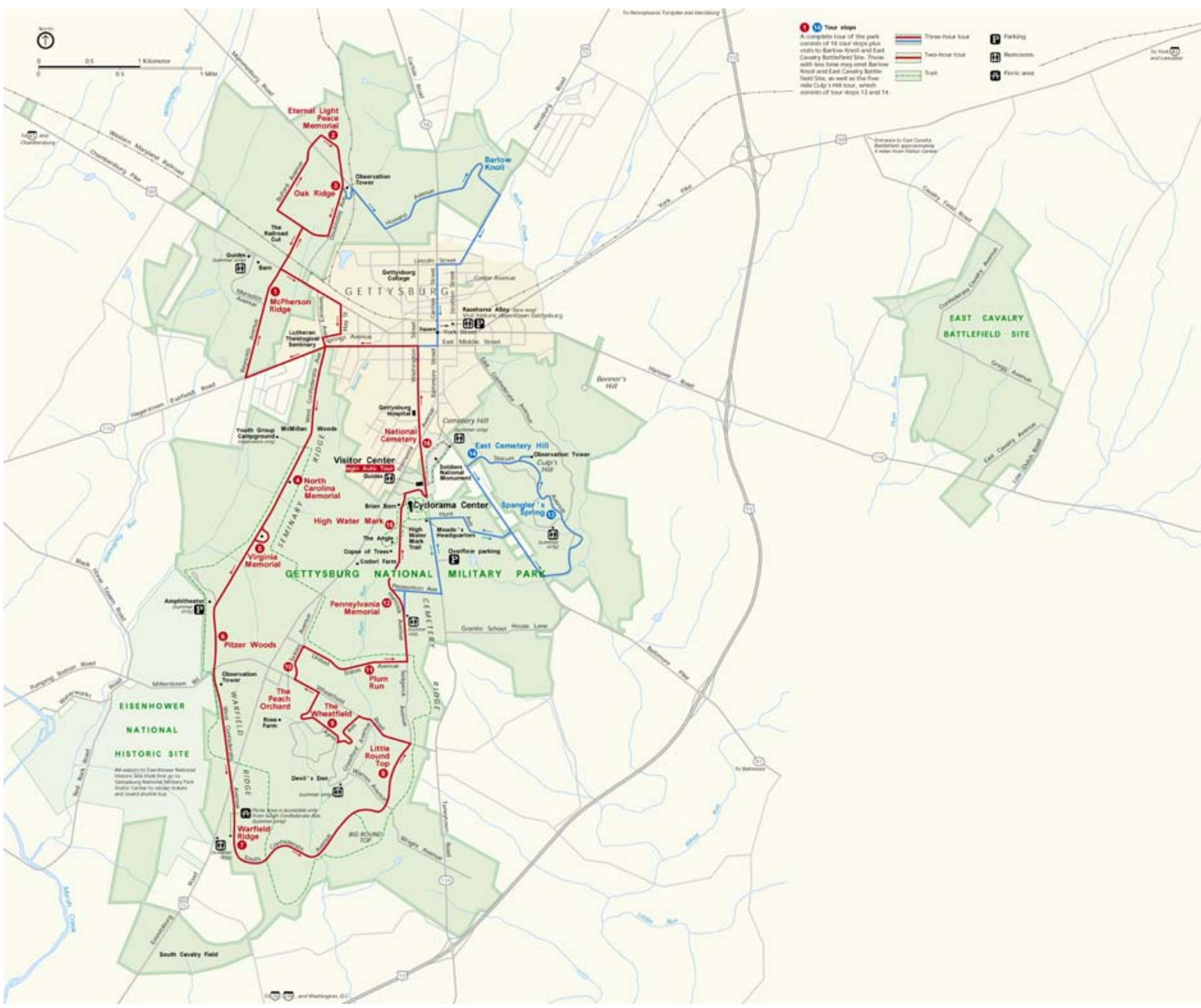

Figure 2-4: Detailed Map of Gettysburg National Military Park

(Source: National Park Service)

systems, has been proposed (5).

2.2.5. 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, a transportation consultant, under the auspices of DOT's National Advanced Rural Transportation Systems Program (6). 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)

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

(Source: National Park Service)

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 CMSs. 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 (6).

2.2.6. 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.

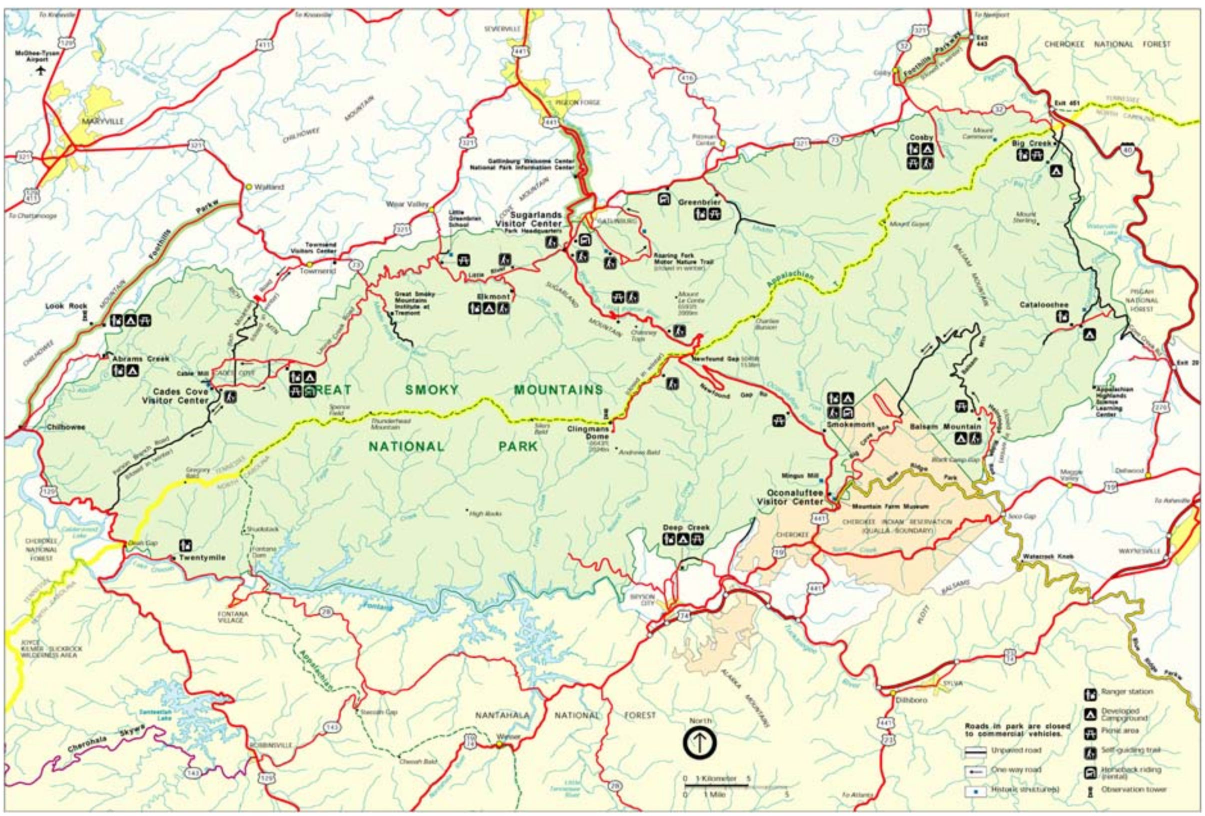

Figure 2-6: Detailed Map of Great Smoky Mountain National Park

(Source: National Park Service)

Great Smoky Mountains National Park not only has a couple of transportation planning projects underway, it also has several that have been completed. The park is currently working with the Federal Lands Highway Program to adapt ITS strategic planning for national parks (5), as well as working on a regional transportation study with the Knoxville Metropolitan Planning Organization (MPO) 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 an interactive phone system for visitors to obtain road, camping, recreation and visitor information. Road updates are also posted on the park website.

2.2.7. 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, is sometimes 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 its partners, was chosen to develop a comprehensive ATIS for the park. Made available to the public in April 2000 (7), 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, CMS, and highway advisory radio (HAR).

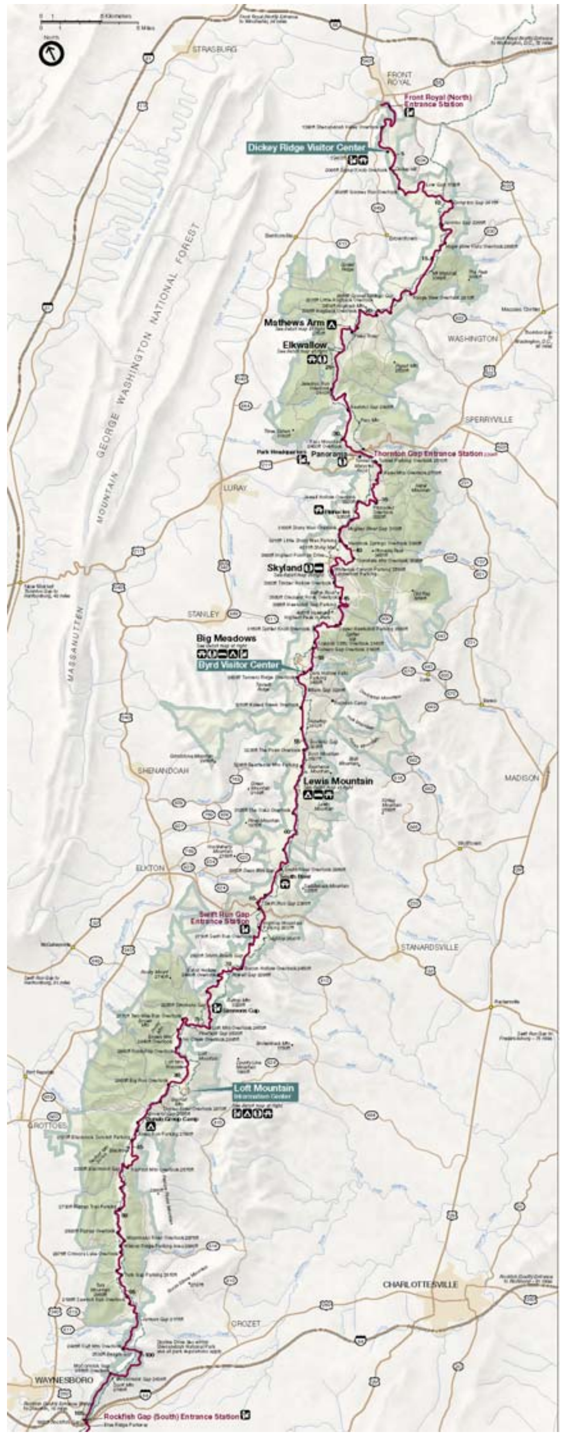

Figure 2-7: Detailed Map of Shenandoah National Park

(Source: National Park Service)

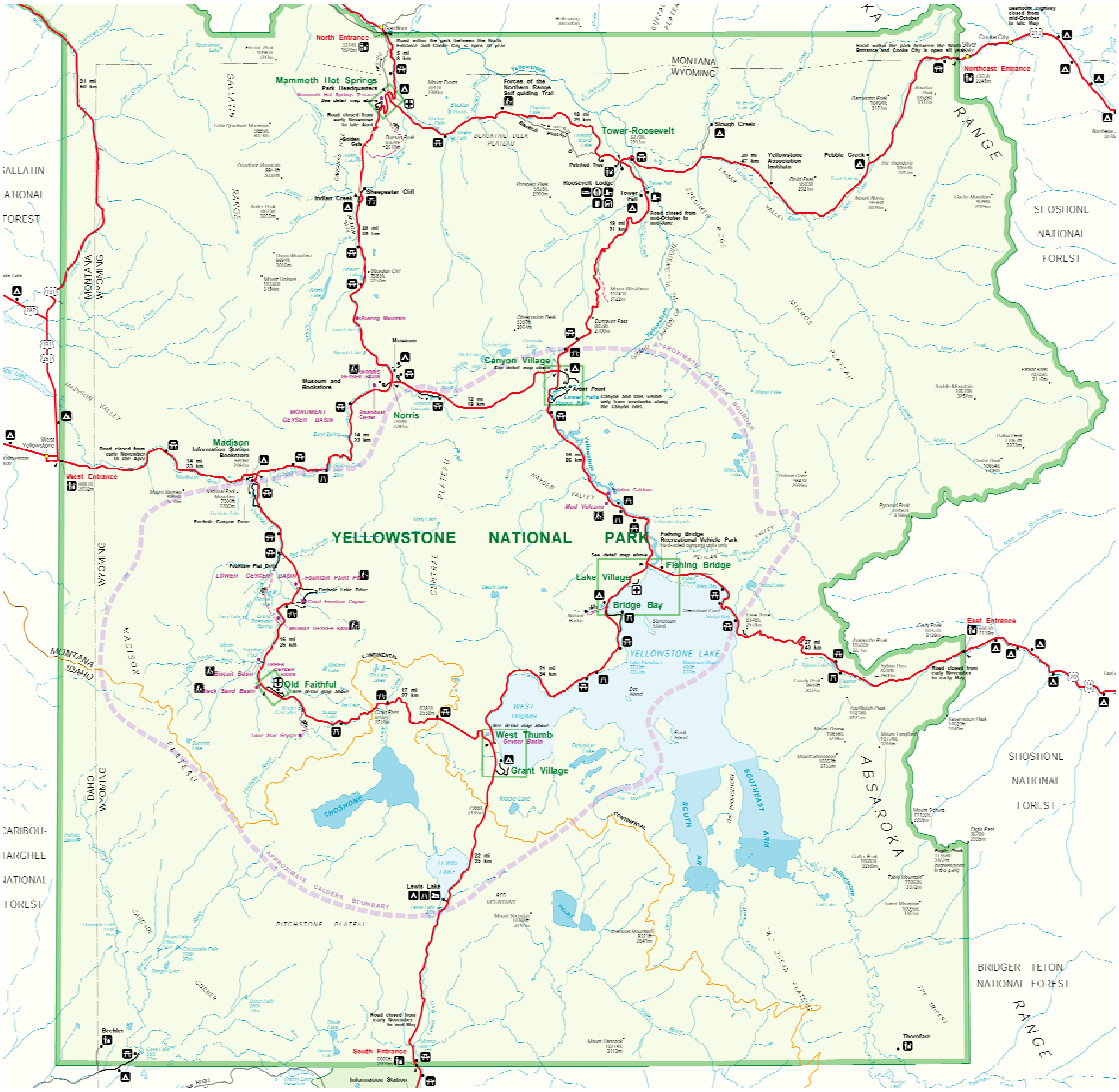

Figure 2-8: Detailed Map of Yellowstone National Park

(Source: National Park Service)

2.2.8. 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, it 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 (8). 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, changeable portable variable message signs, automatic vehicle identification/smart cards at park entrances, and an incident management plan.

2.2.9. 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.

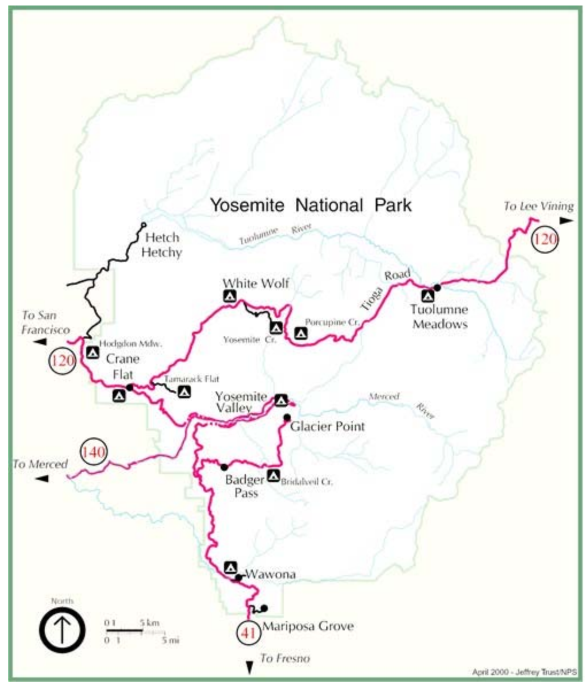

Figure 2-9: Detailed Map of Yosemite National Park

(Source: National Park Service)

Caltrans and Yosemite conducted a Field Operational Test on the Yosemite Area Traveler Information System in the mid-1990s (5). The system is designed to disseminate weather, traveler and road condition information. ITS tools used were CMSs, 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.

2.3. Review of Park Selection Procedure

A key element to this project was the identification of suitable case study parks which could provide useful information about the potential benefits ITS may offer. This section reviews the process that was used for identifying and selecting parks for this study.

2.3.1. Park Classification

The National Park Service manages 23 units within the State of California, as shown in Figure 2-10 (see page 15). 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 2-1 (see page 16). 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 (9). 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 in CA. 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.

2.3.2. Project Kickoff Meeting

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

- Caltrans New Technology & Research (now Division of Research and Innovation) staff;

- National Park Service Western Regional Office;

- National Park Service Units (Channel Islands NP, GGNRA, Yosemite NP); and

- Federal Highway Administration, Central Federal Lands Highway Division.

Figure 2-10: National Park Units in California

(Source: National Park Service)

Table 2-1: Comparison of Selected Park Attributes

	Annual Visitation		Peak Visitation (3)			Urban / Rural (5)	VTS (6)	Size		Designation	Land Type (8)	Overnight Stays	
Park (1)	Number	Level (2)	Number	% of Year	Level (4)			Acreage	Level (7)			Ratio (9)	Level (10)
Eugene O'Neill NHS	**2,966**	**1**	**1,365**	**46%**	**3**	**Urban**	**Yes**	**13**	**Small**	**Historic Park/Site**	**Land**	**-**	**1**
Fort Point NHS	**1,596,933**	**4**	**542,779**	**34%**	**1**	**Urban**	**No**	**29**	**Small**	**Historic Park/Site**	**Land/Water**	**-**	**1**
John Muir NHS	**28,336**	**1**	**9,529**	**34%**	**1**	**Urban**	**No**	**345**	**Small**	**Historic Park/Site**	**Land**	**-**	**1**
Manzanar NHS	**61,917**	**1**	**22,734**	**37%**	**2**	**Rural**	**No**	**814**	**Small**	**Historic Park/Site**	**Land**	**-**	**1**
San Francisco Maritime NHP	**3,984,826**	**4**	**1,421,346**	**36%**	**2**	**Urban**	**No**	**50**	**Small**	**Historic Park/Site**	**Land/Water**	**0.28**	**1**
Cabrillo NM	1,086,074	4	312,104	29%	1	Urban	No	160	Small	Monument	Land/Water	-	1
Devils Postpile NM	118,550	2	89,368	75%	4	Rural	Yes	798	Small	Monument	Land	3.62	2
Lava Beds NM	120,286	2	51,779	43%	2	Rural	No	46,560	Medium	Monument	Land	4.25	2
Muir Woods NM	719,350	3	279,171	39%	2	Urban	No	554	Small	Monument	Land	-	1
Pinnacles NM	162,791	2	65,082	40%	2	Rural	No	17,614	Medium	Monument	Land	-	1
Channel Islands NP	**605,754**	**3**	**219,221**	**36%**	**2**	**Rural**	**Yes**	**249,561**	**Medium**	**Park/Preserve**	**Water**	**21.56**	**3**
Death Valley NP	**924,181**	**3**	**264,760**	**29%**	**1**	**Rural**	**No**	**3,340,410**	**Large**	**Park/Preserve**	**Desert**	**27.97**	**4**
Joshua Tree NP	**1,287,985**	**4**	**464,969**	**36%**	**2**	**Rural**	**No**	**1,018,162**	**Large**	**Park/Preserve**	**Desert**	**22.48**	**3**
Kings Canyon NP	**577,736**	**3**	**268,650**	**47%**	**3**	**Rural**	**Yes**	**461,901**	**Large**	**Park/Preserve**	**Land**	**37.09**	**4**
Lassen Volcanic NP	**404,384**	**2**	**258,376**	**64%**	**4**	**Rural**	**No**	**106,372**	**Medium**	**Park/Preserve**	**Land**	**20.62**	**3**
Mojave National Preserve	**615,269**	**3**	**211,260**	**34%**	**1**	**Rural**	**No**	**1,531,832**	**Large**	**Park/Preserve**	**Desert**	**0.97**	**1**
Redwood Nat'l and State Parks	**408,126**	**2**	**187,987**	**46%**	**3**	**Rural**	**No**	**112,513**	**Medium**	**Park/Preserve**	**Land/Water**	**9.26**	**2**
Sequoia NP	**983,466**	**3**	**470,984**	**48%**	**3**	**Rural**	**Yes**	**404,051**	**Large**	**Park/Preserve**	**Land**	**28.63**	**4**
Yosemite NP	**3,475,317**	**4**	**1,619,642**	**47%**	**3**	**Rural**	**Yes**	**761,266**	**Large**	**Park/Preserve**	**Land**	**48.25**	**4**
Golden Gate NRA	13,854,750	5	3,759,495	27%	1	Urban	Yes	74,816	Medium	Rec. Area/Seashore	Land/Water	0.36	1
Point Reyes NS	2,250,670	4	722,200	32%	1	Urban	Yes	71,068	Medium	Rec. Area/Seashore	Water	1.55	2
Santa Monica Mountains NRA	492,656	2	142,976	29%	1	Urban	No	153,672	Medium	Rec. Area/Seashore	Land/Water	0.03	1
Whiskeytown NRA	757,267	3	354,173	47%	3	Rural	No	42,503	Medium	Rec. Area/Seashore	Land/Water	7.23	2

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

(2) - 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)

(3) - Peak three consecutive months

(4) - 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)

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

(6) - Visitor transportation system.

(7) - 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).

(8) - 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.

(9) - The number of annual overnight stays multiplied by 100 divided by annual visitation.

(10) - 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, 2003; land size statistics, fiscal year 2002.

Table 2-2: 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

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 resulting list of criteria is shown in Table 2-2.

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 the following two chapters.

3. GOLDEN GATE NATIONAL RECREATION AREA

3.1. Description of Park & History

The Golden Gate National Recreation Area (GGNRA) is one of the largest urban parks in the world, and one of the most popular within the national system with over 15 million visitors annually. 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 ranger talks, hiking, biking, visiting historic military facilities, horseback riding, going to the beach, and engaging in ocean sports.

3.1.1. 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 anchors both sides of the Golden Gate Bridge, as shown in Figure 3-1. GGNRA spans both north and south of San Francisco and lies in San Francisco, Marin, and San Mateo Counties.

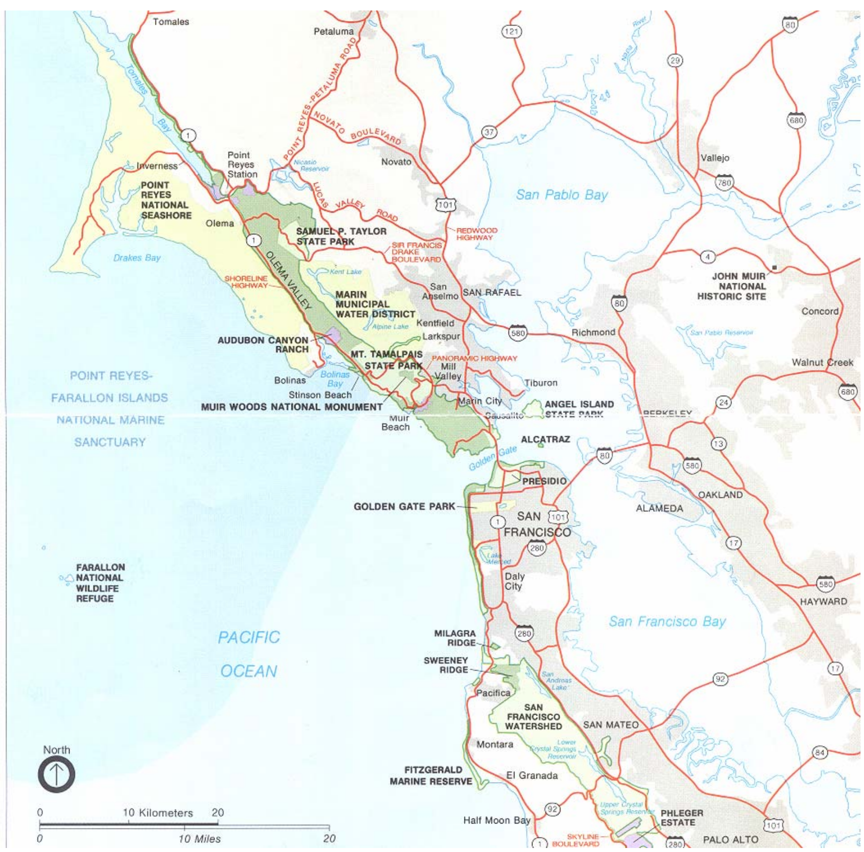

Figure 3-1: Area Map of Golden Gate National Recreation Area

(Source: National Park Service)

North of the Golden Gate Bridge within Marin County, GGNRA extends 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. A more detailed map of the National Recreation Area is provided in Figure 3-2.

GGNRA was established October 27, 1972. Most of the original national recreation area lands

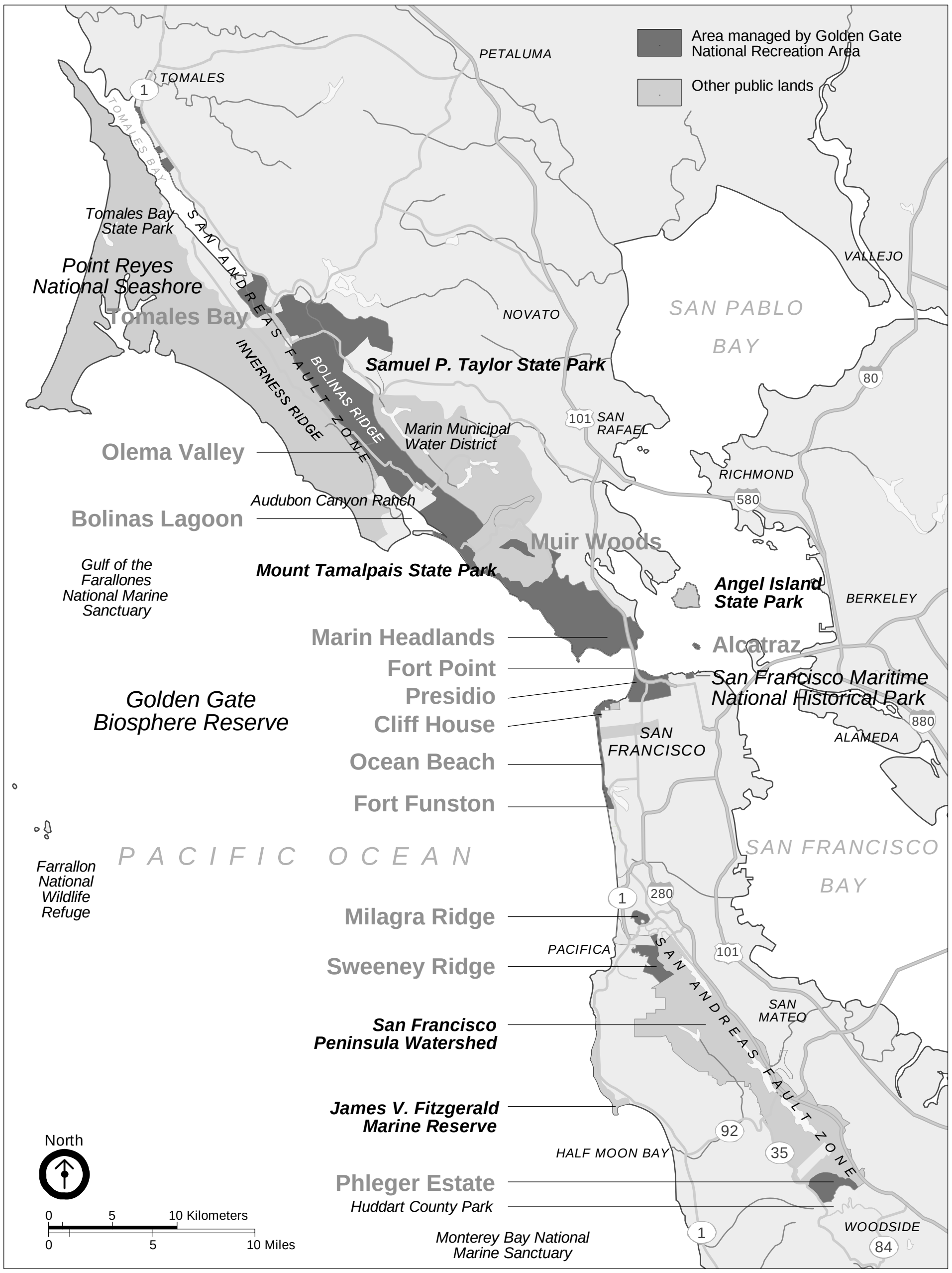

Figure 3-2: Detailed Map of Golden Gate National Recreation Area

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.) In the north, GGNRA includes well-known national treasures such as Muir Woods National Monument, Stinson Beach, Alcatraz Island and the Marin Headlands. Also included within the GGNRA, south of Golden Gate bridge, are Fort Mason, Fort Funston, Fort Point, Crissy Field, Baker Beach, China Beach, Ocean Beach, Land's End, and Sutro Heights/Cliff House, and the Presidio of San Francisco.

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 (10, 11).

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 (12).

There have been a number of boundary expansions since the GGNRA 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 (13).

The Presidio of San Francisco was built by the Spanish in 1776 and served as a Spanish fort from 1776 to 1822, a Mexican fort from 1822 to 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 (14).

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 (15).

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 (16, 17).

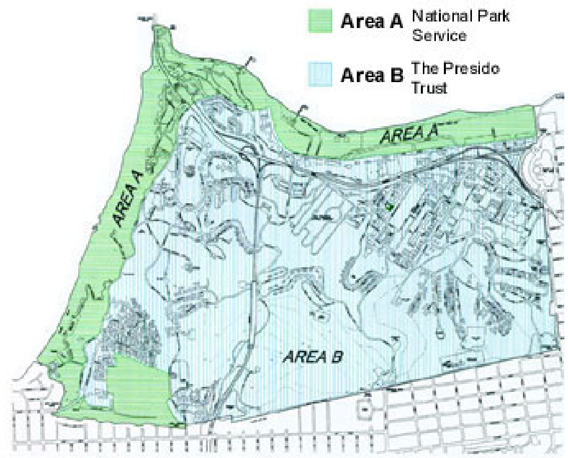

Figure 3-3: Management Areas of the Presidio

(Source: Presidio Trust)

Although Muir Woods National Monument was established as a separate entity in the National Park System, the monument is managed, as a result of GGNRA 1972 enabling legislation, as part of GGNRA. Muir Woods does, however, maintain visitation statistics separate from the rest of GGNRA as part of its fee collection program. Another site in the GGNRA that has a discrete site management is the Presidio. As shown in Figure 3-3, Area A in, the coastal areas is managed by the NPS, while Area B, the interior 80 percent of the Presidio including many of the historic structures, is managed by the Presidio Trust, a public-private governmental agency. This arrangement is due to the congressional mandate that Area B of the Presidio must be managed to be self-sufficient by 2013 (18).

3.1.2. Visitation

Figure 3-4 (see page 22) shows NPS statistics for annual visitation to the Golden Gate National Recreation Area. Visitation during 2003 was approximately 13.9 million. Figure 3-5 (see page 22) 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 recorded visits have averaged between 700,000 and 900,000 per year. Recorded visitation during 2003 was approximately 720,000, but actual visitation was likely 30 to 40 percent higher as many visitors use the park before or after the entrance station is staffed, especially during the summer.

Most areas within the park are no more than an hour drive from San Francisco and it encompasses much of the available open space in the area; therefore GGNRA is a popular destination for Bay Area residents. Results from surveys conducted in 2000 and 2001 to support the development of the Transportation Management Plan for the Marin Headlands and Fort Baker and the Southwest Marin Comprehensive Transportation Management Plan indicate that more than two-thirds of all visitors to the Marin areas of GGNRA are from the Bay Area (19). 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 of the visitors being locals combined with an almost complete absence of overnight lodging facilities within the park. Muir Woods National Monument had no recorded overnight visitors in 2003, as camping and picnicking are not allowed.

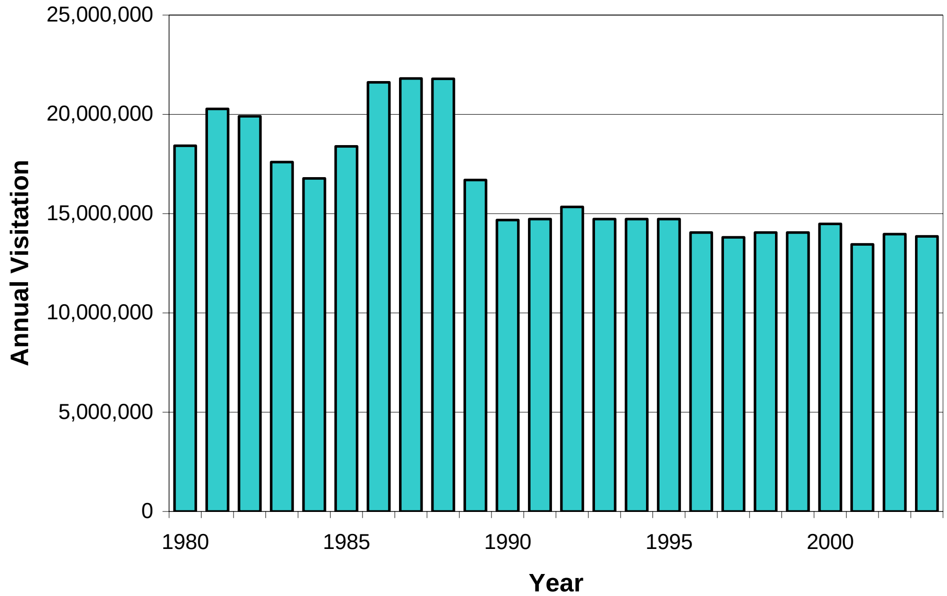

Figure 3-4: Annual Visitation Statistics at GGNRA

(Source: National Park Service)

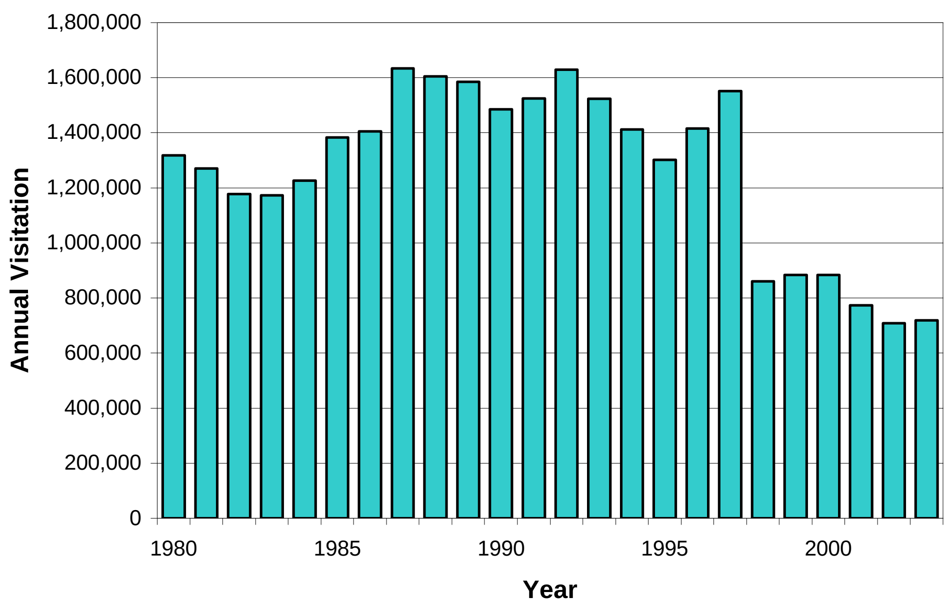

Figure 3-5: Annual Visitation Statistics at Muir Woods National Monument

(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 along Crissy Field allows for walking and biking in a 3.5-mile section. Visitors will find many beaches within the GGNRA including Stinson, Muir, Rodeo, 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, one of the most popular tourists destinations in the Bay Area. Camping and picnicking can be found in the Marin headlands while the former Rancho Corral de Tierra boasts horse stables, agricultural land, and rare species of animals.

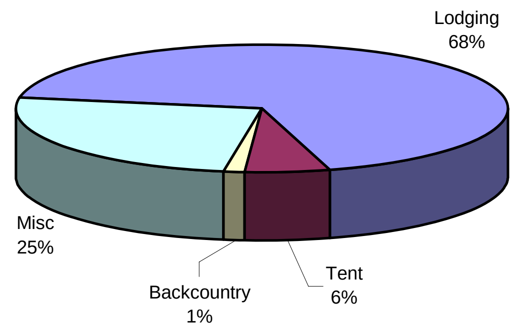

Figure 3-6: Accommodations for Overnight Visitors at GGNRA

(Source: National Park Service)

While visitation at GGNRA remains fairly constant throughout the year, as shown in Figure 3-7,

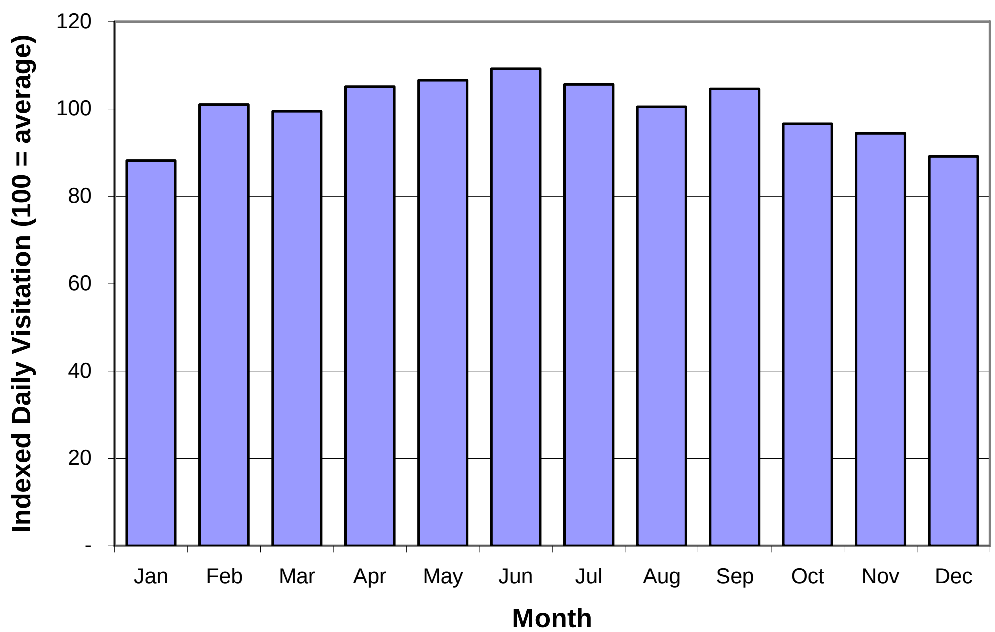

Figure 3-7: Seasonal Patterns in Visitation at GGNRA

(Source: National Park Service)

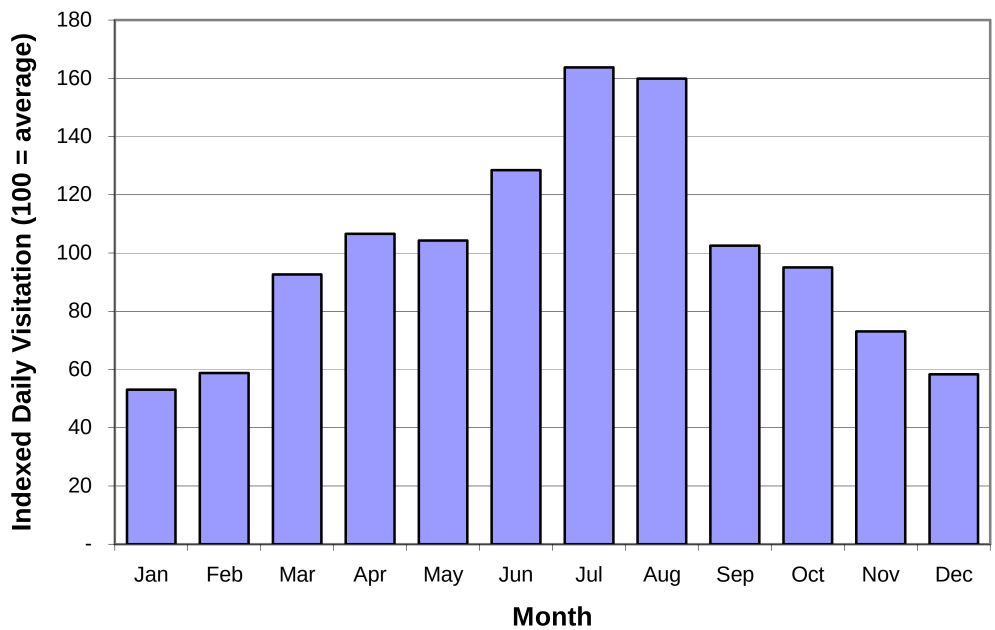

Figure 3-8: Seasonal Patterns in Visitation at Muir Woods National Monument

(Source: National Park Service)

the visitation at Muir Woods National Monument tends to peak in the summer months and shoulder weekends, as shown in Figure 3-8.

3.1.3. Transportation System

Due to GGNRA's proximity to San Francisco and other urban areas, there are several transit agencies that provide service from metropolitan areas to the southern lands of GGNRA. The San Francisco Municipal Railway (MUNI) provides service throughout San Francisco to shoreline destinations and also connects to other Bay Area transit systems. In addition to route service to southern GGNRA park sites, MUNI currently has a route that services Battery Spencer, in the Marin Headlands, daily, along with Rodeo Beach and Battery Alexander on 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) (20, 21).

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 (22) – 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 Transportation District (GGBHTD) 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 between March and October, and carries approximately 200 riders a day. This route also provides service above the Muir Woods area; however, the bus stop nearest the park is approximately a 1 mile walk away on narrow, winding trails. GGBHTD also provides ferry service to the City of Sausalito and Larkspur which cyclists can use to access Fort Baker and other Marin parklands (21, 23). The City of Sausalito began operating a pilot 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 and connects Sausalito to the Fort Baker area of GGNRA

The Alcatraz Island ferry service operated by a park concessionaire provides daily access to the island from Pier 39. 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 located outside of the GGNRA (21, 24).

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 (19).

3.2. Existing Management Goals

The general management plan (GMP) for the GGNRA was adopted in 1980 (25), 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. 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 GGNRA including:

- South West Marin Comprehensive Transportation Management Plan (26),
- GGNRA Ferry Study (27),
- Marin Headlands/Fort Baker Transportation Management Plan (19),
- Presidio Trails Master Plan (28),
- E/F line Extension study, 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.

3.2.1. 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;

- address parking over demand and impacts at park sites;

- 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 a visit to GGNRA attractions by providing easy to use and integrated transportation services within individual units (e.g. Presidio) and between multiple units (GGNRA units in Marin County, the Presidio, and other San Francisco GGNRA units) (21).

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 (29).

The Southwestern Marin Comprehensive Transportation Management Plan also had objectives that relate directly to visitor experience:

- Improve advanced information, education, and orientation for visitors;
- Improve the visitor support systems in the project study area in a manner consistent with staffing levels and visitor use to insure a quality visitor experience;
- Solutions are consistent with nature of visitor use/experience of the park site/area;
- Preserve, protect, and enhance the parklands and its natural resources for future generations; and
- Promote a model of equitable access for all ages and abilities.

And congestion and crowding:

- Manage residential, commercial, and park-generated congestion along the Shoreline Highway corridor (including Panoramic Highway) from U.S. 101 to Stinson Beach in a sustainable manner so that it:
    - i. Improves egress and ingress for residents and emergency vehicles and
    - ii. Improves the quality of visitor access and experience;
- Ensure safe, affordable alternatives for access and multi-modal connections for a variety of park visitors;
- Provide a sustainable balance of parking and alternative access options;
- Ensure cars park in designated areas;
- Provide trail linkages for viable, safe alternative access;
- Improve traffic management and parking enforcement;
- Provide traffic flow and safety improvements, such as scenic and slow vehicle pullouts;
- Enhance safety and reduce conflicts among automobiles, buses, pedestrians, and bicycles on Highway 1 and other roads in the CTMP study area;
- Integrate and link various transportation modes (such as ferries, buses, and bicycles) from throughout the Bay Area to take advantage of existing transit infrastructure and potential transit partnerships; and
- Transit intercept facility(ies) does(do) not reduce available transit and carpool parking for commuters (30).

3.2.2. 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 (19).

The Southwest Marin 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, a Tennessee Valley multi-use trail, and a visitor intercept/commuter parking facility, which would provide a shuttle staging area for park visitors and parking facility for visitors along US Route 101 before entering the communities and park lands (26).

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 being funded 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 2002. 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. 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 (27).

The Parklands Transportation Task Force was created, and continues to be coordinated, by the Metropolitan Transportation Commission (MTC), which is the Metropolitan Planning Organization (MPO) for the San Francisco Bay Area. The Task Force is made up of representatives from NPS, Marin County, the Federal Highway Administration (FHWA), MTC, Caltrans, Department of Fish and Game, California State Parks, GGBHTD, and the City of Sausalito. The purpose of this group is to oversee studies and implementation of regional transportation solutions for parklands in southwestern Marin County along the Golden Gate Bridge and US Route 101 and State Route 1 corridor (27).

3.3. Documentation of Previous Park Studies

The Golden Gate Recreational Travel Study was published in 1977 (31), and the Golden Gate/Point Reyes General Management Plan was published in 1980 (25). 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 useful, but dated.

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) and the Southwest Marin Comprehensive Transportation Management Plan visitor intercept survey and CTMP Existing Conditions Report were completed in 2002 and 2003 respectively (19). These documents have 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 (32). Additional park studies conducted for Muir Woods include the Natural Resources and Management Plan published in 1974 (33), and the Muir Woods Access Feasibility study of 1999 (34).

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 (35).

The Presidio Trust of San Francisco completed a Presidio Trust Management Plan in May 2002 (36) that replaced the General Management Plan Amendment done in 1994 by the NPS. The plan for the Presidio calls for preserving and protecting the park's 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 goal 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.

3.4. Relationships to Other Transportation Plans

This section addresses other regional 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.

3.4.1. 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 (37). This document does not include improvement plans for the GGNRA area because its primary goal is to improve commuter travel.

3.4.2. 2004 Regional Transportation Plan for the San Francisco Bay Area

The 2004 Regional Transportation Plan for the San Francisco Bay Area is currently in print (38). Like the document listed above, this one does not include information or improvement plans for any area within the GGNRA. However, the primary goal of most initiatives in this document is to improve commuter travel rather than addressing traffic related to the GGNRA.

3.4.3. 2004 WTA Regional Water Transportation Study

This study, completed by the San Francisco Bay Area Water Transit Authority (WTA), addresses the need for, and makes recommendations on, implementing increased ferry services in the region. It includes references to GGNRA and collaboration for daily, off-peak services (39).

3.5. 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) and to get stakeholders' input on the transportation needs, challenges, and potential integrated solutions for GGNRA.

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 3-1 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

Table 3-1: 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**

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 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, road conditions, and road closures within the area of the park. 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, in order to manage traffic flow. It would allow for the management of 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.

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 key park site in GGNRA per day, and would also let them obtain a count of the number of visitors to GGNRA per day. More accurate statistics would allow the park service to gain a better grasp of the number of materials needed for distribution each 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 improved and recent (2000-2003) information on the origin and destination of visitors, but no monies are available to continue this type of data collection on a regular basis. Information on trip patterns within the park exists for southwestern Marin County park sites. This type of information is useful for park staff to understand how visitors generally move around the park. It provides insight into whether most visitors visit certain attractions within the park in a certain order and could assist in better traffic management and to 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 and visitors to non-park destinations like Sausalito may also identify other routes that could be used, identify companies that could possibly set up transit for their employees, and suggest collaborative solutions.

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. Current parking information would allow for parking management and dissemination 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 and cyclists. It would also help in the development of trail maps for the park.

4. SEQUOIA AND 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. 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 are open year-round to visitors and 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 (40).

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 (41).

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

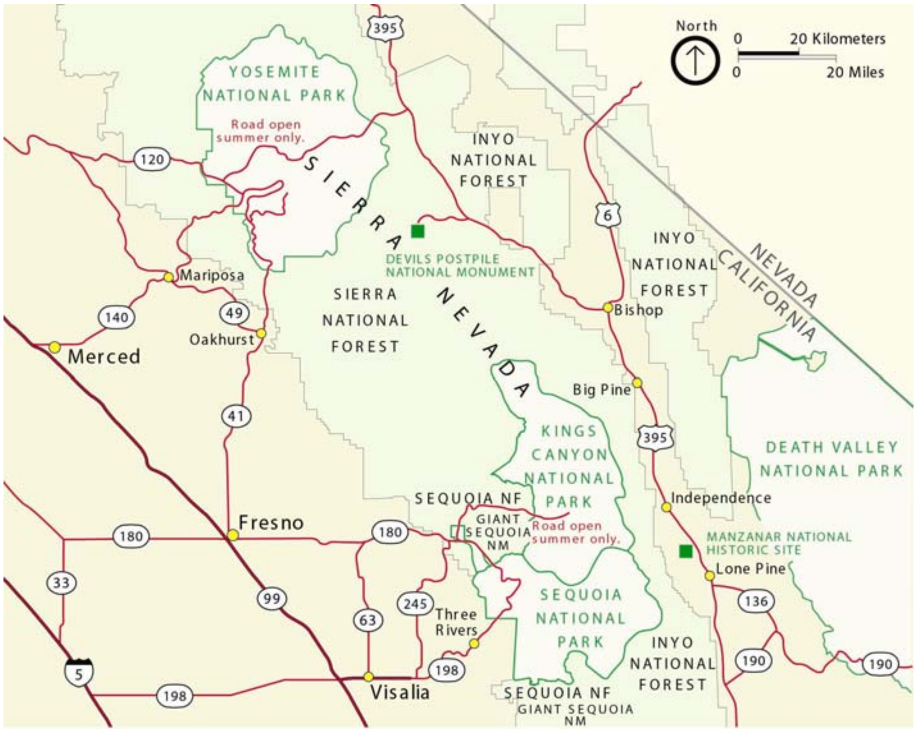

Figure 4-1: Area Map of Sequoia and Kings Canyon National Parks

(Source: http://www.nps.gov/carto)

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.

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 popular 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 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 their historic settings throughout the Sierran environments (40).

A more detailed map of the park is provided in Figure 4-2 (see page 36). 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 (42). 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 (43).” 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 (see page 37) 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 2003 was over 1.5 million visitors[2].

Many visitors to Sequoia and Kings Canyon – almost one-third in 2003 – stay at the park overnight; Figure 4-4 (see page 38) shows the accommodations used by these visitors during their stay in the park. More than 80 percent of overnight visitors camp: in tents (40 percent), the backcountry (28 percent) or RVs (9 percent).

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,

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[1] Change in visitation between 1991 and 1992 occurred due to a change in the formula for calculating visitation, not from an actual change in visitation.

[2] Total park visitation is the sum of visitation to Sequoia and visitation to Kings Canyon. Since many visitors enter both parks during one visit, they are double counted in the “annual visitation” total.

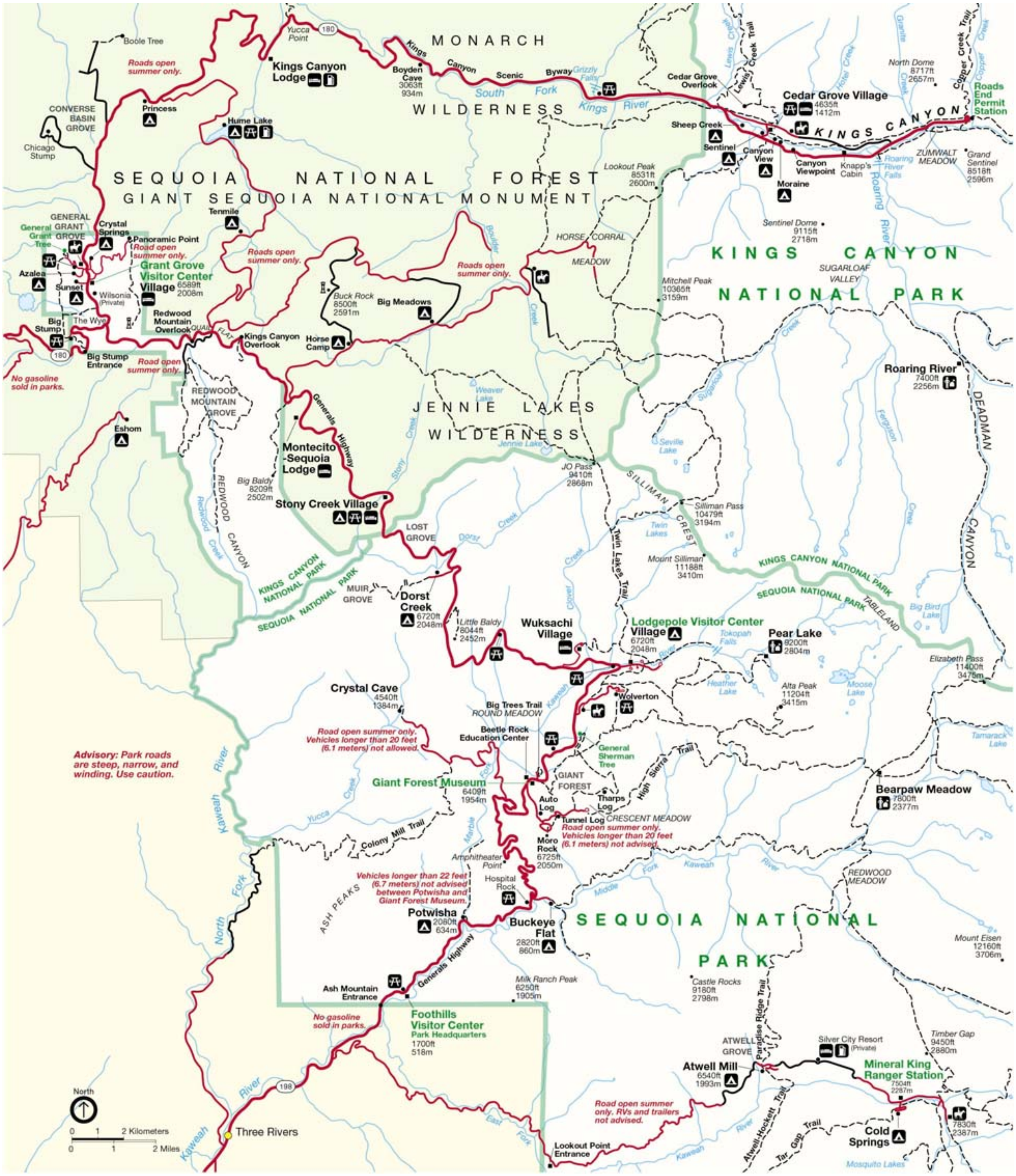

Figure 4-2: Detailed Map of Sequoia and Kings Canyon National Parks

(Source: http://www.nps.gov/carto)

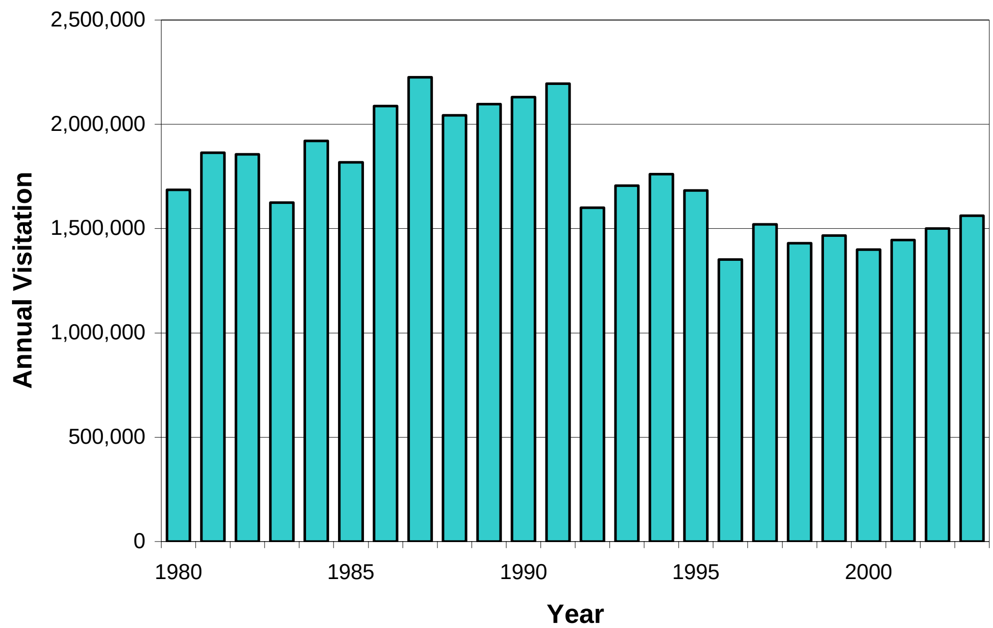

Figure 4-3: Annual Visitation Statistics at Sequoia and Kings Canyon National Parks.

(Source: National Park Service)

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.

While visitation peaks in the summer, as shown in Figure 4-5 (see page 38), the park also offers winter recreation opportunities. Skiing and snow sports are 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 (40). 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 (40). Broken into three separate categories, the park survey indicates the visitors' satisfaction for park facilities, visitor services, and recreational opportunities.

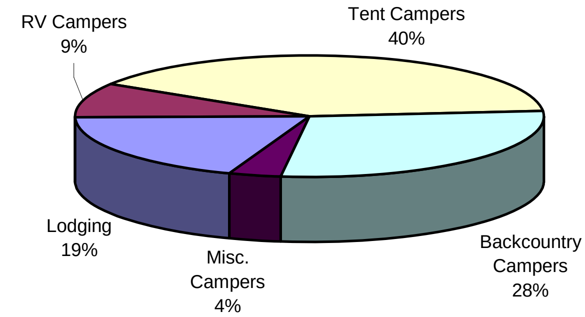

Figure 4-4: Accommodations for Overnight Visitors at Sequoia and Kings Canyon National Parks

(Source: National Park Service)

- 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.

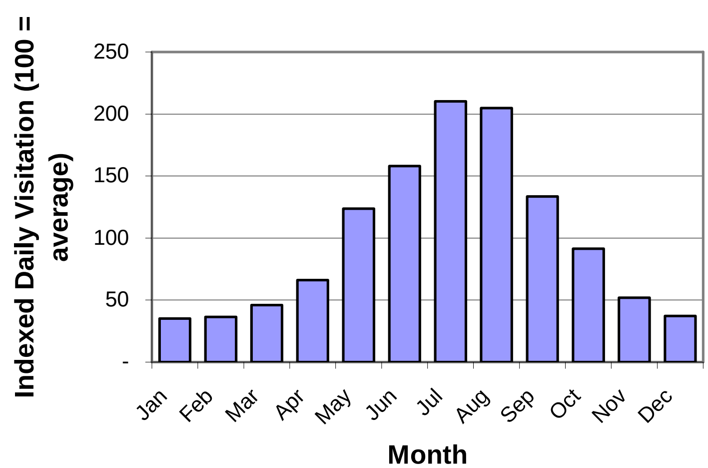

Figure 4-5: Seasonal Patterns in Visitation at Sequoia and Kings Canyon National Parks

(Source: National Park Service)

- 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 (40).

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, cyclists 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 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 in much smaller numbers than the main attractions. 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 most of 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 are not maintained, 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 (40). 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 park planners decided to break the area into two separate groups.

- High-Use Scenic Driving. These roads are generally paved, in good condition, and 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 park officials 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 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 (44). 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.

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

- 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.

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 (45). 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 (46) notes that Tulare County opportunities include providing safety along routes that provide access to the national parks. 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 (47), 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 C, 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 D) 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 Grove Village, Beetle Rock Education Center, and Giant Forest.

Table 4-1: Sequoia and Kings Canyon National Parks 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**

4. Road/Weather Information. This system would collect information on weather, road conditions, and road closures within the area of the park. 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 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 improve the efficiency of new transit that is implemented into the park.

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. 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 for daily distribution and would help in transportation planning.

2. Linked Trip and Trip Pattern Data. Currently there is limited information on the origin and destination of visitors, along with their trip patterns within the park. 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 the food and lodging needs of their customers. 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 enhance visitor experience by eliminating wait times and help natural resources by eliminating roadside parking.

5. VISITOR SURVEYS

In order to develop workable applications for ITS it is important to understand how visitors to national park units perceive and use the information and technologies associated with these systems. National Parks have a long tradition of providing experiences that are inherently different from those in more developed urban areas. However, some national park units are adjacent to urban areas and serve urban recreation demands on a daily basis. It is likely that visitor perceptions differ dependent on the specific park unit along with attitudes and behaviors related to information technology.

The purpose of this study was to examine the attitudes and behaviors of visitors using national park units relative to ITS. A better understanding of national park visitors will help guide decisions about if, what and where systems of this type might be used in California's national parks.

5.1. Methodology

One of the most direct ways to collect information on visitor perceptions is to gather data through on-site surveys. This report conveys summary findings of surveys conducted at two national park units in California: Golden Gate National Recreation Area (GGNRA) and Sequoia and Kings Canyon National Park (SEKI). These two units were selected based on their relatively high levels of use and the different functions they serve within the National Park System. GGNRA is located in and around the San Francisco Bay Area and serves a largely urban population. It has one of the highest rates of annual visitation within the entire National Park System (estimates of over 14 million per year). SEKI is a more traditional national park located further away from major metropolitan areas providing more rural, "wilderness" experiences to visitors. SEKI receives approximately 1.5 million visits a year.

A survey instrument was developed with the assistance of park employees, transportation engineers and other stakeholders involved in transit in and around these two parks. The survey was pilot tested on-site at both park units in March 2002. Visitors were intercepted in parking areas at Muir Woods and Stinson Beach in the GGNRA and at several key stopping points (e.g., Grants Grove, The Sherman Tree, Visitors Centers) in SEKI. The pilot test revealed that the scale designed to measure perceived usefulness of planning tools in parks and the scale designed to measure intent to use them were not sufficiently different. There was also some concern that the questionnaire was too long and that a shorter version could enhance participation. The usefulness scale was dropped from the form and a few minor changes were made to reduce categorical response choices that the pilot suggested were of little practical use. Many of these were offered as open-ended response categories so information would not be lost but the form would be shorter.

On-site intercepts with the revised survey (after March pilot) were conducted May 19 to 25 and July 14 to 20 to represent shoulder and peak seasons respectively[4]. The same intercept locations were used in both survey periods. Within those sampling periods intercepts were distributed in a random, representative fashion to include multiple days of the week and times of day. Intercept points for GGNRA (Stinson Beach parking lot and Muir Woods parking lot) were selected as the primary entry and exit points for visitors to both park units. These two units were selected as representative sites for GGNRA in consultation with local transportation planners. Both were targeted due to specific issues related to traffic congestion and access. Sampling points in SEKI were also chosen in concert with park personnel. Key stopping points along the main drive (e.g., Grant's Grove, The Sherman Tree) through the park were selected because they were identified as places that most visitors stopped while in the park. Less prominent park features were also used as intercept points in an attempt to capture variance in visitors that might choose to stop in those spots.

During the on-site intercepts, visitors were approached, introductions were made and a brief explanation of the survey given along with the request to participate. If visitors agreed to participate they were asked a few basic questions about their travel that day and were then given a longer survey and postage paid envelope to take away, complete and return at their convenience. Ten to 14 days after the surveys were distributed on-site, a reminder card was sent to non-respondents, after another 10 days a second survey was sent to those visitors who said they would participate, but had not yet returned their survey. A total of 79 agreed to participate at Stinson Beach resulting in 38 returns, 289 agreed to participate at Muir Woods with 168 returns yielding a total of 206 responses for GGNRA and a response rate of 56 percent. At SEKI a total of 687 respondents agreed to participate in the mail survey resulting in 454 returns for a response rate of 66 percent. The total number of visitors in the sample (combining the parks) was 660. While the return rate for surveys was higher than for a typical transportation survey (e.g. 20 percent), this is not an uncommon return rate for National Parks. The sampling error is difficult to determine because of uncertain population parameters. A binomial estimation method suggests that for the seasons sampled the error is within ± 6 percent for GGNRA and ± 5 percent for SEKI. The lower margin of error for SEKI is due to its larger sample size.

The surveys, shown in Appendices E and F, were spilt into eight sections to gain information about the visitors. These sections included:

1. <u>Your visit to Golden Gate National Recreation Area (GGNRA)/Sequoia and Kings Canyon National Parks</u>. This section was designed to gain information on: sites in the park that they visited, how many days they spent on this trip, what activities they participated in, whether or not they considered themselves a tourist or local, whether they stayed inside or outside the park, what type and level of satisfaction they had with the transportation they used to get there, how they perceived the level of congestion in the park, their perception of how crowded they felt in the park, and the level of importance they put on certain safety and congestion points.

[4] The May survey was conducted just prior to Memorial Day (May 27), which may have increased the percentage of tourists or non-local visitors at the end of the survey period.

2. Park Use Experience. This section was designed to gain information on their experience with this and other National Parks, such as: was this their first visit, how many times have they visited this park, what year was their first trip to the park, do they plan to visit the park again, and how many other National Parks have they visited.

3. Planning For This Trip. This section was designed to determine what types of information visitors obtained when planning their trip both before and while in the park, how visitors obtained this information both before and while in the park, and how they made lodging/camping reservations.

4. Attitudes. This section was designed to determine visitors' views on the appropriateness of certain ways to obtain information in a National Park setting and the importance of preservation of natural resources and recreational use in a National Park setting.

5. Technology. This section was designed to determine what types of technology visitors own, where they have Internet access, and what types of technology they use when planning a trip.

6. Obtaining Travel Information. This section was designed to determine how likely visitors are to use certain modes of transportation and ways of obtaining information before and after arriving at the park.

7. Transportation. This section was designed to determine how often visitors use public transportation on a day-to-day basis and if they have ever used it in a National Park setting.

8. General Information (Demographics). This section was designed to determine the characteristics of the survey respondents. This will allow researchers to determine if the survey respondents match "typical" National Park visitors. The questions asked in this section included: gender, year of birth, race, primary language, education level, household income, and type of employment.

In this synopsis of the survey results only May and July statistics are shown. Also, most of section 1, all of section 2, 1 question from sections 3, 4, 5, and 8 will not be addressed as they do not directly affect the transportation in the park. These questions, however, will be addressed in more depth in Technical Memorandum 3, and the basic response statistics for all questions can be seen in Appendices G and H.

5.2. GGNRA Results

5.2.1. Section 8: General Information (Demographics)

Table 5-1 provides basic demographic information from this GGNRA survey. Males (47 percent) and females (53 percent) were well represented. Approximately 45 percent of respondents were between ages 35 and 50 and 31 percent were between ages 51 and 65 with the average respondent age for GGNRA being 46 years old. The respondents were predominately Caucasian, although almost 5 percent of respondents were of other races. More than three-quarters of GGNRA respondents were college graduates or had a graduate or professional degree and more than half made at least $80,000 a year. English was the primary language spoken at home by over 95 percent of respondents. The other languages mentioned included German, Russian, and Dutch. These responses indicate that survey respondent visitors to Marin County GGNRA sites were almost evenly split gender-wise, but were on average English-speaking, middle aged, college-educated, and upper income.

Table 5-1: Demographic Information for GGNRA May and July Survey Respondents

Demographic Variable	
	%
Gender	
Female	52.9
Male	47.1
Age	
Under 19	0.0
19-34	18.4
35-50	45.3
51-65	30.8
66+	5.5
Race	
Black/African American	1.0
Hispanic/Latino	1.5
White/Caucasian	95.1
Asian	1.5
American Indian or Native Alaskan	0.5
Native Hawaiian/Pacific Islander	0.0
Other	1.0
Education	
Less than 12 years	0.0
High school grad	3.9
Technical/Vocational school	2.5
Some college	17.2
College grad	38.4
Graduate or professional degree	37.9
Income	
Under $20,000	3.6
$20 to $39,999	8.9
$40 to $59,999	14.7
$60 to $79,999	15.7
$80 to $99,999	14.7
$100,000 or more	42.4

5.2.2. Section 1: Your Visit to Golden Gate National Recreation Area (GGNRA)

The purpose of this section was to determine whether respondents were locals or tourists, what type of transportation visitors used to get to the park, how congested they felt traffic was in certain areas of the park, how crowded they felt by people during their trip to the park, and the level of importance for safety and congestion.

Of the 206 survey respondents for GGNRA, 18.4 percent of these respondents were intercepted at Stinson Beach and 81.6 percent were intercepted at Muir Woods. As it is thought that the majority of visitors to Stinson Beach are "locals" or regional visitors and those at Muir Woods tend to be "tourists," this was examined as well. The assumption had some validity as 80 percent of visitors to Muir Woods were "tourists" defined as living outside the region while 75 percent of visitors to Stinson Beach were regional visitors ("locals"). This agrees with findings in the CTMP survey that two-thirds of Muir Woods visitors are from outside of the region. Figure 5-1 indicates that the automobile, whether private or rental, was the predominant way (85 percent) of reaching GGNRA. This is a fairly expected result, given the relative lack of transit access to Muir Woods. Of the other category, 21 of the 23 people were on a tour bus.

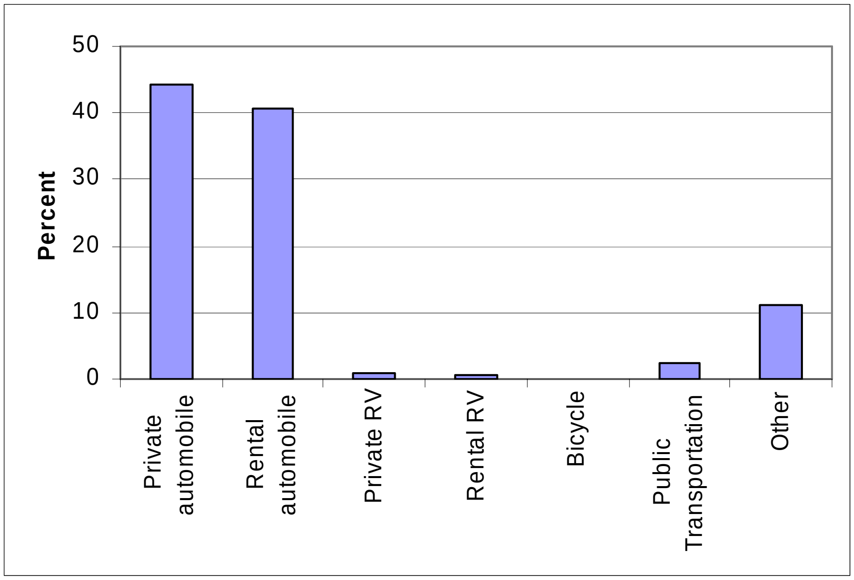

Figure 5-1: Types of Transportation Used by GGNRA Survey Respondents

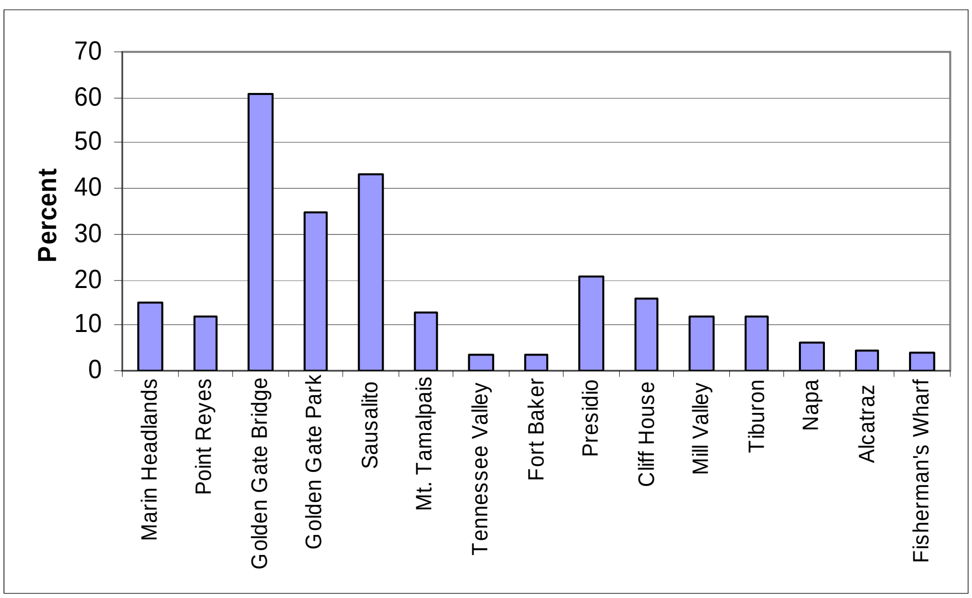

Figure 5-2: Other Sites Visited in GGNRA

Figure 5-2 shows that the most popular sites to visit within the same trip as Stinson Beach and Muir Woods included Golden Gate Bridge, Golden Gate Park, and Sausalito[5]. Of the respondents who visited multiple sites, 44 percent used a private automobile, 40 percent used a rental car, 11 percent used a tour bus and 2 percent used a public bus. Respondents from Muir Woods visited an average of three of the other sites included in Figure 2 with 16 percent of them visiting more than five other sites. The localness of Stinson visitors is reflected in the fact that those respondents visited an average of only one of the other sites in Figure 2 with 5 percent visiting more than five. By highlighting which park sites visitors are likely to visit on the same trip, this information may be useful in developing transit alternatives that may be more appealing to visitors than using a private/rental automobile[6].

GGNRA survey respondents were asked to rate the congestion in certain areas in the park on a 5 point scale with 1 being uncongested, 3 being neither congested nor uncongested, and 5 being congested. As shown in Figure 5-3, GGNRA survey respondents felt on average that the roads leading to the park were somewhat uncongested, the trails were slightly more congested and the parking lots were somewhat congested. The GGNRA survey had one less option for this question than the SEKI survey; the “roads inside this park” option was not used for GGNRA, since the park’s lands are scattered and therefore there are no roads that are truly “inside the park.”

Figure 5-3 and Figure 5-4 indicate that overall levels of perceived congestion were low (between somewhat uncongested and neutral). The exception to this was the perception of parking lots at

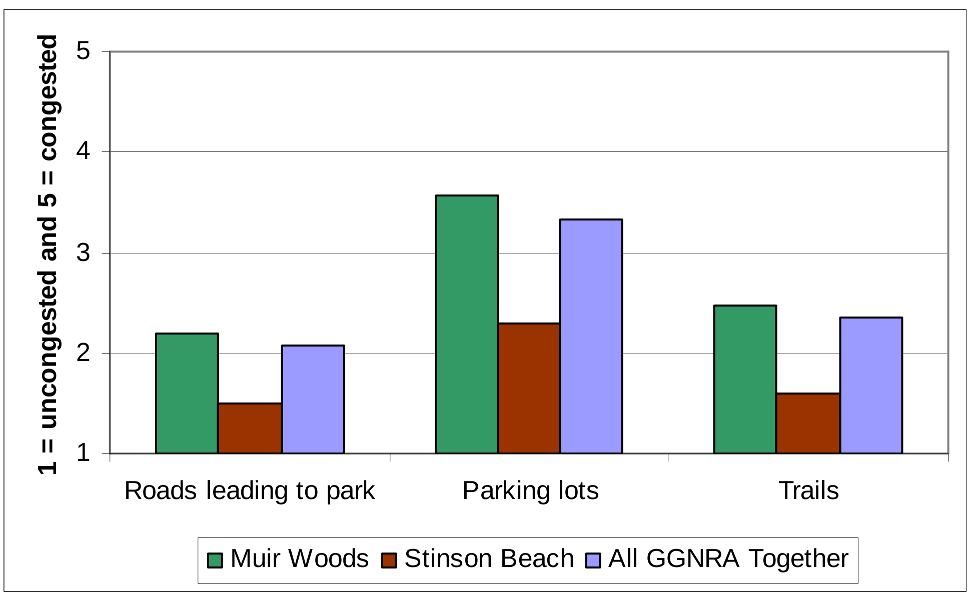

Figure 5-3: Perceived Levels of Congestion for Muir Woods vs. Stinson Beach

[5] Some Stinson Beach respondents visited Muir Woods on the same trip, and the converse was true as well.

[6] The CTMP survey findings provide further detail on trip combinations.

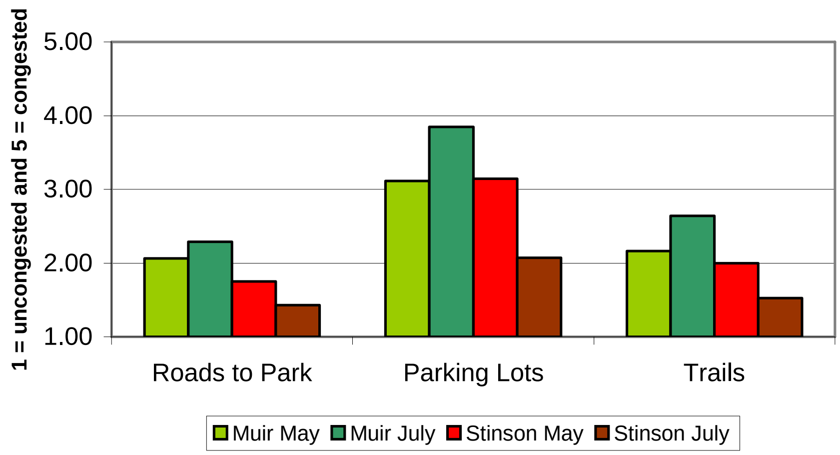

Figure 5-4: Mean Values for Perceived Congestion by Study Site and Time of Intercepts.

Muir Woods. Looking at perceived congestion over time provides some added insight. While Stinson Beach respondents appear to have felt that facilities were more congested in May than July, the May sample was relatively small, creating a larger probability of error. Muir Woods parking was viewed as "somewhat congested" by respondents from both the May and July surveys. The perception of parking lot congestion was almost a full point higher for Muir Woods in July when visitation was also higher. This result suggests that there is some seasonality in the level of congestion perceived by visitors and that ways to reduce congestion may be especially helpful in July and other busy periods.

The survey respondents were also asked to rank how crowded they felt during their trip to GGNRA on a 5 point scale with 1 being not crowded at all, 3 being crowded, and 5 being extremely crowded. The mean answer for survey respondents was 2.02 or somewhat uncrowded. Crowding refers to the way people feel about the number of other people around them. Some may not feel crowded by large numbers in small spaces while others would perceive the situation as quite crowded.

Figure 5-5 indicates that visitors to both Stinson Beach and Muir Woods did not feel crowded "during the visit." While data on congestion suggest that some negative perceptions may exist related to numbers of people in specific places (e.g. parking lots), respondents did not appear to feel that their experience at the site or within the park was crowded overall (73.6 percent did not feel crowded). For example, once visitors enter the Muir Woods site, congestion perceived in the parking lot may be mitigated by the dispersion of visitors along trails. If respondents reported feeling crowded (by responding between 3 and 5), they were asked to clarify at which parts of the park they felt crowded. Of those who listed specific locations, 47 percent cited nature trails, 47 percent cited parking lots, and 21 percent listed restrooms, gift shops, and the entrance gate as congested locations.

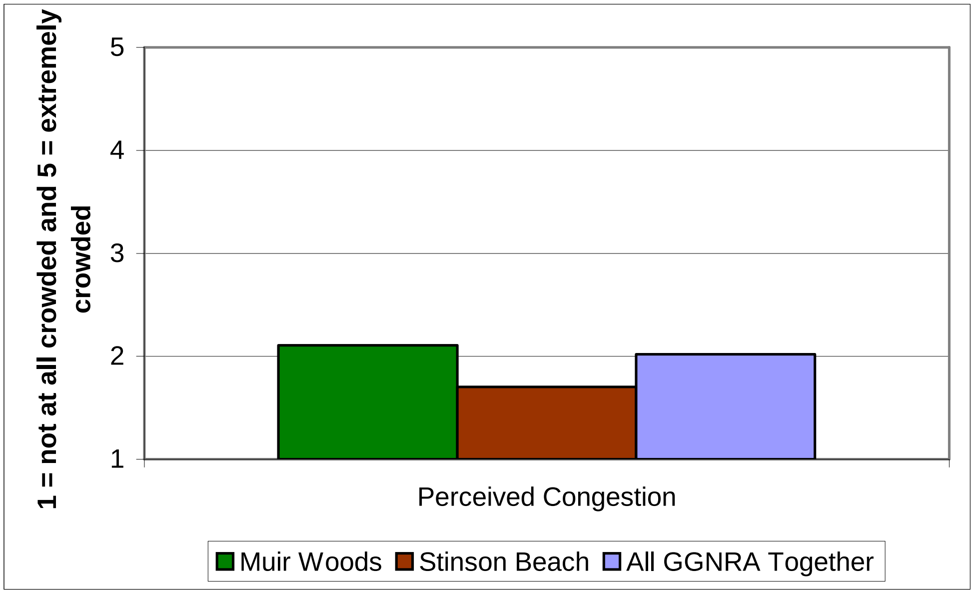

Figure 5-5: Levels of Crowding for Muir Woods vs. Stinson Beach

Lastly in this section, survey respondents were asked to rank the importance of safety and congestion on a 5 point scale with 1 being unimportant, 3 being neutral, and 5 being important. As shown in Figure 5-6, on average, survey respondents felt that safe roads (4.60) and safe parking areas (4.54) were the most important of these five items. They also felt, however, that the level of congestion on roads leading to the park (4.17), the level of congestion on trails in the park (4.17) and the ability to use their own vehicle (3.91) was somewhat important. There were no meaningful differences in the way that respondents from the GGNRA felt about the importance of these safety and congestion items across the seasons sampled. This makes some intuitive sense, as people are likely to feel that these items are important all the time but may be more likely to differ on how they see other factors performing across times of the year and changing conditions. For example, there were differences in the way that Muir Woods visitors perceived the levels of congestion by season.

5.2.3. Section 3: Planning For This Trip

The purpose of this section of the survey was to learn what information survey respondents want when going to GGNRA, when they want the information[7], and how they would like to obtain this information.

Figure 5-7 indicates that the types of information that GGNRA visitors obtain most often relate to general information about park operations (e.g. hours of operation), activities in the park and

[7] Please note that these percents may equal more that 100 because people could choose all options that apply.

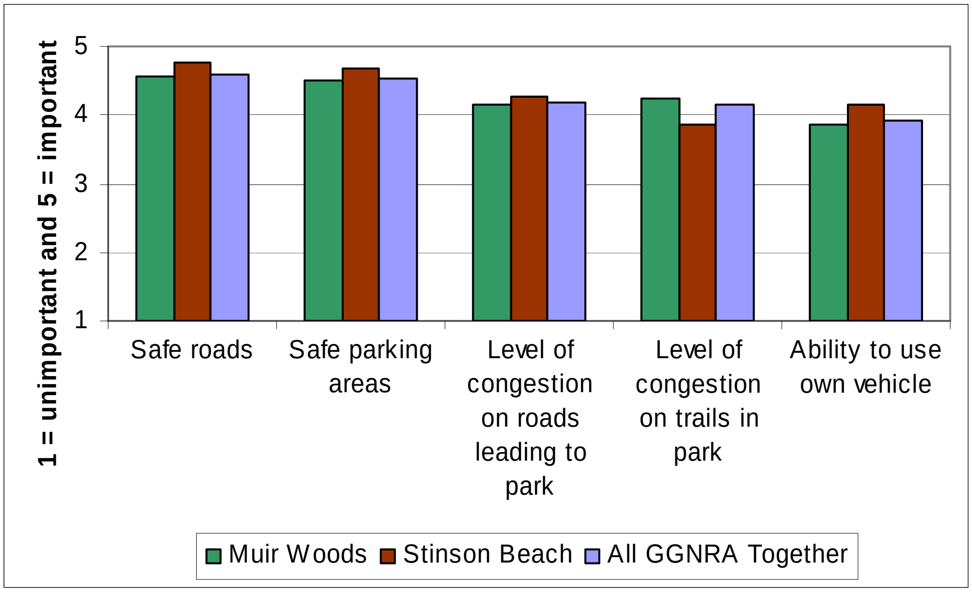

Figure 5-6: Level of Importance of Safety and Congestion for Muir Woods vs. Stinson Beach

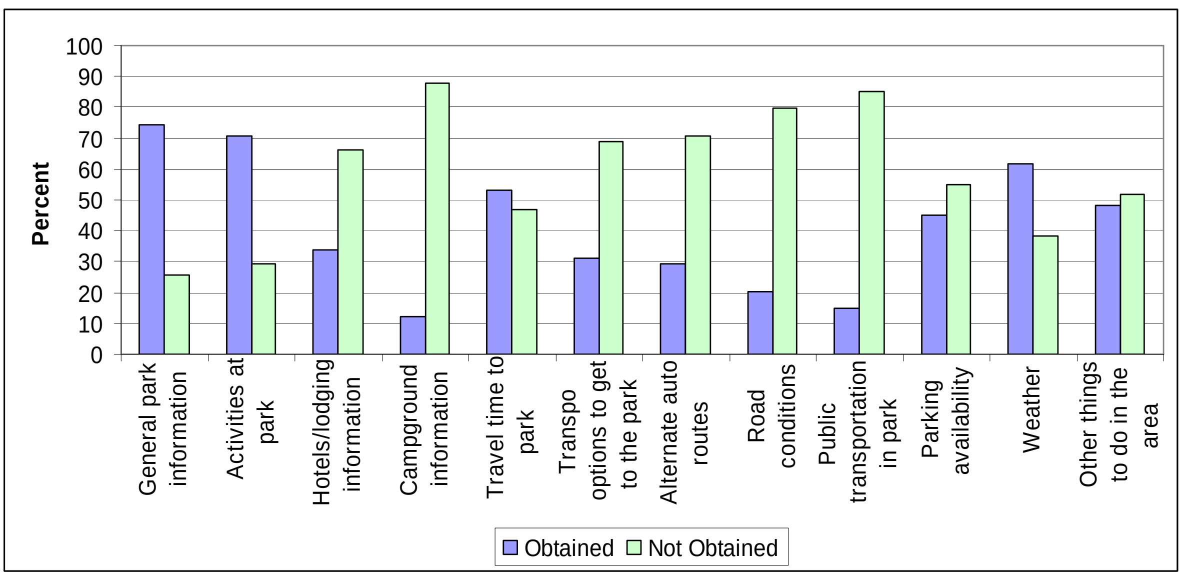

Figure 5-7: Types of Information Obtained During Planning for GGNRA

surrounding area, travel time to the area, the availability of parking and the weather. Figure 5-8 indicates that visitors obtain most information about their travel before arriving at a park or outside its boundaries, which has special implications for ITS implementation. The exceptions to

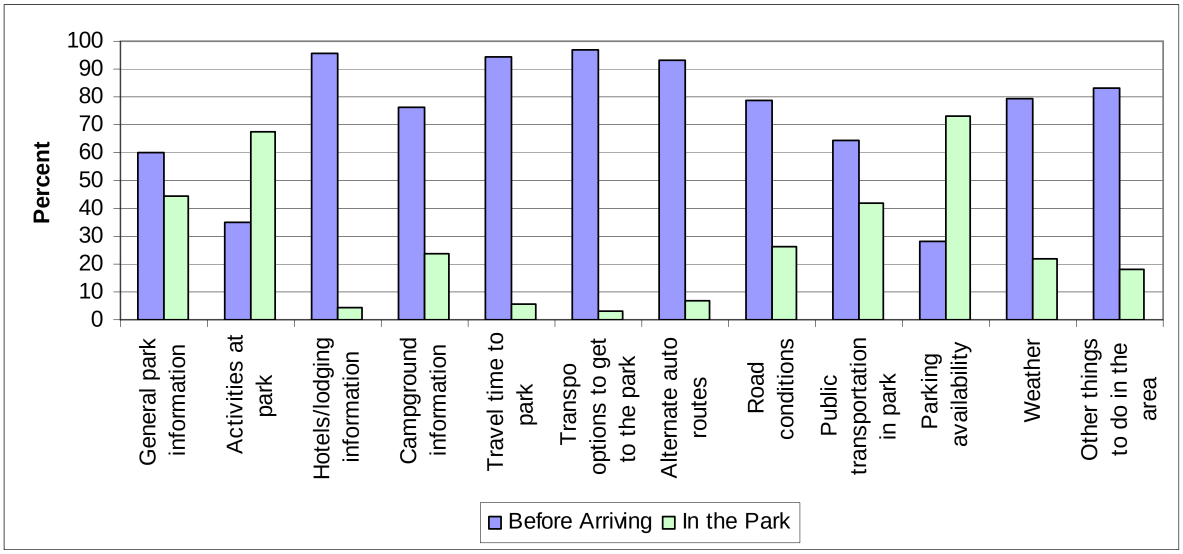

Figure 5-8: When Information Was Obtained for GGNRA

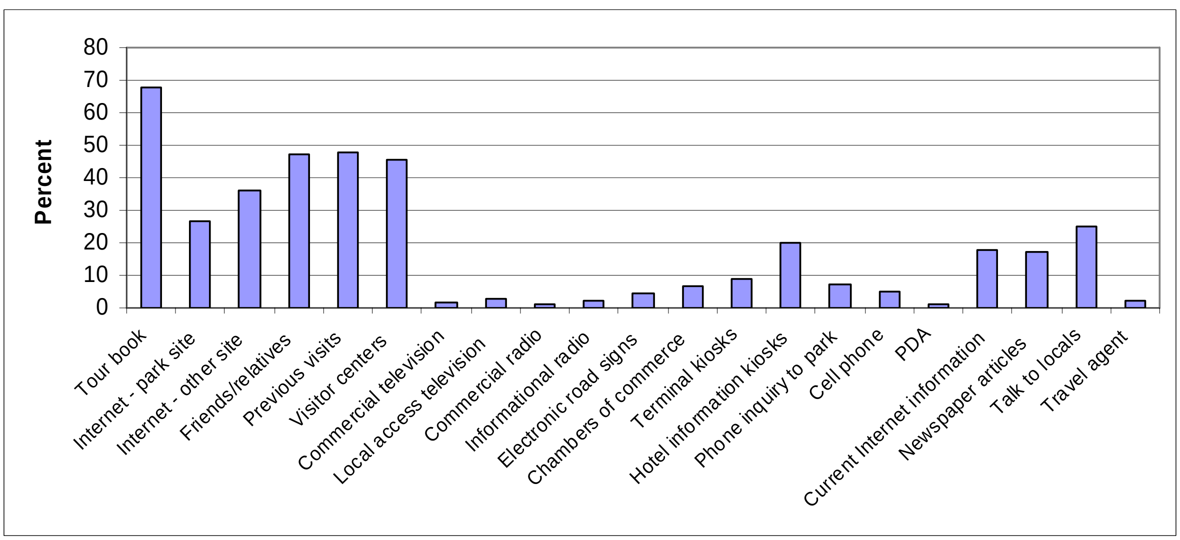

Figure 5-9: Sources of Information Used for GGNRA

this were information about in-park activities and parking; both were more often sought after arrival.

Figure 5-9 indicates that respondents most often used traditional types of information sources when planning a trip. For example "tour book" was the source of information consulted most often followed by friends and family, other trips and visitor centers. Among newer technologies, the Internet was used by a number of GGNRA visitors (36 percent) to obtain information in planning for their trips to these park units. Among Muir Woods visitors alone, there was a higher rate of Internet use as, 39 percent accessed either a GGNRA web site or another web site to obtain travel information prior to arrival.

5.2.4. Section 4: Attitudes

This section was used to determine how appropriate visitors felt certain transportation modes and technologies would be for a National Park setting. As shown in Figure 5-10, respondents felt that the tour book, friends and relatives, visitor centers, the National Park Service automated telephone line, talking to a ranger in the park, and NPS informational radio were the most appropriate ways to obtain information (scored between "somewhat appropriate" and "appropriate"). Most of the methods to obtain information were scored at least "neutral" (3.0), with the exception of "Internet in the park" which respondents felt was "somewhat inappropriate." As for the transportation modes (i.e. public bus, mandatory shuttle, optional shuttle, and riding your bike), respondents on average felt that the public bus was "somewhat appropriate" and the optional shuttle, mandatory shuttle and park-and-bike options were between "neutral" and "somewhat appropriate."

A closer look at some of the individual items by park unit revealed that respondents to Stinson Beach and Muir Woods felt differently about the appropriateness of Internet terminals in parks. On average Muir Woods visitors indicated that Internet terminals are somewhat inappropriate (mean response of 2.5) while Stinson Beach respondents scored it more neutrally (3.1). Stinson visitors were spilt on this issue, as 46 percent felt that Internet was at least somewhat appropriate in a National Park unit with the remaining 54 percent feeling neutral or that it was inappropriate. On the other hand, a much higher 76 percent of Muir Woods respondents felt that Internet terminals were either neutral or inappropriate. None of the other items revealed meaningful

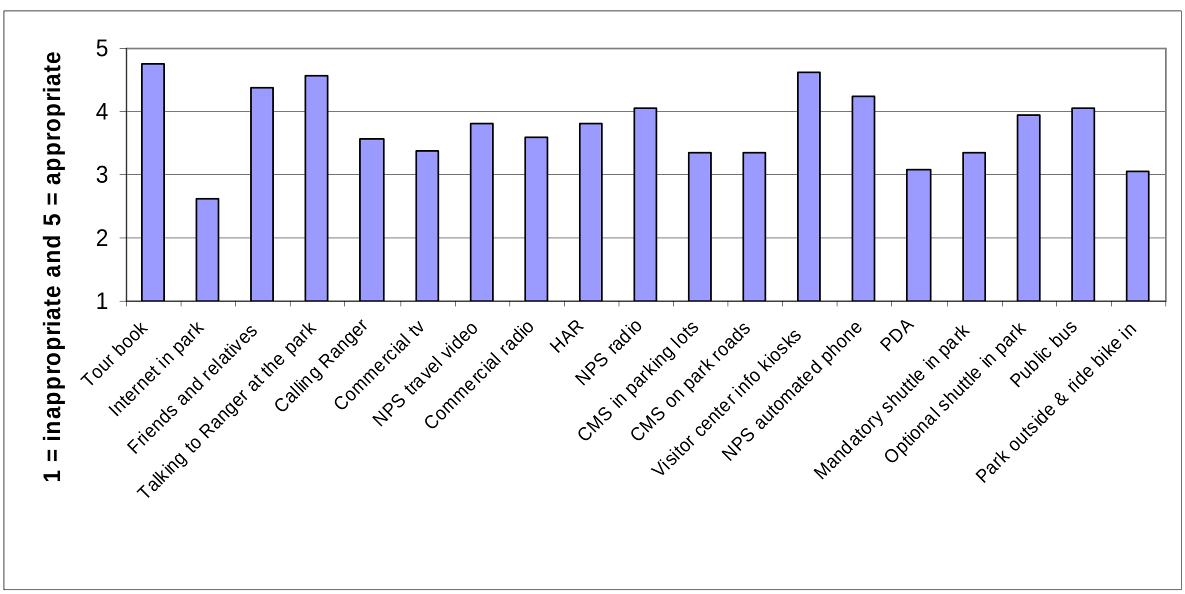

Figure 5-10: Appropriateness of Methods to Obtain Information and Transportation Modes for GGNRA

differences between visitors to these two units. There was some feeling that Stinson Beach visitors might feel that technology was more appropriate in NPS units due to its more local appeal. However, appropriateness of other technological items like personal digital assistants (PDAs) and electronic message signs were scored somewhat lower (based on mean scores) by Stinson Beach visitors than those to Muir Woods. As with the Internet terminal, Stinson Beach respondents varied a lot on these items indicating that some had much more accepting attitudes toward these technologies than others when it comes to park use.

5.2.5. Section 5: Technology

This section was used to determine how familiar visitors were with certain technologies. As shown in Figure 5-11, the majority of survey respondents from GGNRA own computers (93 percent) and cell phones (85 percent). It can also be seen that personal digital assistants and global positioning units were not owned by many respondents (20.5 and 11.7 percent respectively). The majority of survey respondents had access to the Internet with 87 percent having access at home and 77 percent having access at work.

This section also looked at what technological methods respondents used to plan their trips, if applicable. As can be seen in Figure 5-12, current Internet information (85 percent) was the most commonly used technological method to plan trips, followed by computer trip planners (69 percent) and informational television (61 percent).

5.2.6. Section 6: Obtaining Travel Information

This section was used to determine how likely survey respondents would be to use certain methods of gaining information and travel modes and whether they would use them prior to

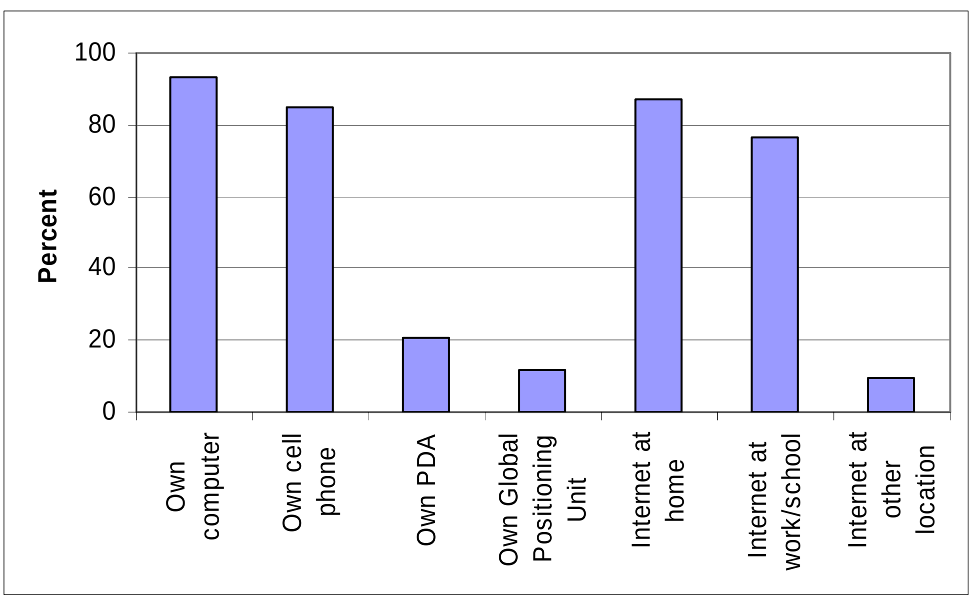

Figure 5-11: Technology Ownership and Internet Access at GGNRA

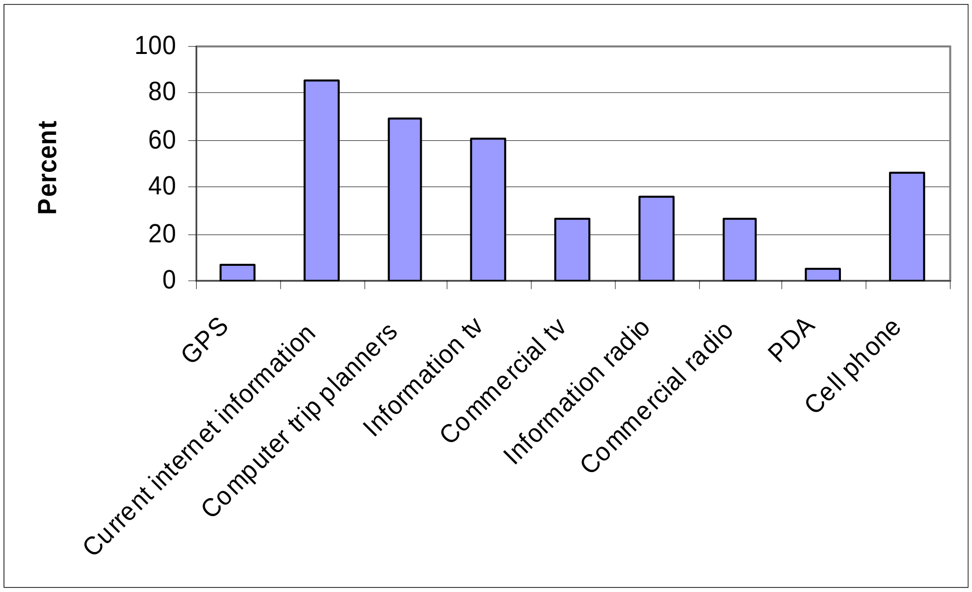

Figure 5-12: Technological Methods Used for Planning Trips for GGNRA

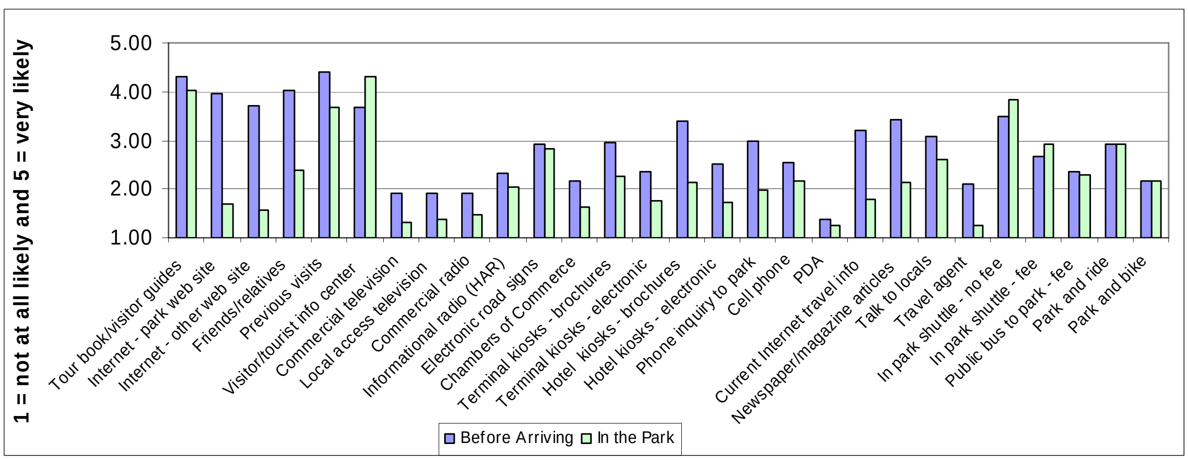

Figure 5-13: Likeliness of Using Methods of Gaining Information or Transportation Modes at GGNRA

arrival or while in the park. As shown in Figure 5-13, on average survey respondents were between not at all likely (1) and neutral (3) for most options. However, on average survey respondents were between somewhat likely and very likely to use tour guides/visitor guides both before arriving and within the park, information and experience from friends or relatives and previous visits before arriving, and visitor and tourist information centers while in the park. Survey respondents were less likely to use the Internet park web site, other Internet web sites, visitor and tourist information centers, hotel kiosks with brochures, current Internet travel information, newspaper and magazine articles, and talking to locals for information.

The trends in Figure 5-13 indicate that most planning information is likely to be gathered prior to arrival in the park unit. The contrast is especially large for the Internet items. Respondents indicated that they were much more likely to use the Internet before arriving in the park than once there. While there is little access to the Internet in most park units, the low level of likeliness to use it may be related to the perceived inappropriateness of using the Internet in the park (see Figure 5-10). More traditional methods like tour books and visitor centers, on the other hand, were the most likely to be used for planning once in the park.

Respondents were also asked about their likeliness to use various transportation alternatives. Respondents indicated some likeliness to use shuttles (fee and non-fee) as well as park and ride options. A no-fee shuttle was more likely to be used than a fee shuttle, and a park-and-ride shuttle system was more likely to be used than a park-and-bike service.

5.2.7. Section 7: Transportation

This section was created to show how often survey respondents use public transportation and whether or not they have ever used it in a National Park setting. The majority of survey respondents use public transportation only once a year (44 percent) or never use it (28 percent), as shown in Figure 5-14.

Respondents were also asked if they have used public transportation in a National Park setting; 38 percent of respondents had. The parks in which they have used public transportation (may have multiple per respondent) included Yosemite (51 percent), Grand Canyon (29 percent), Zion (9 percent), and Denali (4 percent). The 62 percent who had not used public transportation in a National Park were asked to provide a reason why they had not. Interestingly, the most frequent response is that public transportation was not available at that park (23 percent); other frequent

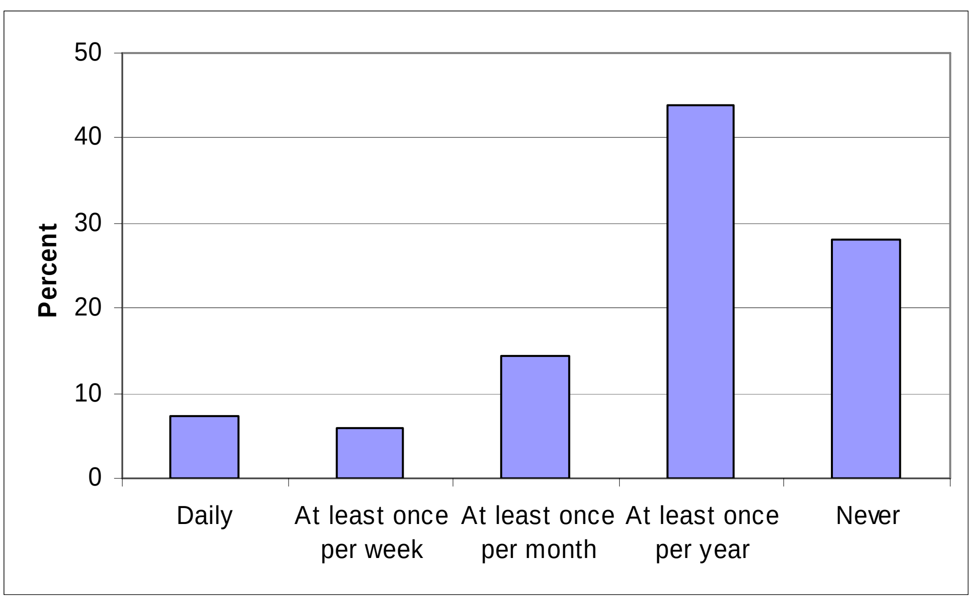

Figure 5-14: Frequency of General Public Transportation Use by GGNRA Visitors

responses included, they had a car (10 percent), there was no need (8 percent), they preferred the convenience of their own car (6 percent), and they had never seen it (5 percent). This suggests that, while most visitors to GGNRA do not typically use transit and do not have experience with transit in a park setting, they may be open to using transit, if a reasonable transit alternative were available.

5.3. SEKI Results

5.3.1. Section 8: General Information (Demographics)

Table 5-2 provides basic demographic information for SEKI visitors. There was a nearly equal representation of male (49 percent) and female (51 percent) respondents. Thirty-nine percent of respondents were between ages 35 and 50, and 33 percent were between ages 51 and 65 with the average respondent age for SEKI being 50 years old. The respondents were predominately Caucasian, with 8 percent of respondents indicating other races. The majority of respondents at SEKI were college graduates or had a graduate or professional degree (65 percent) and 44 percent made at least $80,000 a year. English was the primary language spoken at home by 96 percent of respondents. The other languages mentioned included German, Chinese, and Dutch. This indicates that survey respondents for SEKI were almost evenly split gender wise, and were typically English-speaking, middle-aged, college-educated, and upper income.

Table 5-2: Demographic Information for SEKI May and July Survey Respondents

Demographic Variable	
	%
Gender	
Female	50.6
Male	49.4
Age	
Under 19	0.2
19-34	14.8
35-50	38.7
51-65	32.6
66+	13.7
Race	
Black/African American	0.9
Hispanic/Latino	3.0
White/Caucasian	91.6
Asian	4.5
American Indian or Native Alaskan	1.1
Native Hawaiian/Pacific Islander	0.2
Other	1.1
Education	
Less than 12 years	1.1
High school grad	7.4
Technical/Vocational school	3.1
Some college	23.2
College grad	29.5
Graduate or professional degree	35.7
Income	
Under $20,000	4.2
$20 to $39,999	10.4
$40 to $59,999	19.6
$60 to $79,999	21.8
$80 to $99,999	17.4
$100,000 or more	26.6

Managers at SEKI have observed a growing Hispanic user group and indicated that there may be some cultural differences in the way they use the park. Intercept surveys did not pick up as many Hispanic/Latino users as expected. This could be due to visitor avoidance behavior and unwillingness or inability to participate, lack of Spanish speakers on the survey team or the intercept points used. Due to cost considerations we did not develop a Spanish questionnaire nor did we employ Spanish-speaking survey personnel. This may create limitations in the ability to generalize these data; however, the NPS's visitor survey program that was conducted at SEKI in the same year resulted in a low number (10 percent) of Hispanic/Latino respondents as well and their survey did have a Spanish translation (48).

5.3.2. Section 1: Your visit to Sequoia and Kings Canyon National Parks (SEKI)

Of the 453 survey respondents for SEKI, 62 (14 percent) considered themselves locals.

Figure 5-15 indicates that private automobile was the predominant way (69 percent) of reaching SEKI. Over 10 percent of respondents drove recreational vehicles – either private or rental – which may be a consideration for access to some park sites.

To better understand the transportation challenges at SEKI, the survey respondents were asked what route they took through the park and which sites they stopped at. The route chosen through the park was varied with 31 percent entering the south entrance (Sequoia) and exiting the north entrance (Kings Canyon), 30 percent entered and exited the north entrance (Kings Canyon), 19 percent entered the north entrance (Kings Canyon) and exited the south entrance (Sequoia), 19 percent entered and exited from the south entrance (Sequoia), and 1 percent entered and exited at both entrances due to the Generals Highway being closed due to snow. Figure 5-16 shows the most popular sites to visit at SEKI. These sites included General Sherman Tree (69 percent), General Grant Tree (60 percent), Grant Grove Visitor Center (54 percent), Grant Grove Village (52 percent), and Giant Forest Museum (50 percent).

SEKI survey respondents were asked to rate the congestion in certain areas in the park on a 5 point scale with 1 being uncongested, 3 being neither congested nor uncongested, and 5 being congested. As shown in Figure 5-17, SEKI survey respondents perceived on average that the roads leading to the park, the roads inside the park, and the trails were relatively uncongested.

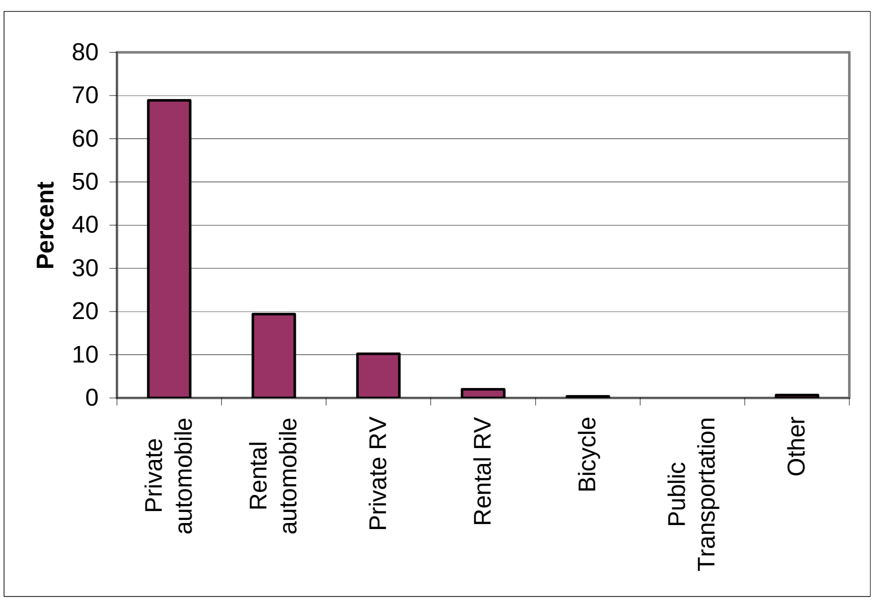

Figure 5-15: Types of Transportation Used by SEKI Survey Respondents

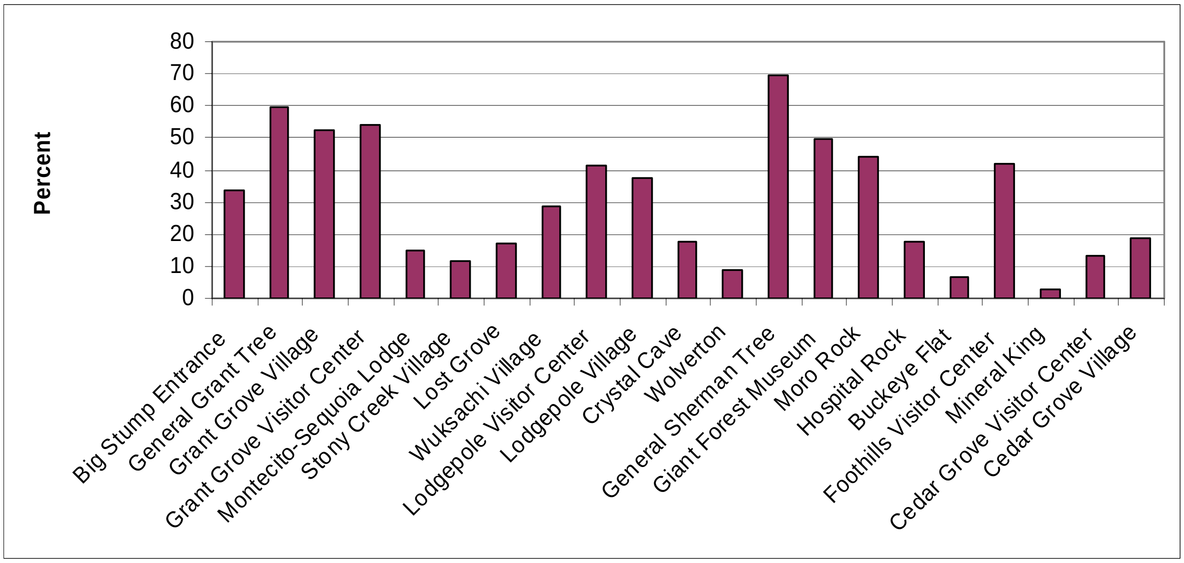

Figure 5-16: Other Sites Visited in SEKI

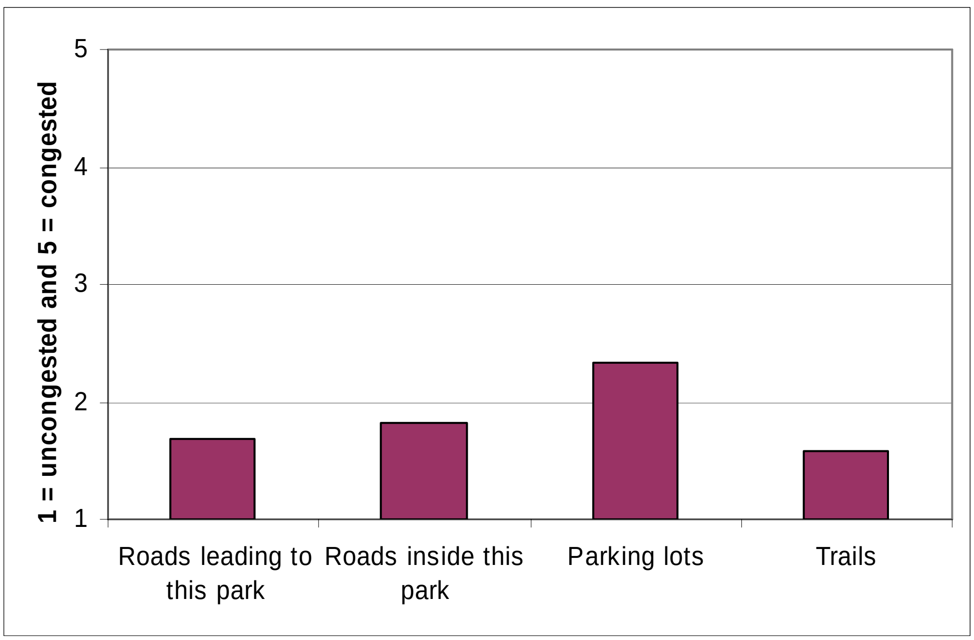

Figure 5-17: Perceived Levels of Congestion in SEKI

Levels of perceived congestion were generally consistent, even when sampled across the seasons. While roads within the park were perceived as being significantly more congested by SEKI respondents who visited in July their mean score for the item was still only 2.0, indicating a view that they were "somewhat uncongested." The highest levels of perceived congestion are in parking areas, in both seasons sampled.

The survey respondents were also asked to rank how crowded they felt during their trip to SEKI, using a 5 point scale with 1 being not crowded at all, 3 being crowded, and 5 being extremely crowded. The mean answer for survey respondents was 1.60, which reflects a general perception of a lack of crowding. If respondents reported feeling crowded (by responding between 3 and 5), they were asked to clarify at which parts of the park this occurred. Of those who indicated they felt crowded, the most commonly cited locations included Sherman Tree (27 percent), Moro Rock (19 percent), parking lots (15 percent), Grant Grove (12 percent), the entrance gates (10 percent), Grant Grove Village (10 percent), Azalea Campground (7 percent), the Giant Forest museum (5 percent), and Giant Forest (5 percent). Though perceived crowding was slightly higher for SEKI visitors in July than in May (mean scores of 1.62 and 1.58, respectively) the differences were small and not statistically significant.

Lastly in this section, survey respondents were asked to rank the importance of safety and congestion on a 5 point scale with 1 being unimportant, 3 being neutral, and 5 being important. As shown in Figure 5-18, on average survey respondents felt that safe roads (4.73), safe parking areas (4.53), and ability to use their own vehicle (4.39) were between somewhat important and important. They also felt that the levels of congestion on trails in the park (4.06) as well as the level of congestion on roads leading to the park (4.19) were somewhat important. A more detailed analysis revealed that mean values for these items were almost identical between visitors in the May and July seasons, showing no real differences between respondents' perceptions about the importance of these items. It appears that they are of equal, and relatively high, importance across seasons.

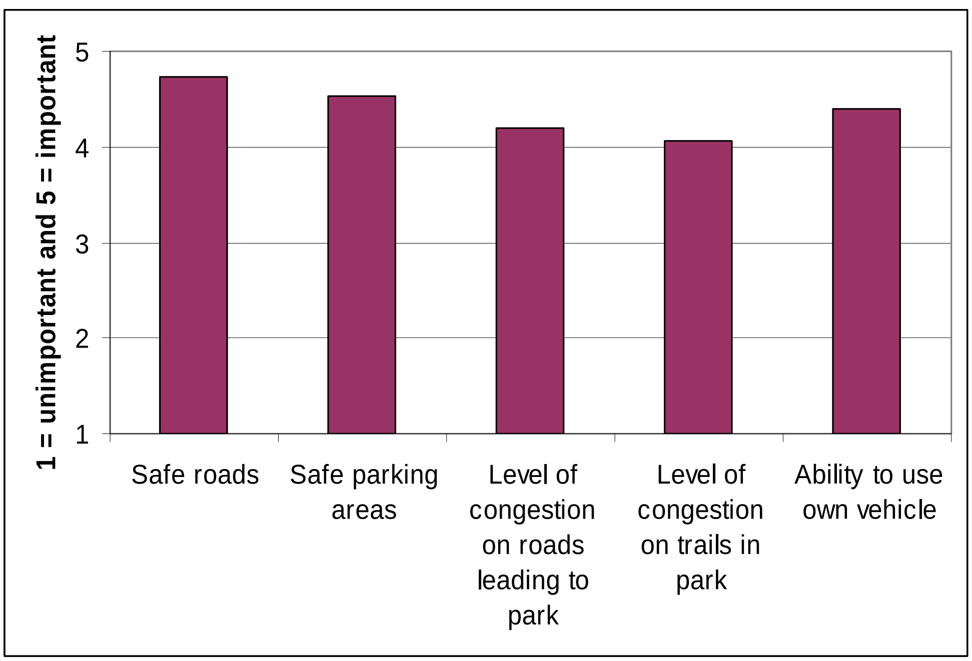

Figure 5-18: Level of Importance of Safety and Congestion in SEKI

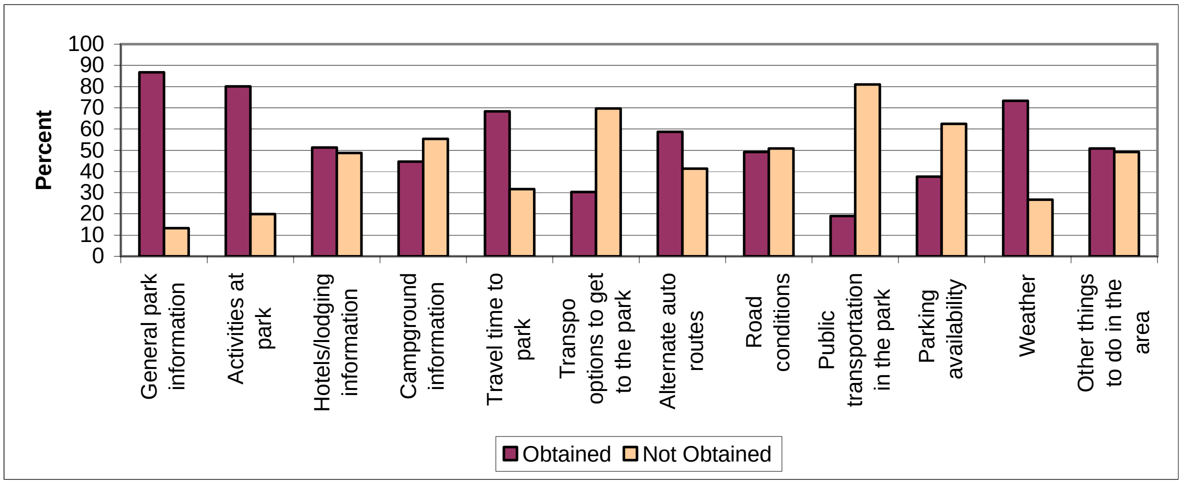

Figure 5-19: Types of Information Obtained During Planning for SEKI

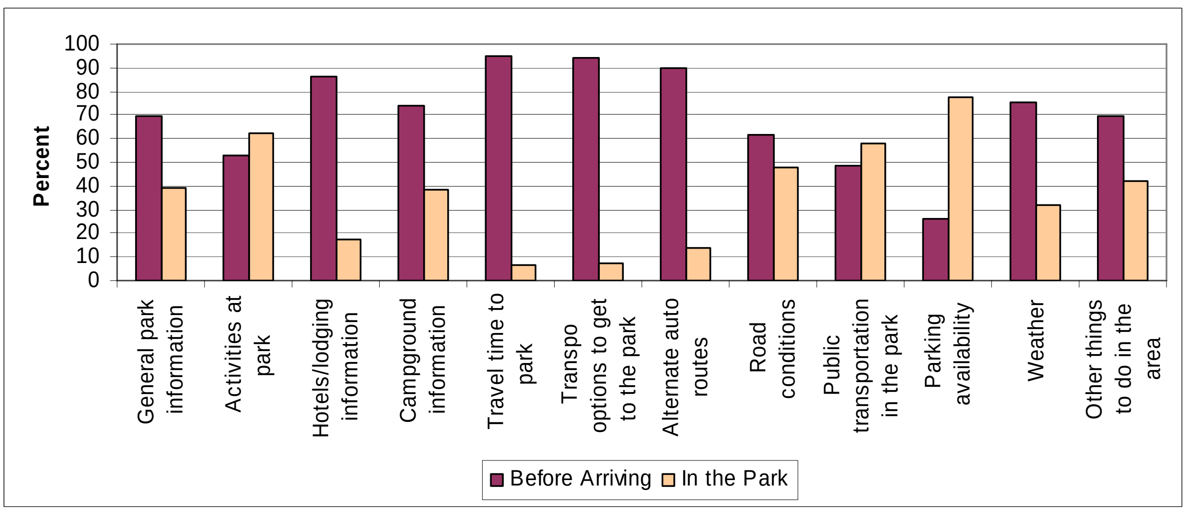

Figure 5-20: When Information Was Obtained for SEKI

5.3.3. Section 3: Planning For This Trip

Researchers asked what types of information visitors obtained, and when they obtained it[8]. Figures 5-19 to 5-22 show what types of information SEKI visitors obtained, as well as when and how. As with GGNRA respondents, those from SEKI primarily obtained information about park operations and activities (over 80 percent of respondents, Figure 5-19). Weather, travel time

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[8] Please note that these percents may equal more that 100 because people could choose all options that apply.

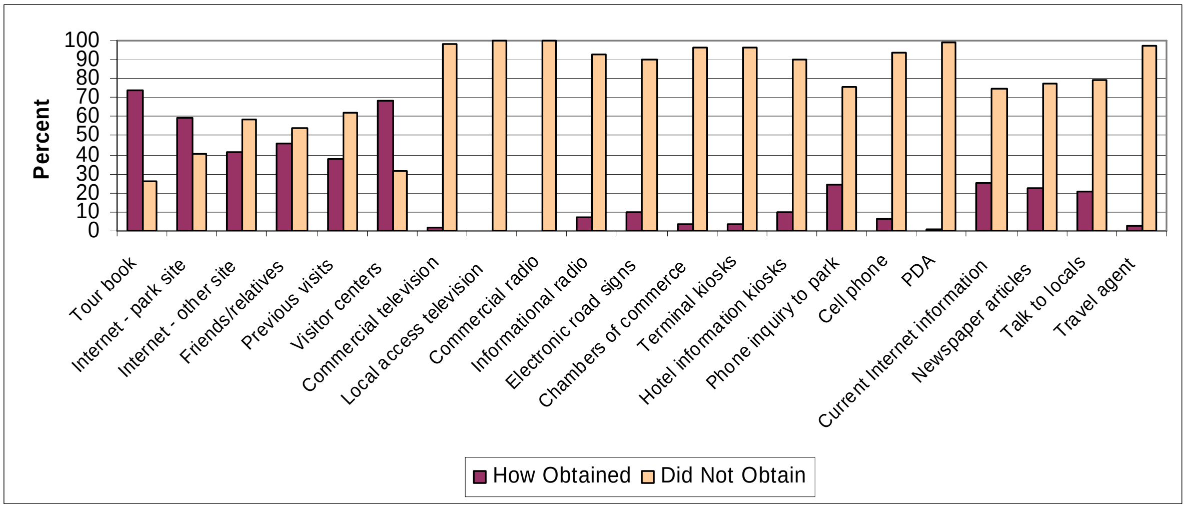


Figure 5-21: Sources of Information Used for SEKI

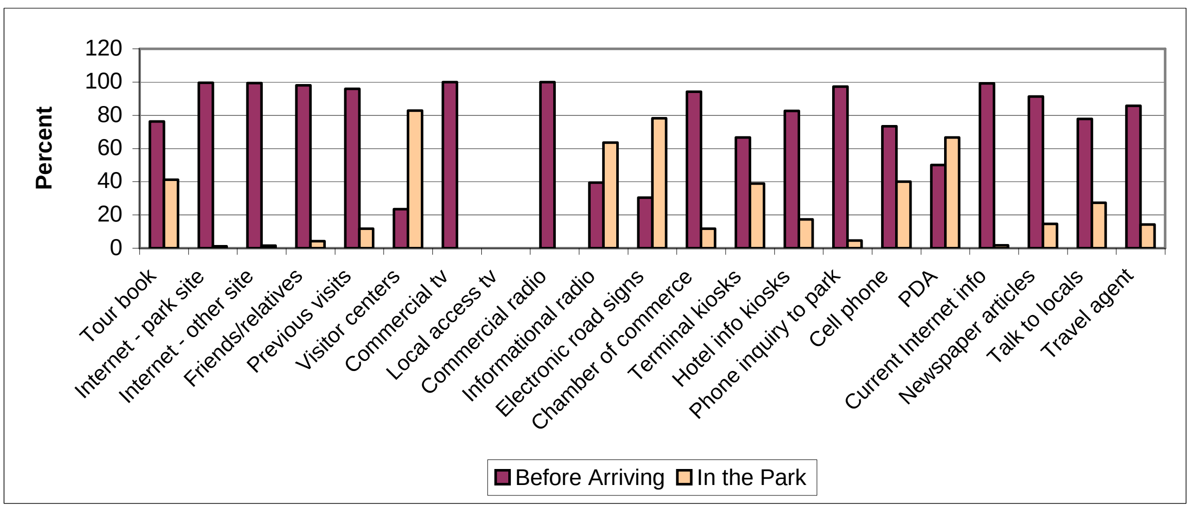


Figure 5-22: When Sources of Information Were Used in SEKI

and alternative route information were each obtained by at least 50 percent of this group. Transportation mode options to and in the park were obtained least often (less than 30 percent). Figure 5-20 indicates that most types of information sought by visitors were obtained prior to arrival in the park, presumably as they made plans to take their trip. Park activities, transportation options and parking information were all much more likely to be obtained on-site.

Figure 5-21 and Figure 5-22 provide percentages of respondents who said they obtain information through certain types of media. Tour books and visitor centers were the most common ways that visitors obtained information. SEKI visitors were likely to have used the park's web site (Internet) to gather information about the area with 59 percent having done so.

Most sources of information were consulted before arrival at the park (Figure 5-22). The major exception to this was the use of the visitor center, with over 80 percent of SEKI respondents indicating their use after arrival. The visitor center was by far the most popular way to gather information after arrival in the park. Park visitors are accustomed to stopping in visitor centers as this has been one of the primary methods of information dissemination used by the Park Service over most of its history.

5.3.4. Section 4: Attitudes

This section was used to determine how appropriate visitors felt certain transportation modes and technologies would be in a National Park setting. As shown in Figure 5-23, on average respondents felt that tour books, information from friends and relatives, visitor center information kiosks with brochures, and talking to a ranger in the park were generally appropriate. Most of the other methods to obtain information were seen as mildly appropriate with the exception of Internet in the park and PDA. As for the transportation modes (i.e. public bus, mandatory shuttle, optional shuttle, and riding your bike), respondents on average felt that the optional shuttle in the park was somewhat appropriate followed by the public bus, which was between somewhat appropriate and neutral. The mandatory shuttle in the park and the park outside and bike in options were considered slightly inappropriate, on average.

Table 5-3 and Figure 5-23 both provide information about how respondents from SEKI felt about the appropriateness of different information sources in National Parks. As might be expected the more traditional types of information like books, visitor centers and rangers were high on the list

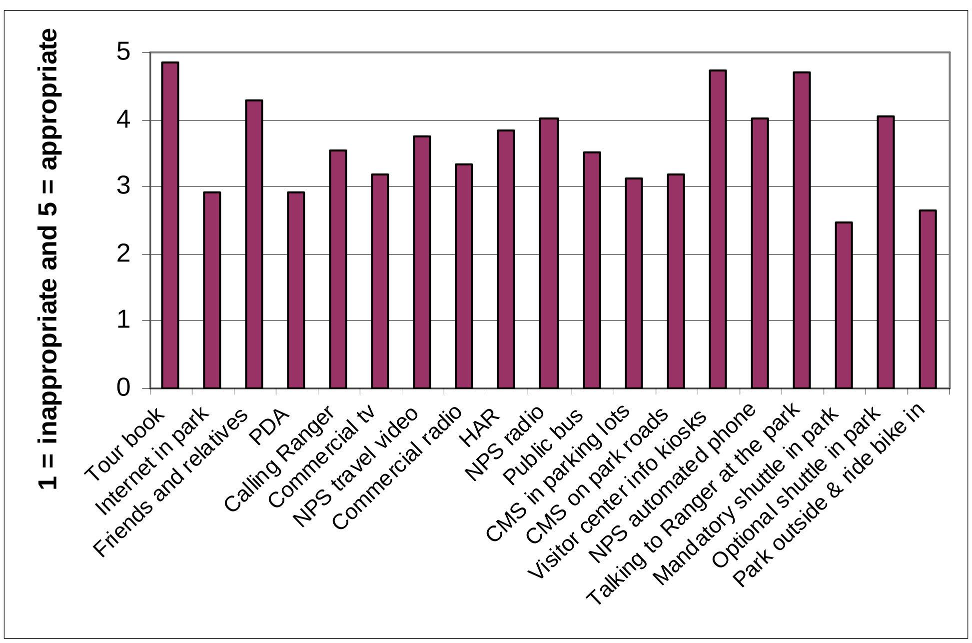


Figure 5-23: Appropriateness of Methods to Obtain Information and Transportation Modes for SEKI

Table 5-3: Level of appropriateness that visitors to SEKI assigned to different ways of providing/obtaining travel information or traveling in a national park

	SEKI	
Items listed in descending order of mean value	mean (1)	std dev
Tour book	4.85	0.47
Visitor center info kiosks	4.72	0.66
Talking to a ranger	4.70	0.68
Talking with family/friends	4.28	0.91
Optional shuttle to travel within park	4.04	1.16
Park Service automated phone info line	4.03	1.11
Park Service dedicated radio travel info	4.01	1.02
Highway advisory radio	3.83	1.11
Park Service travel video	3.75	1.09
Phone call to a ranger	3.55	1.24
Taking a public bus to a park	3.51	1.24
Commercial radio	3.32	1.17
Electronic signs on park roads	3.18	1.46
Commercial television	3.17	1.23
Electronic signs in park parking lots	3.13	1.39
Personal digital assistant (PDA) links	2.93	1.13
Internet terminals in the park	2.91	1.35
Park outside and ride a bike into park	2.65	1.49
Mandatory shuttle in the park	2.47	1.43

(1) Mean values were calculated based on a five point scale used by respondents where 1 = inappropriate, 2 = somewhat inappropriate, 3 = neither, 4 = somewhat appropriate, 5 = appropriate.

(appropriate) while some of the newer technologies were seen as somewhat inappropriate in parks. For example PDAs and Internet terminals were both seen as somewhat inappropriate. Alternative transportation options were viewed in a mixed way. Optional shuttles were scored as appropriate while a mandatory shuttle was seen as least appropriate among the 19 items questioned. Optional shuttles have been a part of National Parks almost from their inception, making them part of the mix of traditional National Park facilities in the minds of visitors. Thus the idea of having shuttles in parks appears to be accepted; however, the idea of taking choice away regarding their use was seen somewhat negatively (as inappropriate). The standard deviations for items in Table 3 provide some added insight. In general the deviation, or variance, in the way respondents scored the items grow as the level of appropriateness goes down. This indicates that visitors were not in agreement and some felt that newer opportunities and initiatives like Internet and mandatory shuttles were appropriate in National Parks while many others felt strongly that they were not.

5.3.5. Section 5: Technology

This section was used to determine how familiar visitors are with certain technologies. As shown in Figure 5-24, the majority of survey respondents from SEKI own computers (92 percent) and cell phones (80 percent). It can also be seen that personal digital assistants and global positioning

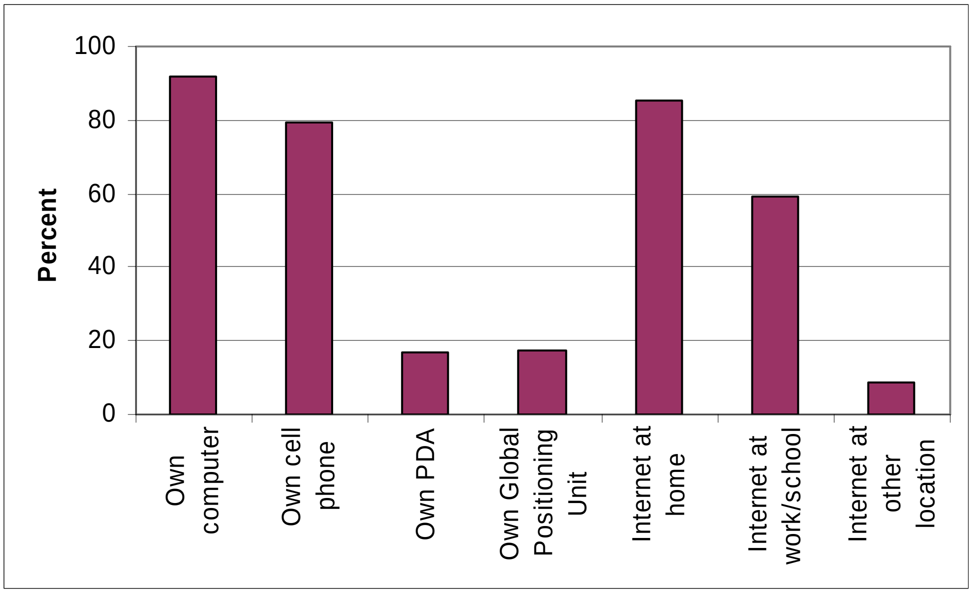


Figure 5-24: Technology Ownership and Internet Access at SEKI

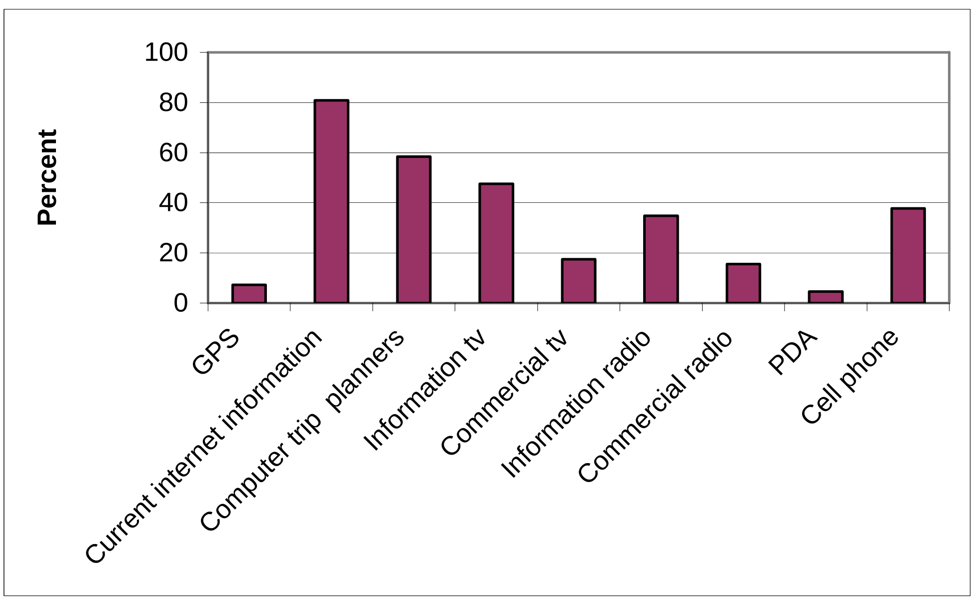


Figure 5-25: Technological Methods Used for Planning Trips for SEKI

units were not owned by too many respondents. The majority of survey respondents had Internet access at home (85 percent) and/or at work (59 percent).

This section also looked at what technological methods survey respondents use to plan their trips. As can be seen in Figure 5-25, current Internet information (81 percent) was the most

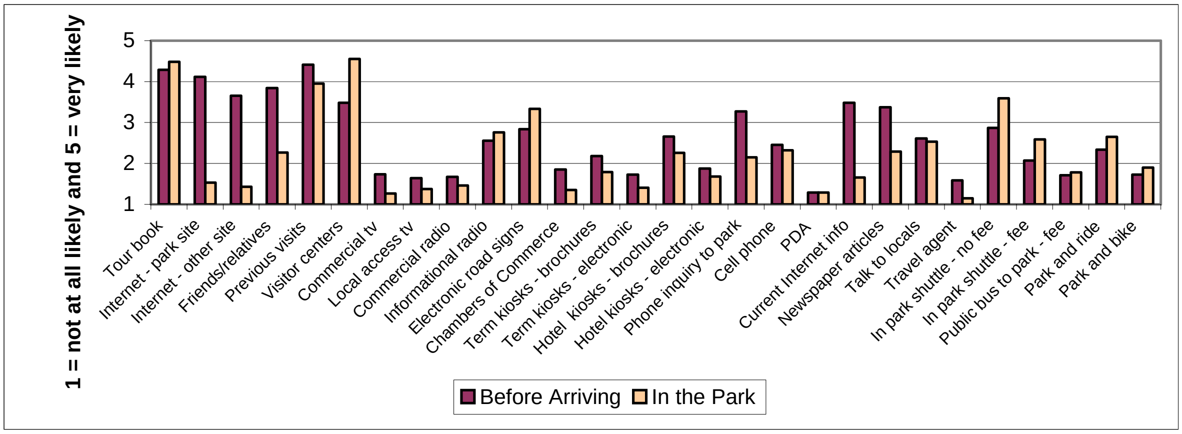


Figure 5-26: Likeliness of Using Methods of Gaining Information or Transportation Modes at SEKI

common way for survey respondents to plan their trips followed by computer trip planners (58 percent) and informational television (48 percent).

5.3.6. Section 6: Obtaining Travel Information

This section was used to determine how likely survey respondents would be to use certain methods of gaining information and travel modes, and whether they would use them prior to arrival or while in the park. As shown in Figure 5-26, on average survey respondents were between very likely to use tour books and experience from previous visits both before and after arriving in the park, the park web site before arriving, and visitor center information after arriving. Respondents were somewhat likely to use other Internet web sites, information from friends and relatives, visitor center information, phone inquiries to the park, current Internet travel information, and newspaper or magazine articles prior to arriving at the park. Respondents said they would be somewhat likely to use electronic road signs for information or a free in-park shuttle, but were less likely or even unlikely to use a park-based informational radio station or a fee-based in-park shuttle.

5.3.7. Section 7: Transportation

This section was created to show how often survey respondents use public transportation and whether or not they have ever used it in a National Park setting. As shown in Figure 5-27, the majority of survey respondents use public transportation only once a year (29 percent) or never use it (57 percent).

Fifty-four percent of respondents indicated they had used public transportation in a National Park setting. The parks in which they have used public transportation (multiple parks were allowed per respondent) included Yosemite (62 percent), Grand Canyon (25 percent), Zion (22 percent), Denali (7 percent), Bryce Canyon (4 percent), Yellowstone (3 percent), and Glacier (2 percent). The 46 percent who had not used public transportation in a National Park stated this was because

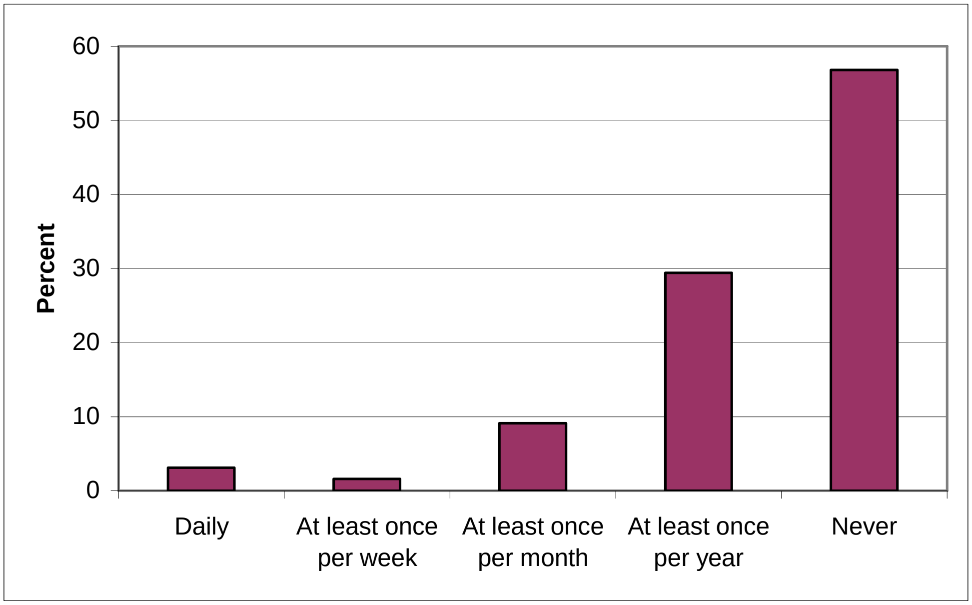


Figure 5-27: Frequency of General Public Transportation Use by SEKI Visitors

their car was more convenient (13 percent), they had a car (12 percent), they preferred the freedom of setting their own schedule (10 percent), they were not aware of alternative transportation as an option (5 percent), and privacy (2 percent).

5.4. GGNRA and SEKI Comparison

There are several obvious differences between responses in the two parks: GGNRA had 206 responses and SEKI had 454 responses; GGNRA is an urban park and SEKI is a rural park. Several other survey questions were analyzed to see if other differences could be identified. A comparison of the units is conveyed below.

5.4.1. Section 8: General Information (Demographics)

Males and females were well represented in each sample. On average, respondents from SEKI were older than those from GGNRA. This difference in mean age was found to be statistically significant in a t-test. Both groups were predominately Caucasian. There were some small numeric, but statistically significant, differences in education and income between the groups that were discovered in a chi-squared test. While both respondent groups had relatively high levels of education and income, GGNRA respondents were more educated and had higher incomes than respondents from SEKI.

5.4.2. Section 1: Your visit to GGNRA or SEKI

Figure 5-28 indicates that the private automobile was the dominant way of reaching these parks. SEKI respondents were much more likely to be driving their own car than visitors to GGNRA, while GGNRA respondents were more likely to arrive in a rental car than visitors to SEKI. SEKI respondents were more likely to use a recreational vehicle (RV) while those from GGNRA were more likely to come on a tour bus. The rural nature of SEKI means that it is likely to be more difficult to find alternative transportation. Comments received from open-ended questions related to transportation options indicated that several SEKI visitors felt there were no options other than a private car to access the park. The differences in RV use is due to the fact that SEKI is in a more remote area that provides overnight camping opportunities while GGNRA is located in a major metropolitan area and has no overnight use.

As shown in Figure 5-29, there did not appear to be high levels of perceived congestion at either park unit. However, the perceived levels of congestion in GGNRA were higher than those in SEKI[9], especially in the parking lots. This perception was also reflected in GGNRA's higher level of perceived crowding (2.02) then at SEKI (1.60). The perception of more crowding and congestion in GGNRA is not surprising given its proximity to an urban area and its significantly higher visitation levels than SEKI (13.5 million in 2001 at GGNRA versus 1.4 million at SEKI).

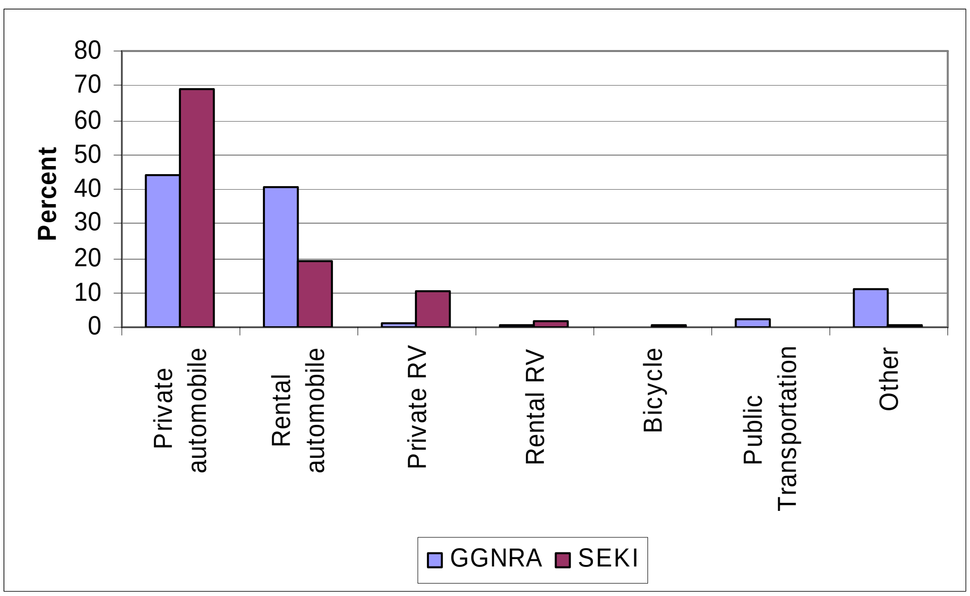


Figure 5-28: Comparison of Types of Transportation Used by GGNRA and SEKI Survey Respondents

[9] Note that these rated comparisons may be difficult to make due to the parks having disproportional responses (GGNRA having 205 and SEKI having 453)

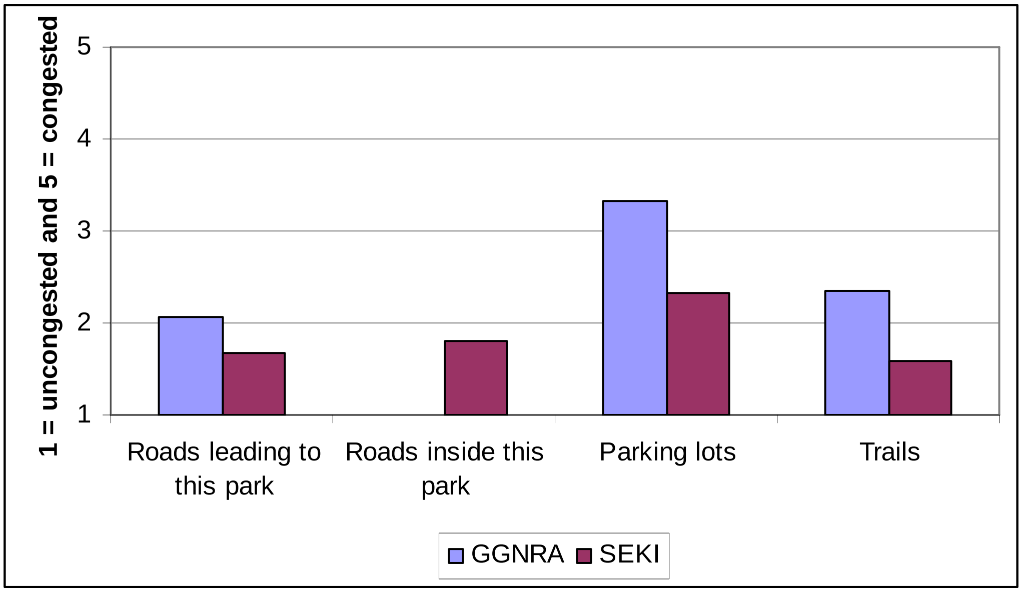


Figure 5-29: Comparison of Perceived Levels of Congestion in GGNRA and SEKI

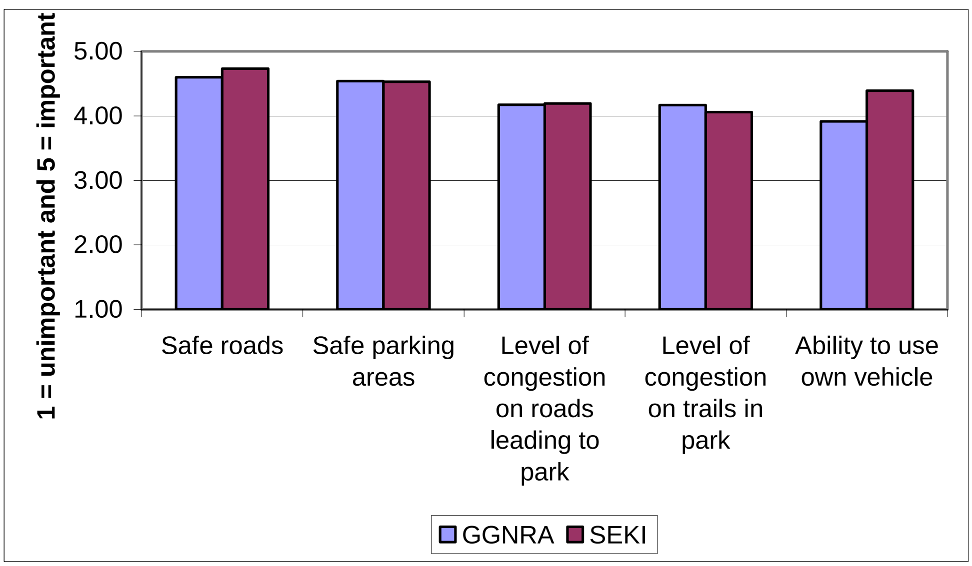


Figure 5-30: Comparison of the Level of Importance of Safety and Congestion in GGNRA and SEKI

As shown in Figure 5-30, there were very small differences between the two parks in their perceived level of importance of safety, congestion, and their ability to use their own car. Respondents for both parks felt that all of the areas were generally important. The biggest difference between the parks was that SEKI respondents felt that the ability to use their own car was slightly more important than GGNRA respondents. It can be hypothesized that the higher importance that SEKI respondents attached to using their own vehicle was due to limited access options. In addition, GGNRA respondents currently have access to public transportation and use it more often – 72 percent of GGNRA respondents have used public transportation once or more in the last year, whereas only 43 percent of SEKI respondents have used public transportation once or more in the last year.

5.4.3. Section 3: Planning For This Trip

Generally the types of information that visitors to both areas obtained followed a similar trend, as shown in Figure 5-31. The only noticeable differences were in the travel information related to travel time, road conditions and weather, each of which was more often sought by SEKI visitors. The remote mountain nature of SEKI and the fact that many people are coming from a distance to visit suggest that visitors would seek this kind of specific travel information.

The two areas were also very similar in when respondents obtained information (Figure 5-32). Most information discussed in the paragraph above was obtained prior to arrival. Visitors to the two areas were somewhat different in the ways they obtained their information (Figure 5-33 and Figure 5-34). Before arriving at the park, SEKI visitors were more likely than GGNRA visitors to have used a web site, and especially a park specific web site, to obtain information. They were also more likely than GGNRA visitors to have made a phone inquiry to the park. GGNRA visitors were much more likely to have used other visitor centers, hotel information kiosks and to have talked to local residents before arriving in the area. Once in the park, SEKI respondents were more likely to use a tour book and were much more likely than GGNRA respondents to have used visitor centers to gather information. Overall very few of the information items (exceptions noted) were used much once a visitor arrived at the park (Table 5-4).

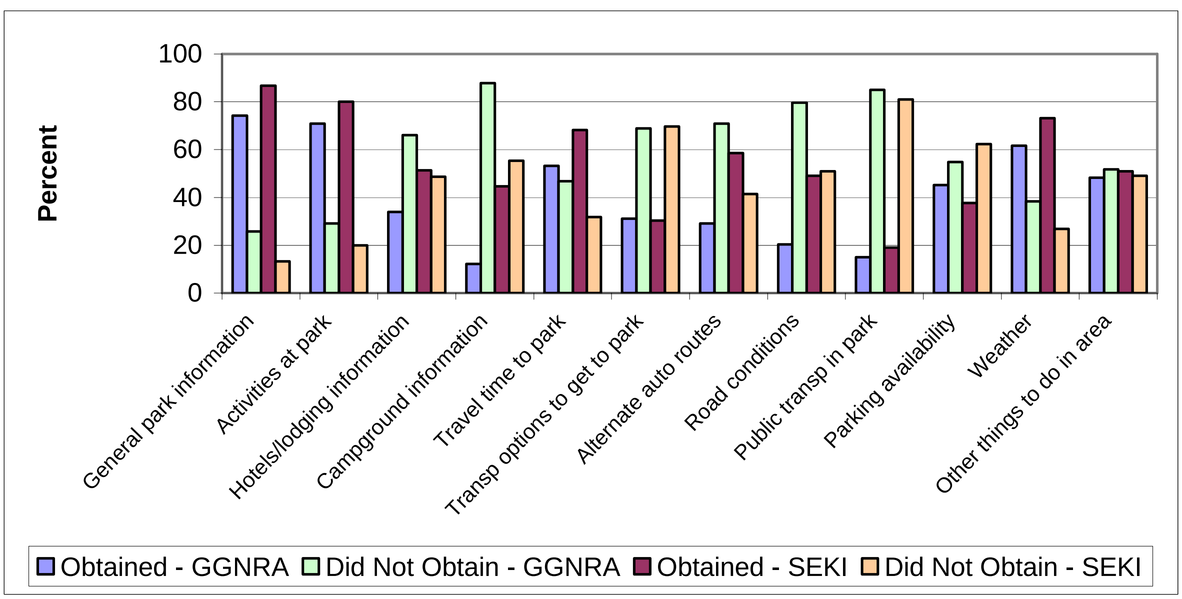


Figure 5-31: Comparison of Types of Information Obtained in GGNRA and SEKI

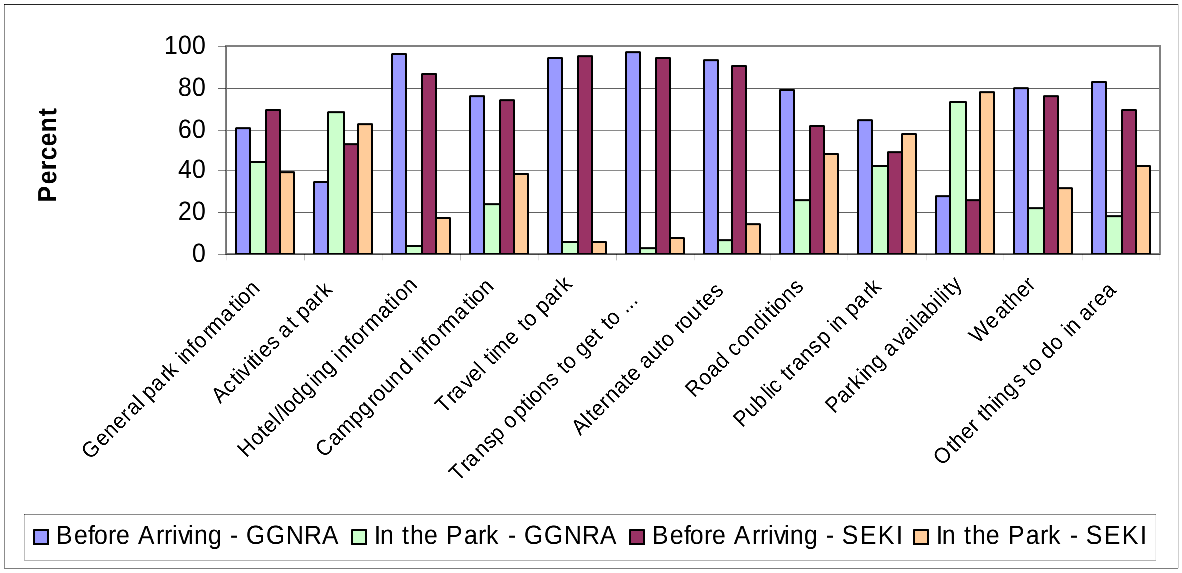


Figure 5-32: Comparison of When Information Was Obtained in GGNRA and SEKI

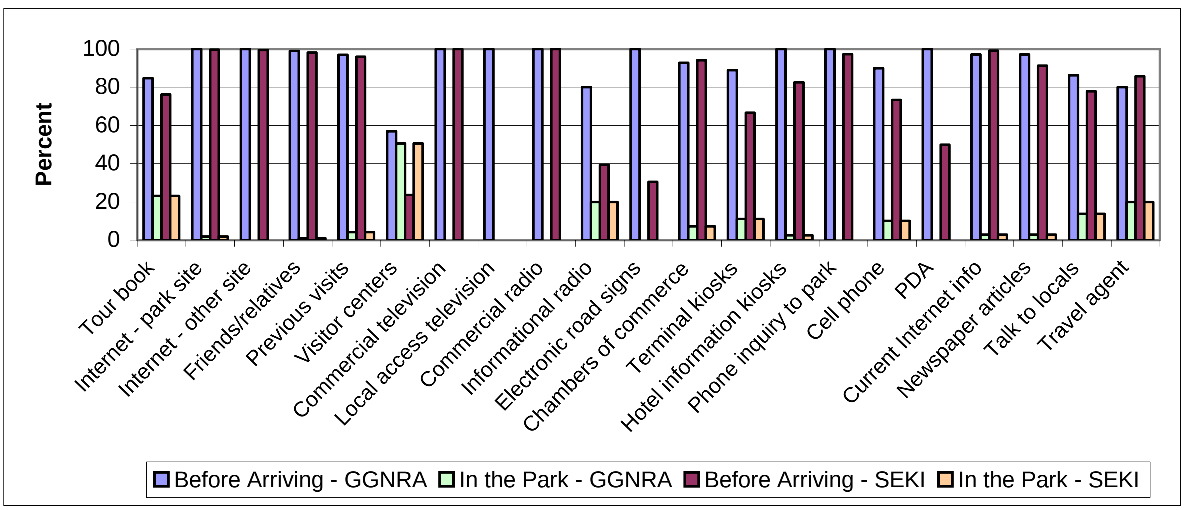


Figure 5-33: Comparison of When Sources of Information Were Used in GGNRA and SEKI

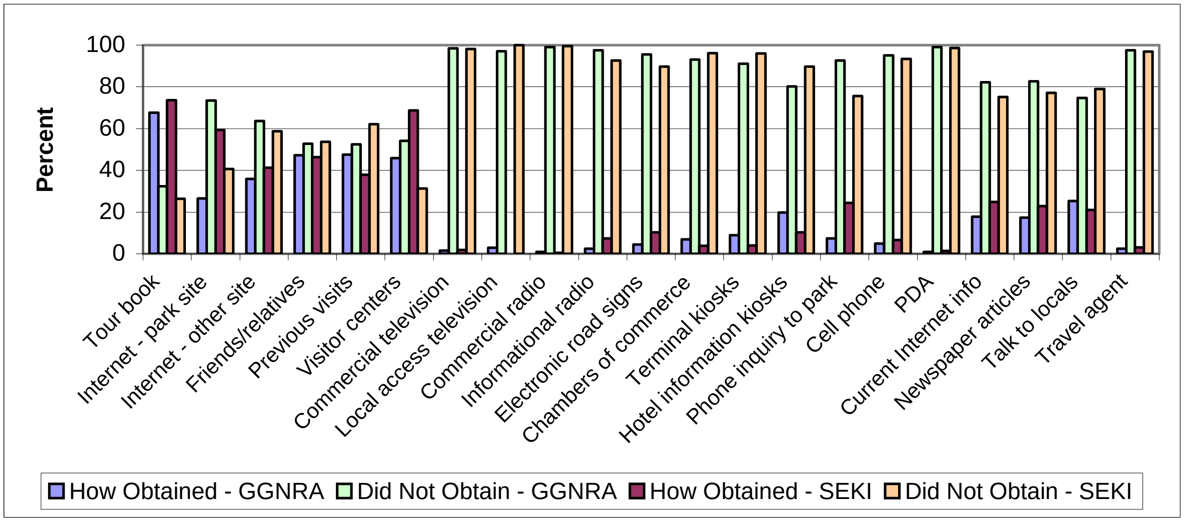


Figure 5-34: Comparison of Sources of Information Used in GGNRA and SEKI

Table 5-4: Sources of information used by visitors before or during trips to GGNRA and SEKI in May and July 2002.

Sources of information used (1)	Before Arriving		Before Arriving				In The Park			
Items in descending order by use before arrival	Both Areas		GGNRA		SEKI		GGNRA		SEKI	
for both areas	n	%	n	%	n	%	n	%	n	%
Tour book	370	56	117	57	253	56	32	16	137	30
Park web site	321	49	54	27	267	59	1	*	3	1
Friends and relatives	300	46	95	47	205	45	1	*	9	2
Other web site	259	39	74	36	185	41	0	0	3	1
Previous visits/experience	258	39	94	46	164	36	4	2	20	4
Current internet travel info	146	22	35	17	111	25	1	*	2	*
Newspaper/magazine	128	20	34	17	94	21	1	*	15	3
Visitor information centers	126	19	53	26	73	16	47	23	257	57
Phone inquiry to the park	122	19	15	7	107	24	0	0	5	1
Talk to people in local area	118	18	44	22	74	16	7	3	26	6
Hotel information kiosks	78	12	40	20	38	8	1	*	8	2
Cell phone to access data	31	5	9	4	22	5	1	*	12	3
Chambers of commerce	29	4	13	6	16	4	0	0	2	*
Terminal kiosks (e.g., airport)	28	4	16	8	12	3	2	1	7	2
Electronic road signs	23	4	9	4	14	3	0	0	36	8
Information radio (conditions)	17	3	4	2	13	3	1	*	21	5
Travel agent	16	2	4	2	12	3	1	*	2	*
Commercial television	11	2	3	1	8	2	0	0	0	0
Local access television	6	1	6	3	0	0	0	0	0	0
Personal digital assistant (PDA)	5	1	2	1	3	1	0	0	4	1
Commercial radio	4	1	2	1	2	0	0	0	0	0

(1) Total number in sample varied slightly across items due to missing values for some respondents on some items.

5.4.4. Section 4: Attitudes

Respondents were asked to consider how appropriate different information delivery systems or styles are in a national park. These results can be seen in Figure 5-35 and Table 5-5. While these results indicate that traditional forms of information delivery like tour books, visitor center kiosks, information from friends and family, and rangers were seen as most appropriate (having high means and low standard deviations), less traditional forms of delivery like electronic signs, commercial radio/TV and Internet terminals were scored lowest. However, the mean score for these lower items were primarily in the neutral to slightly inappropriate range. No items received group scores that represented "inappropriate" in a national park. Larger standard deviations on several items indicate that respondents felt differently about these lower items in several instances. For example, electronic signs, commercial TV, Internet terminals and mandatory shuttle service were each scored by some people as inappropriate and by others as appropriate.

Although not many, there were differences between the two parks. For example a mandatory shuttle was scored as much more appropriate by GGNRA visitors than by SEKI visitors. GGNRA visitors also scored "taking a public bus to the park" and "parking outside and ride a bike" more favorably than their SEKI counterparts.

Respondents with experience using public transportation also had favorable attitudes toward the use of it in National Parks. Figure 5-36 indicates that all three shuttle/bus related items were perceived as neutral or appropriate by a majority of visitors with public transportation experience. An almost identical pattern of appropriateness for these modes was evident for those who had used public transportation in a National Park. This finding may indicate two things. First, people are more likely to accept things with which they are more familiar. If alternative transportation modes are implemented in parks, certain levels of familiarity, acceptance and

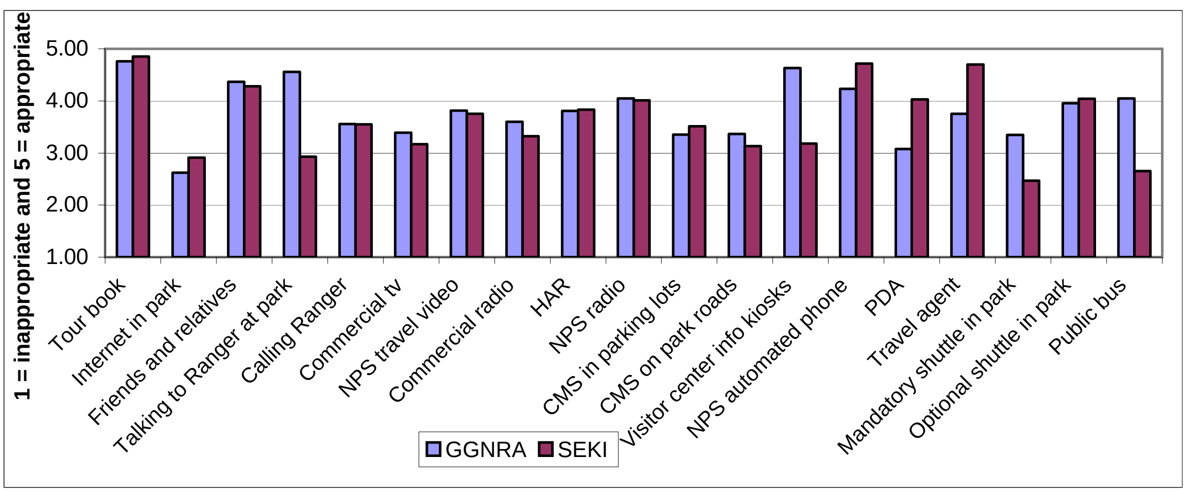


Figure 5-35: Comparison of Appropriateness of Methods to Obtain Information and Transportation Modes for GGNRA and SEKI

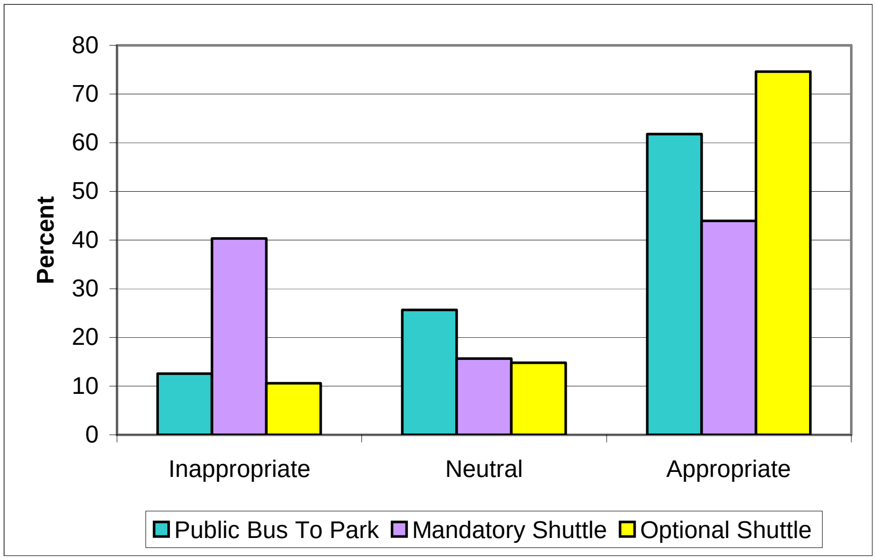


Figure 5-36: Appropriateness of Public Transportation Choices for a National Park by Respondents Who Had Previously Used Public Transportation

Table 5-5: Levels of appropriateness that visitors to GGNRA and SEKI assigned to different ways of providing/obtaining travel information or traveling in a national park

Items listed in descending order for combined sample (both areas)	Both Areas		GGNRA		SEKI	
	mean (1)	std dv	mean	std dv	mean	std dv
Tour book	4.82	0.54	4.76	0.66	4.85	0.47
Visitor center info kiosks	4.69	0.65	4.63	0.64	4.72	0.66
Talking to a ranger	4.66	0.72	4.56	0.80	4.70	0.68
Talking with family/friends	4.31	0.88	4.37	0.81	4.28	0.91
Park Service automated phone info line	4.10	1.08	4.23	1.00	4.03	1.11
Park Service dedicated radio travel info	4.02	1.04	4.05	1.09	4.01	1.02
Optional shuttle to travel within park	4.01	1.16	3.95	1.15	4.04	1.16
Highway advisory radio	3.82	1.12	3.81	1.14	3.83	1.11
Park Service travel video	3.77	1.08	3.82	1.06	3.75	1.09
Taking a public bus to a park	3.68	1.23	4.05	1.11	3.51	1.24
Phone call to a ranger	3.55	1.22	3.56	1.18	3.55	1.24
Commercial radio	3.41	1.16	3.60	1.13	3.32	1.17
Electronic signs on park roads	3.24	1.44	3.36	1.38	3.18	1.46
Commercial television	3.24	1.20	3.39	1.13	3.17	1.23
Electronic signs in park parking lots	3.20	1.37	3.35	1.33	3.13	1.39
Personal digital assistant (PDA) links	2.98	1.15	3.08	1.19	2.93	1.13
Internet terminals in the park	2.82	1.39	2.62	1.44	2.91	1.35
Park outside and ride a bike into park	2.78	1.49	3.05	1.46	2.65	1.49
Mandatory shuttle in the park	2.75	1.47	3.35	1.38	2.47	1.43

(1) Mean values were calculated based on a five point scale used by respondents where 1 = Inappropriate, 2 = Somewhat inappropriate, 3 = Neither, 4 = Somewhat appropriate, 5 = Appropriate.

greater feelings of appropriateness are likely to develop over time. Second, the more urban park visitors in this study were also somewhat more likely to use public transport and to view it more favorably in and around the park than the rural park visitors. This may indicate that alternative transportation would be more easily accepted in park units adjacent to urban areas because of the physical connections people make in urban settings, as well as their familiarity with doing so through the use of alternative transportation. In rural areas these connections may be viewed as less feasible and less appropriate.

Figure 5-37 shows similar results based on questions to public transportation users regarding what type of alternative transportation they were likely to use in a National Park. They were not likely to use public buses but were very likely to use an in park shuttle that did not charge a fee. They were more split in their reactions regarding fee based shuttles and park and ride options. As to the case with less traditional forms of media, these alternatives drew a mixed reaction from respondents. Fairly large percentages (35-40 percent) appear likely to use alternatives and may even prefer them in terms of the potential experience they would provide (e.g., can look at scenery instead of pavement, can be taken to specific features rather than searching them out). However, there are equally larger percentages that seem to feel negatively and indicate they would not be likely to use these modes.

5.4.5. Section 5: Technology

Figure 5-38 indicates that the vast majority of respondents at each park owned computers, had access to the Internet and owned cell phones, while a much smaller percentage owned PDAs and/or global positioning system (GPS) units. It should also be noted that there is not much difference between GGNRA and SEKI in technology ownership and Internet access, although GGNRA has a slightly higher percentage of respondents owning computers, cell phones, and

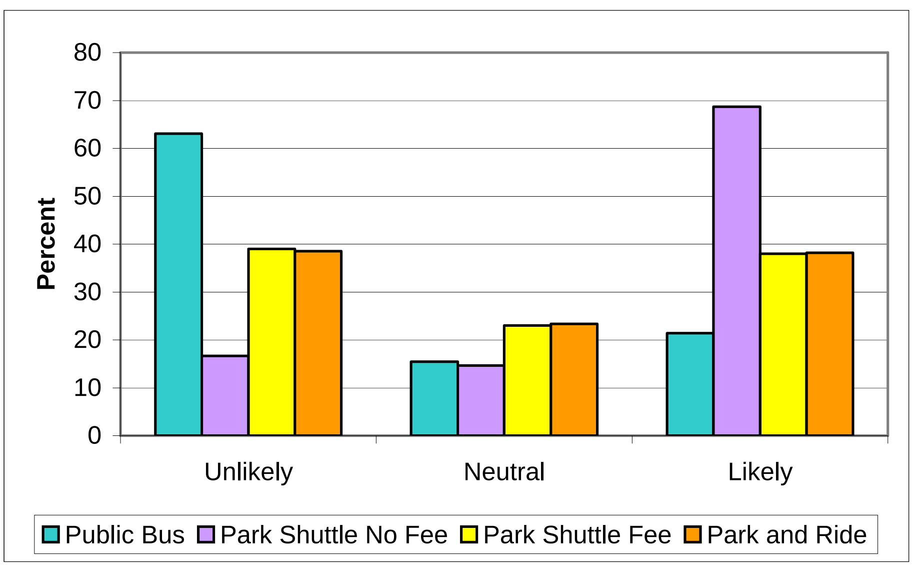


Figure 5-37: Likeliness of Respondents to Use Public Transportation Choices in a National Park by Those Who Had Previously Used Public Transportation

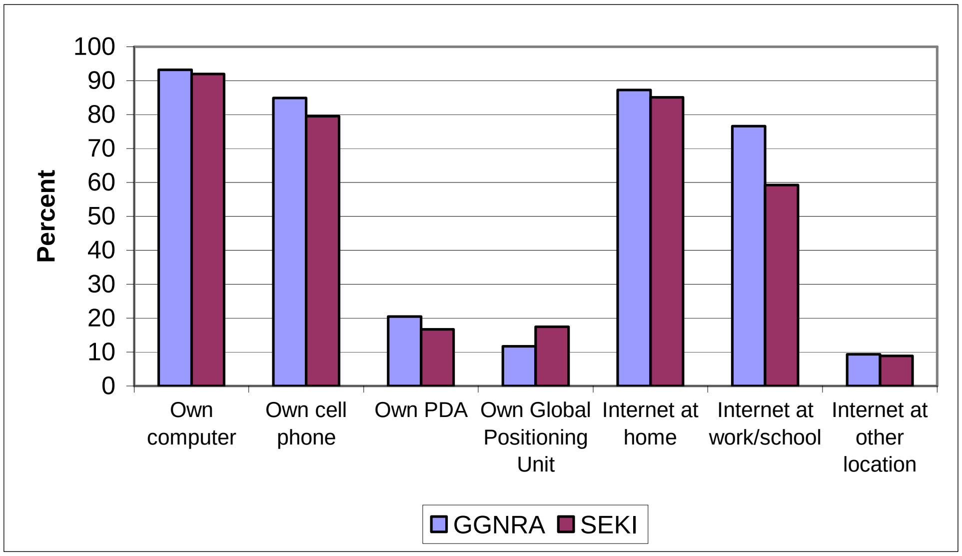


Figure 5-38: Comparison of Technology Ownership and Internet Access at GGNRA and SEKI

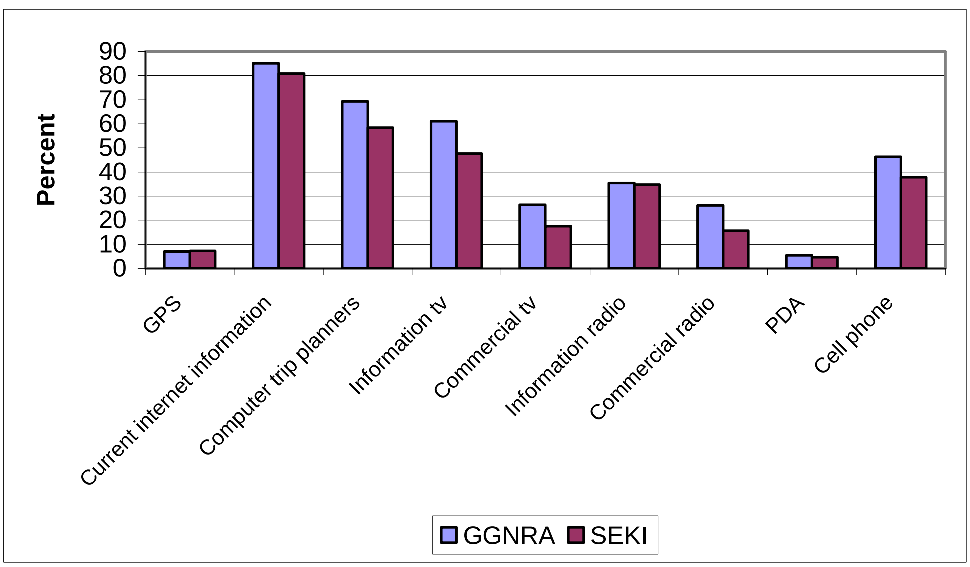


Figure 5-39: Comparison of Technology Methods Used for Planning Trips for GGNRA and SEKI

PDAs while SEKI had a slightly higher percentage of GPS ownership.

As shown in Figure 5-39, GGNRA respondents appeared to be slightly more likely to use these technology sources. It can be hypothesized that this may be due to GGNRA respondents having a slightly higher ownership/access percentage as well.

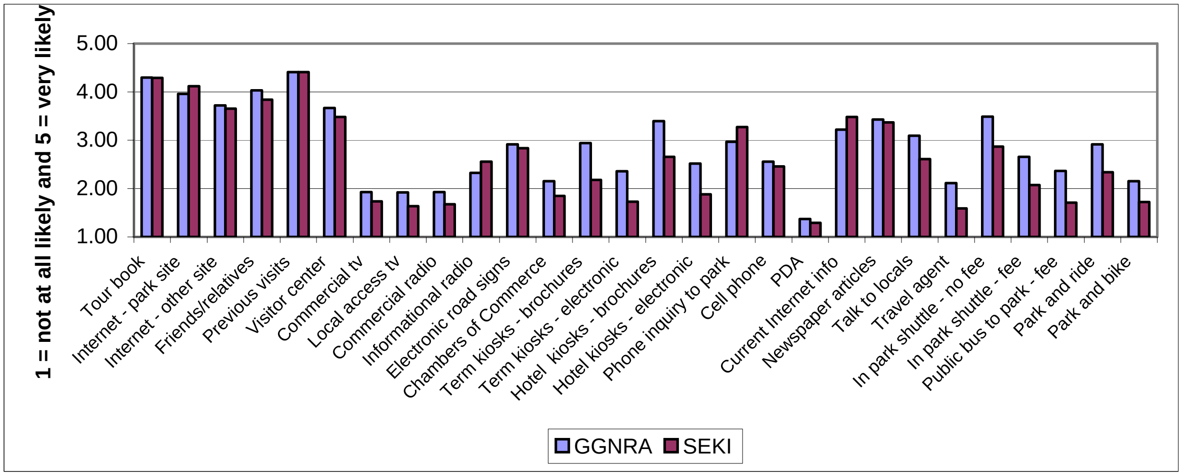


Figure 5-40: Comparison of Likeliness to Use Information Sources and Transportation Modes before Arriving at GGNRA and SEKI

5.4.6. Section 6: Obtaining Travel Information

Figure 5-40 and Table 5-6 indicate that visitors felt they were most likely to continue using traditional sources of information like their own experiences and tour books as they traveled to national parks. However, three items in the top seven indicated that they were also very likely to use park web sites and other Internet sources for travel information when coming to a national park. On the other end of the spectrum, most television and radio sources, travel agents and PDAs were viewed as having the lowest potential for use before arriving at the park.

Some of the largest differences between responses from GGNRA and SEKI visitors came on items related to the use of airport and hotel based information sources and public transportation. GGNRA visitors indicated they were more likely to use hotel and airport based kiosks for information prior to arriving in the park. This is likely due to the fact that many are traveling to the park as tourists from the San Francisco area where they have had access to this type of information. This group also indicated they were more likely to ride a public bus to the park. SEKI visitors appear to be more likely than GGNRA visitors to telephone the park and to make use of electronic road signs and/or highway advisory radio en route.

Figure 5-41 and Table 5-7 include information that suggests, with the exception of visitor centers, that most information sources are much less likely to be used once a visitor arrives in the park. An in park shuttle was scored as very likely to be used by visitors to both areas as long as it was offered at no additional charge. Including the use of a “public bus” item in this mix suggests that GGNRA respondents were more likely to use public transport in the park that those from SEKI. Electronic road signs, which were scored in the middle of the range for appropriateness in parks, were nonetheless among the most likely items in the list to be used by visitors. SEKI visitors scored this type of sign as less appropriate than GGNRA, but here indicated a higher likeliness to use them in a park. Internet information dropped well down the list for likelihood of use once in the park.

Table 5-6: Likeliness of GGNRA and SEKI Visitors to Use Information Sources or Travel Modes Before Arriving at that Park.

How likely to use before arriving -	Both Areas			GGNRA			SEKI		
listed in descending order both areas	mean (1)	std dv (2)	rank (3)	mean	std dv	rank	mean	std dv	rank
Previous visits to this park	4.41	1.03	1	4.41	1.07	1	4.41	1.14	1
Tour book	4.29	1.18	2	4.30	1.20	2	4.29	1.18	2
This park's web site	4.07	1.33	3	3.96	1.32	4	4.12	1.37	3
Friends and family	3.90	1.26	4	4.04	1.22	3	3.84	1.31	4
Web sites other than this park's	3.68	1.50	5	3.72	1.45	5	3.66	1.58	5
Visitor/Tourist info. center	3.54	1.57	6	3.67	1.45	6	3.49	1.68	6
Current internet information	3.40	1.55	7	3.22	1.55	10	3.49	1.62	6
Newspaper	3.39	1.39	8	3.43	1.36	8	3.37	1.44	8
Telephone the park	3.18	1.50	9	2.97	1.51	12	3.27	1.52	9
In-park shuttle - no fee	3.08	1.49	10	3.49	1.62	7	2.86	1.72	10
Hotel information kiosk	2.90	1.55	11	3.40	1.49	9	2.66	1.57	12
Electronic road signs	2.86	1.52	12	2.91	1.51	14	2.84	1.63	11
Talk to local residents	2.77	1.49	13	3.09	1.51	11	2.61	1.51	13
Park and ride	2.52	1.44	14	2.91	1.52	14	2.34	1.48	16
Cell phone for data access	2.49	1.54	15	2.55	1.51	17	2.46	1.63	15
Highway advisory radio	2.48	1.46	16	2.33	1.41	21	2.55	1.54	14
Terminal kiosk (e.g., at an airport)	2.43	1.48	17	2.94	1.55	13	2.18	1.45	17
In-park shuttle - fee	2.27	1.27	18	2.66	1.53	16	2.07	1.36	18
Hotel kiosk with computer access	2.09	1.40	19	2.52	1.53	18	1.88	1.35	19
Chamber of commerce	1.95	1.27	20	2.15	1.34	22	1.85	1.28	20
Terminal kiosk with computer	1.94	1.29	21	2.36	1.47	20	1.73	1.22	21
Take a public bus to park	1.92	1.25	22	2.37	1.49	19	1.71	1.18	24
Park and bike	1.87	1.26	23	2.15	1.44	22	1.72	1.28	23
Commercial television	1.80	1.11	24	1.93	1.23	25	1.73	1.12	21
Commercial radio	1.76	1.13	25	1.93	1.27	25	1.67	1.12	25
Travel agent	1.76	1.16	25	2.11	1.36	24	1.59	1.09	27
Local access television	1.73	1.09	27	1.92	1.25	27	1.64	1.07	26
Personal digital assistant (PDA)	1.32	0.75	28	1.37	0.91	28	1.29	0.81	28

(1) Mean values calculated based on a five point scale where 1 = not at all likely and 5 = very likely
(2) Standard deviation
(3) Rank of mean value within column category

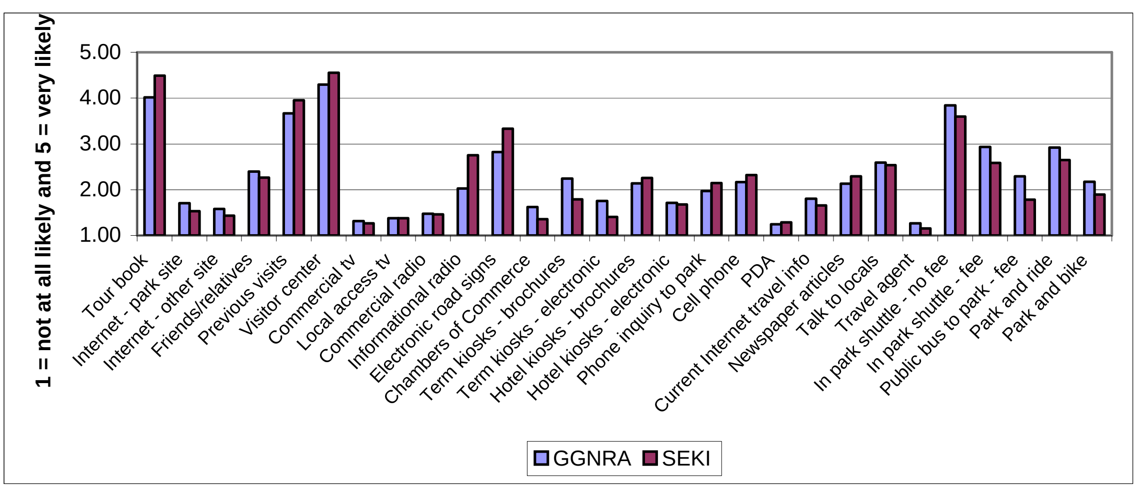


Figure 5-41: Comparison of Likeliness to Use Information Sources and Transportation Modes in the Park at GGNRA and SEKI

Table 5-7: How likely visitors to GGNRA and SEKI felt they were to use information sources or travel modes after arriving at that park

How likely to use after arriving - listed in descending order both areas	Both Areas			GGNRA			SEKI		
	mean (1)	std dv (2)	rank (3)	mean	std dv	rank	mean	std dv	rank
Visitor/Tourist info. center	4.47	1.02	1	4.30	1.09	1	4.55	0.98	1
Tour Book / visitor guides	4.34	1.16	2	4.02	1.39	2	4.49	1.00	2
Previous visits to this park	3.86	1.56	3	3.67	1.57	4	3.95	1.55	3
Free in park shuttle bus	3.67	1.52	4	3.84	1.45	3	3.59	1.55	4
Electronic road signs	3.17	1.54	5	2.82	1.54	7	3.33	1.52	5
Park and ride shuttle system	2.74	1.55	6	2.92	1.59	6	2.65	1.53	7
Fee based in park shuttle	2.69	1.50	7	2.93	1.53	5	2.58	1.47	8
Talk to local residents	2.55	1.58	8	2.60	1.60	8	2.53	1.57	9
Highway advisory radio	2.53	1.56	9	2.02	1.41	16	2.75	1.58	6
Friends and family	2.31	1.56	10	2.39	1.58	9	2.26	1.54	12
Cell phone for data access	2.27	1.57	11	2.17	1.48	13	2.32	1.61	10
Newspaper	2.24	1.47	12	2.13	1.41	15	2.29	1.49	11
Hotel information kiosk	2.22	1.53	13	2.14	1.47	14	2.26	1.56	13
Telephone the park	2.09	1.47	14	1.97	1.40	17	2.15	1.49	14
Park and ride bike system	1.99	1.39	15	2.17	1.46	12	1.90	1.35	15
Use a public bus in the park	1.95	1.37	16	2.29	1.53	10	1.78	1.25	17
Terminal information kiosk	1.94	1.45	17	2.25	1.56	11	1.79	1.36	16
Current internet information	1.70	1.29	18	1.80	1.31	18	1.66	1.28	19
Hotel kiosk with computer access	1.69	1.25	19	1.71	1.22	20	1.68	1.26	18
This park’s web site	1.59	1.15	20	1.71	1.24	21	1.53	1.10	20
Terminal kiosk with computer access	1.52	1.12	21	1.76	1.29	19	1.40	1.01	23
Web sites other than this park’s	1.48	1.03	22	1.58	1.11	23	1.43	0.99	22
Commercial radio	1.47	1.01	23	1.48	1.03	24	1.46	1.00	21
Chambers of commerce	1.44	0.97	24	1.62	1.11	22	1.36	0.89	25
Local access television	1.38	0.90	25	1.38	0.88	25	1.38	0.91	24
Commercial television	1.28	0.76	26	1.31	0.88	26	1.26	0.70	27
Personal digital assistant (PDA)	1.27	0.80	27	1.24	0.70	28	1.29	0.86	26
Travel agent	1.19	0.66	28	1.27	0.74	27	1.15	0.62	28

1 Mean values calculated based on a five point scale where 1 = not at all likely and 5 = very likely
2 Standard deviation
3 Rank of mean value within column category

There was some speculation that the relatively low scores given for using selected technology alternatives for traveler information – GPS, PDA and computer – could reflect the ownership levels of these technologies. Figure 5-42 shows, for people who own each of these technology types, the percentage of respondents who reported using them for trip planning. The majority of owners of PDAs and GPS report not using them for trip planning. This could reflect that suitable software and interfaces have not been widely developed for these technologies.

5.4.7. Section 7: Transportation

As can be seen in Figure 5-43, survey respondents at GGNRA (72 percent) were more likely than those at SEKI (43 percent) to have used public transportation once or more in the last year. Figure 5-44 shows the frequency of survey respondents’ public transportation use. As can be seen, GGNRA respondents use public transportation more often than their SEKI counterparts. Another major difference in public transportation use is that SEKI respondents (54 percent) had used public transportation in a National Park setting more frequently than their GGNRA counterparts (38 percent). Visitors to SEKI had somewhat higher levels of National Park

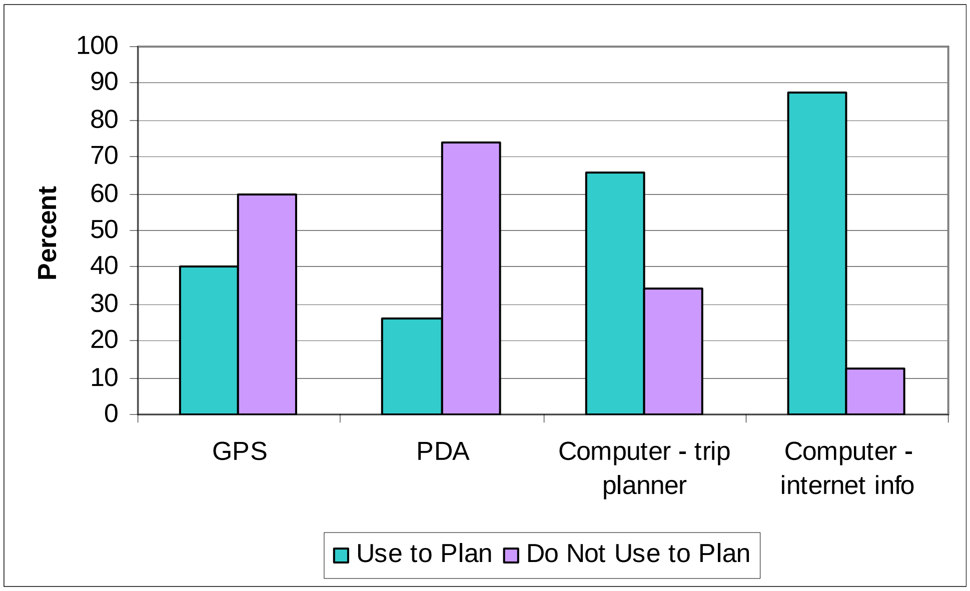


Figure 5-42: Distribution of Technology Usage by Technology Ownership

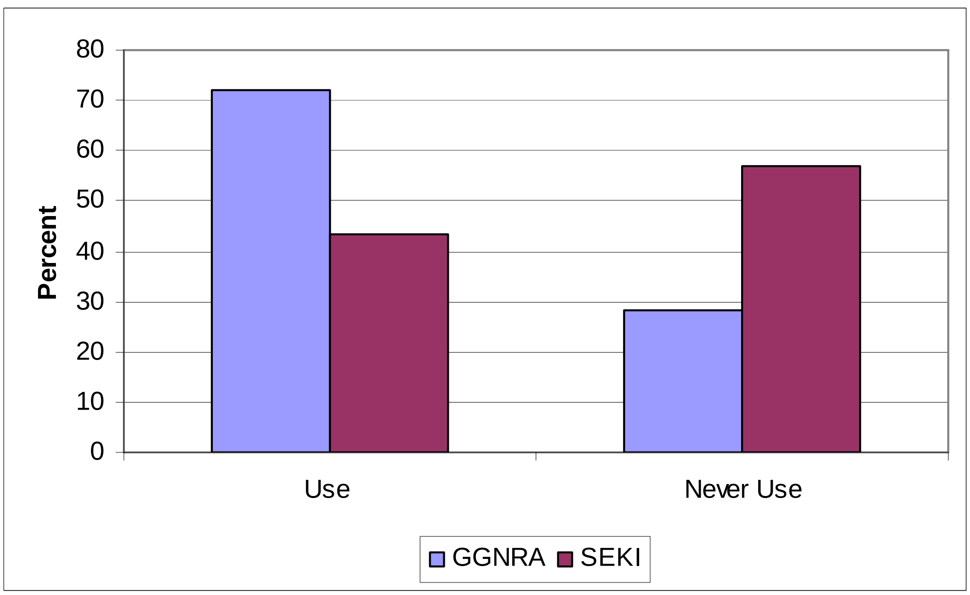


Figure 5-43: Comparison of Public Transportation Use in the Past Year among Visitors to GGNRA and SEKI

visitation than those to GGNRA over the past five years (mean number of visits of 7.4 and 6.3, respectively) but more importantly may have been visiting parks in which some sort of public transportation was available (e.g., Yosemite) or even required (e.g., Zion).

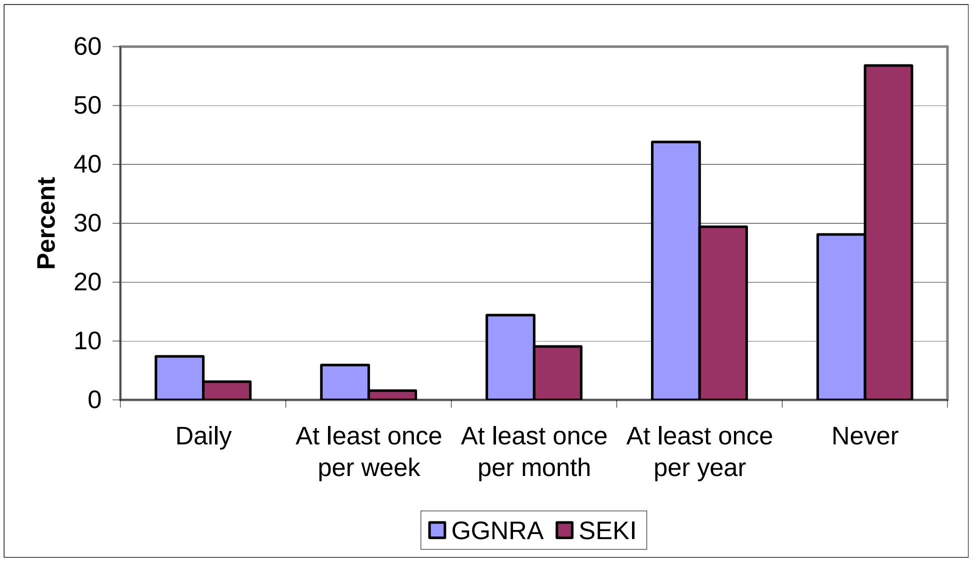


Figure 5-44: Frequency with which Visitors to GGNRA and SEKI Said They Used Public Transportation.

5.5. Summary

These results of this survey suggest several broad perceptions related to ITS and alternative transportation systems among visitors to the two National Park Units. One that has specific implications for emerging ITS technologies was the level of Internet use. Surveys of only four to five years ago indicated much lower use of the Internet in trip planning among tourists in general. Respondents from both areas indicated relatively high levels of use and many indicated having accessed a park specific web site. Use of “this park’s web site” ranked 3rd among the 28 “likely to use” items for SEKI respondents and 4th among those who visited GGNRA. The park specific Internet information appears to be a viable way to reach large numbers of visitors before reaching the park. For example, such information could help managers direct visitors (e.g., traffic) prior to arrival and also allow visitors to make choices about where in the park they may want to go, and when, based on parking or other travel related conditions. Younger, more educated people are those who are also early adopters of computer and other technologies. As younger age-group cohorts grow older, they may create a higher demand for access to technology in National Parks. Though PDAs, for example, were little used by respondents in this study, they may increase in much the way that Internet use did as wireless options become more institutionalized. Cell phone use continues to climb and access to air time in parks for planning and safety purposes is certain to increase within certain groups in the coming years.

Though most visitors did not perceive high levels of congestion in either unit, parking lots were the places perceived as most congested. If ITS solutions are going to be developed to reduce congestion, under the current paradigm of automobile access, parking appears to be a good starting point. Helping visitors understand what the parking situation looks like before they arrive could create more realistic expectations and potentially make conditions more acceptable, particularly if alternative parking places can be provided. Such a strategy might include the use of electronic message signs. These signs met with mixed reactions but SEKI visitors said they were at least somewhat likely to use these devices in the park. The design (e.g., color and materials) of these signs would probably make some difference in their perceived appropriateness in a park. Electronic signs may in fact be less obtrusive than other types of signs as they can be without messages much of the time and create less distraction than traditional signs with permanent fixed messages.

Alternative transportation appears to be accepted by visitors in the form of optional shuttles that have been traditional in National Parks. An optional shuttle, and one without a fee, was perceived as appropriate and likely to be used. However, the overall positive orientation toward this type of shuttle also suggests that other options, such as requiring a shuttle to see the park and/or a fee attached to a shuttle could be more readily accepted given some time. Few people are willing to give up choice or money unless forced to do so and unless the purpose is clear. The implementation of such systems would need to be accompanied by media information that related the benefits of the system to the park environment and to the visitor’s experience.

6. PROBLEMS SUMMARY

This chapter has combined the results of stakeholder outreach, visitor surveys, and park unit management and strategic plans to determine the transportation problems for the parks. The problems were then put into categories to determine appropriate ITS themes for the park unit. The problems for Golden Gate National Recreation Area are listed in Table 6-1 and the problems for Sequoia and Kings Canyon National Parks are listed in Table 6-2.

Table 6-1: ITS Problems Summary for Golden Gate National Recreation Area

Problem Categories	Description of Problem or Issue	Reference
Overarching	Backup in auto traffic on both US Route 101 and State Route 1	Stakeholder Mtg 11/15-16/01
Overarching	Visitor experience is very important; the transportation mode should be part of this experience, not detract from the experience.	Stakeholder Mtg 11/15/01
Overarching	ITS must be aesthetically consistent with Park, e.g. National Register of Historical Places.	Stakeholder Mtg 11/16/01
Overarching	Preserve the natural features of the park.	Stakeholder survey 11/01
Congestion	Congestion is a challenge in accessing the following locations: seasonally on State Route 1 corridor, Conzelman Road, Rodeo Beach, Marin Headlands, Vista Point, south end of Golden Gate Bridge, 19th Avenue/Park Presidio Blvd, Stinson Beach, Crissy Field/Bay Street, Muir Woods, Muir Beach, and Tennessee Valley..	Stakeholder Mtg 11/15/01 & 11/16/01; Stakeholder survey 11/01
Congestion	Key trouble spots include Muir Woods, Marin Headlands, Stinson Beach, Crissy Field, Sutro Heights/Cliff House.	Stakeholder Mtg 11/16/01
Congestion	GGNRA had a higher perception of congestion than SEKI did.	Survey results
Congestion	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.	Cambridge Systematics' Study

Problem Categories	Description of Problem or Issue	Reference
Congestion	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.	Cambridge Systematics' Study
Congestion	Community (Sausalito) adjacent to Fort Baker is concerned about additional traffic in the area and generates traffic itself from "tourists."	Stakeholder Mtg 11/15/01
Congestion; Lack of Planning Data	Want to collect "leading indicators" to provide proactive indications of when demand might be high (e.g. it's a Saturday and the weather is good)	Stakeholder Mtg 11/15/01
Access	Enhancing access to the Presidio, its facilities, and its interpretive programs for visitors of all ages, backgrounds, and abilities.	Presidio Trust Management Plan
Access	Crissy Field and Doyle Drive in Presidio have access issue, due to limited auto access.	Stakeholder Mtg 11/15/01
Access	Access to some sites (Conzelman Road) in the Headlands is limited.	Stakeholder survey 11/01
Access	Limited access from San Francisco as well as in and around park sites.	Stakeholder survey 11/01
Parking	Overflow parking is a challenge in Muir Woods, Stinson Beach, Conzelman, Rodeo Beach, Vista Point, Fort Mason and Fort Baker.	Stakeholder Mtg 11/15/01
Parking	GGNRA had a higher perceived problem with parking than SEKI did.	Survey results
Parking	There are parking needs on Highway 1 and at Muir Woods.	Stakeholder Mtg 11/15/01
Parking	Parking facility management is needed (i.e. such as through SF municipal garages or the Lettermen Garage).	Stakeholder Mtg 11/15/01 & 11/16/01
Parking	Need travel time and advanced information on parking lot status. Parking information is currently disseminated by staff with brochures; crowding should be communicated better.	Stakeholder Mtg 11/15/01 & 11/16/01
Parking	Lack of real-time, advanced information regarding availability of parking.	Stakeholder survey 11/01

Problem Categories	Description of Problem or Issue	Reference
Parking; Traveler Information	Better information on travel time and parking lot status.	Stakeholder Mtg 11/15/01
Transit Coordination and Information	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 coordinated between units (GGNRA units in Marin County, the Presidio, and other San Francisco GGNRA units).	Cambridge Systematics' Study
Transit Coordination and Information	Lack of alternative transportation modes to park, both on weekdays and weekends.	Stakeholder survey 11/01
Transit Coordination and Information	Transit to provide direct access to neighborhoods, park attractions, and museums (i.e. Discovery Shuttle).	Stakeholder Mtg 11/15/01
Transit Coordination and Information	Bus prioritization could make some sense, with real-time arrival information	Stakeholder Mtg 11/15/01
Transit Coordination and Information	Foundations are interested in supporting transit – such as from different neighborhoods on different days.	Stakeholder Mtg 11/16/01
Transit Coordination and Information	In the Presidio Trust it is more useful to keep track of transit and inform users of alternatives than to provide congestion management.	Stakeholder Mtg 11/16/01
Transit Coordination and Information	Need for fleet management of all the different transit systems.	Stakeholder Mtg 11/15/01
Transit Coordination and Information	GGNRA survey respondents felt that a mandatory shuttle, taking a public bus, and parking outside and riding a bike were more appropriate than their SEKI counterparts.	Survey results
Lack of Planning Data	Reliability of counting systems is key. Need to upgrade traffic count systems for visitation purposes. Want to be able to get more accurate statistics and to distinguish between travelers and tourists, find out about linked trips, and trip patterns.	Stakeholder Mtg 11/15/01 & 11/16/01
Lack of Planning Data	Want to count non-motorized travel, but automated means are not easy to implement.	Stakeholder Mtg 11/15/01

Problem Categories	Description of Problem or Issue	Reference
Traveler Information	Need to inform travelers better and earlier (e.g. before/at decision point). Potentially try to reach visitors at San Francisco hotels.	Stakeholder Mtg 11/15/01 & 11/16/01
Traveler Information	A higher number of respondents want the GGNRA information prior to their trip.	Survey results
Traveler Information	Need to get GGNRA user information into systems that people can use.	Stakeholder Mtg 11/16/01
Traveler Information	Need to get information from the source to the user agency (e.g. Fort Mason parking impact reports).	Stakeholder Mtg 11/16/01
Traveler Information	Weather information may be useful to travelers (e.g. fog and beach weather).	Stakeholder Mtg 11/15/01
Traveler Information	Need for improved information about activities, park destinations, history, maps, trail markers	Stakeholder survey 11/01
Work Zone/ Event Coordination	Need better coordination or recommendations on work zones/construction, and providing information on actual vs. planned lane closures, perhaps using the Web.	Stakeholder Mtg 11/15/01
Work Zone/ Event Coordination	A major challenge is overlapping events across several organizations.	Stakeholder Mtg 11/16/01
Work Zone/ Event Coordination	There’s a need to think about special event solutions versus routine solutions.	Stakeholder Mtg 11/16/01
Work Zone/ Event Coordination	Supporting activities that would encourage people to visit such as festivals, educational programs, and military pageantry.	Presidio Trust Draft Implementation Plan
Emergency Response	Emergency response is necessary, particularly in the aftermath of 9/11 and Golden Gate Bridge.	Stakeholder Mtg 11/15/01

Table 6-2: ITS Problems Summary for Sequoia and Kings National Parks

Problem Categories	Description of Problem or Issue	Reference
Overarching	The park is making a transition from a traditional destination park to more of a day-use park serving the growing urban populations of the Central Valley.	Stakeholder meeting (11/14/01)
Overarching	Three Rivers is concerned about the trade-off between quality of life and economic development.	Stakeholder meeting (11/14/01)
Overarching	There are limitations for power and communications within the park, with limited cellular coverage east of Lake Kaweah.	Stakeholder meeting (11/14/01); Stakeholder survey (11/01)
Overarching	ITS needs to be non-intrusive as much as possible.	Stakeholder meeting (11/14/01)
Limited Parking	Some localized parking issues, mostly at Giant Forest (this may be solved in the short-term with recent construction), Grant Grove Visitor Center complex, and General Grant Tree. Also an issue sometimes at the General Sherman pullout when the upper parking lot is closed. Park staff indicated that the weakest link in the park is vehicle parking.	Stakeholder meeting (11/14/01, 3/4/03); BRW March 1999 Traffic Study; Visitor survey results; Stakeholder survey (11/01)
Transit Service	The park is currently exploring a fixed-route shuttle system between Giant Forest, Wolverton, and the Wuksachi Lodge area. A transit shuttle had been operated by the concessionaire but was discontinued because of a low ridership.	Stakeholder meeting (11/14/01, 3/4/03)
Transit Service	If the park pursues a transit system, there is a need for shuttle information (e.g., where is parking, where are shuttle stops, how often do shuttles run, when is the next shuttle arriving, etc.).	Stakeholder meeting (11/14/01, 3/4/03)

Problem Categories	Description of Problem or Issue	Reference
Transit Service	There is no public transportation from Visalia or Fresno into the park. However, there is a potential for high-speed rail service in the Central Valley, which may affect transit usage to the park.	Stakeholder meeting (11/14/01); Stakeholder survey (11/01)
Weather Forecasts and Road Conditions	Need to inform travelers earlier of the common weather concerns (e.g. snow, ice, and fog) at SEKI that can lead to hazardous road conditions.	Stakeholder meeting (11/14/01);
Weather Forecasts and Road Conditions	Stakeholders indicated that more information about road closures is needed lower in the Valley, closer to State Route 99, particularly at the Ash Mountain entrance on State Route 198.	Stakeholder meeting (11/14/01); Stakeholder survey (11/01)
Weather Forecasts and Road Conditions	Information about chain requirements needs to be disseminated earlier. There are no turnouts along State Route 180 for installing chains.	Stakeholder meeting (11/14/01)
Weather Forecasts and Road Conditions	Major storms often create two separate parks, and preclude access to Forest Service sites. There is inadequate information about when park roads are closed.	Stakeholder meeting (11/14/01); Stakeholder survey (11/01)
Weather Forecasts and Road Conditions	It is difficult for visitors to get to and around the parks during the winter.	Stakeholder survey (11/01)
Entrance Gates	Some localized congestion issues, mostly at the Big Stump Entrance Station. Park staff indicated that 20- to 25-minute delays are common at the entrance during peak days.	Stakeholder meeting (11/14/01, 3/4/03); BRW March 1999 Traffic Study; Visitor survey results
Entrance Gates	Safety is an issue when queues extend back from the Big Stump Entrance Station during peak times. Vehicles approach the station not expecting stopped vehicles ahead.	Stakeholder meeting (3/4/03)

Problem Categories	Description of Problem or Issue	Reference
Safety	Driving on steep, winding grades is difficult for some visitors and therefore sometimes results in incidents. The park has installed special signage to inform visitors with automatic transmissions to use low gears.	Stakeholder meeting (11/14/01)
Safety	Response times for emergencies may be long.	Stakeholder meeting (11/14/01); Stakeholder survey (11/01)
Safety	There is a key location on South Mountain near Milk Ranch Peak that could be used to monitor the Generals Highway as it climbs to Giant Forest. The monitoring station could watch for incidents as well as fires.	Stakeholder meeting (11/14/01, 3/4/03)
Safety	There are no call boxes between State Route 99 and the entrance to the park.	Stakeholder survey (11/01)
Safety	Fire evacuation is a concern.	Stakeholder survey (11/01)
Work Zone Information	Various roads in the park will be undergoing reconstruction in the next 10 to 15 years. Stakeholders indicated a need to disseminate more construction information to visitors as well as coordinate within the park.	Stakeholder meeting (11/14/01, 3/4/03)
Work Zone Information	Terminus Dam project will raise water level of Lake Kaweah, requiring raising of Horse Creek Bridge along State Route 198 (east of Visalia) with attendant traffic impacts.	Stakeholder survey (11/01)
Campground Information and Reservations	Several campgrounds permit advance reservation, while most campgrounds are first-come, first served. Many visitors ask about campground availability.	Stakeholder meeting (3/4/03)
Air Quality	Park currently has air quality issues that are caused by activities to the west. Asthma is an issue in the gateway communities. There is interest in getting ozone alerts out to visitors. Currently these are only provided in visitors centers.	Stakeholder meeting (11/14/01, 3/4/03)

Problem Categories	Description of Problem or Issue	Reference
Congestion	There are a lot of visitors that are simply passing through the park on the way to Hume Lake. There were suggestions to re-route Hume Lake traffic away from the Grant Grove area and have them approach Hume Lake from the southern route.	Stakeholder meeting (11/14/01)
Congestion	Slow-moving trucks and recreational vehicles (RVs) crowd roadways, making trips less desirable.	Stakeholder survey (11/01)
Road Design and Infrastructure	Deterioration of roads within the park, including Crescent Meadow and Crystal Cave Roads.	Stakeholder survey (11/01)
Road Design and Infrastructure	The geometrics of State Route 198 into Sequoia National Park are too dangerous for recreational vehicles (RVs) and buses. These roadways are narrow and perceived as treacherous to those unfamiliar with mountain driving.	Stakeholder survey (11/01)
Road Design and Infrastructure	Road marker visibility is a concern during bad weather.	Stakeholder survey (11/01)

6.1. GGNRA Problem Categories

Roadway Congestion. Roadway congestion affects access during high visitation times at many locations throughout the recreation area, including US Route 101, State Route 1 Corridor, Conzelman Road, Rodeo Beach, the Marin Headlands, Vista Point, the south end of Golden Gate Bridge, 19th Avenue/Park Presidio Boulevard, Stinson Beach, Crissy Field/Bay Street, Fort Baker and Muir Woods. Sausalito has expressed concern about the potential traffic impacts when Fort Baker is redeveloped by National Park Service and generates additional traffic as a destination.

Inadequate Access. There is a desire to improve access to various park sites, including Crissy Field and various sites within Presidio, in addition to neighborhoods, museums and other local attractions where automobile access is limited. This problem includes insufficient transit and amenities and facilities for pedestrians and bicyclists to access and use park facilities.

Limited Parking. Overflow visitor parking is a challenge at several GGNRA locations, including Muir Woods, Stinson Beach, Conzelman Road, Rodeo Beach, Vista Point, Fort Mason and Fort Baker. At Muir Woods, for example, parking may back up one mile from the park entrance onto adjacent two-lane roadways which are not designed to support on-street parking. There is a lack of real-time information regarding parking availability and advance information about when crowded conditions might be expected. There is also concern about employee parking as the Presidio continues to be developed.

Transit Coordination and Information. The dispersed lands associated with GGNRA may make it difficult for a visitor to access park lands without an automobile. The variety of transit services in the Bay Area, plus the numerous other cultural, educational and recreational attractions in the area, provide an opportunity for coordinating transit service to improve the level of service and access to GGNRA lands. There is a need to improve information about the limited transit service at park sites as well, to inform travelers of available transit options, their schedules, and their estimated arrival times.

Lack of Planning Data. There is a need for improved data regarding visitation patterns in order to improve transportation planning for park lands and adjacent communities and neighborhoods. There is also a lack of data regarding visitor travel by non-motorized means, although there is limited ability to collect this data automatically.

Traveler Information. There is a need to provide tourists with information about parking, congestion, transit availability and weather prior to their visit, along with improved information about activities within the park as well as in surrounding areas. Ideally, this could be done with a predictive element to allow for better planning and management of visitor traffic. This traveler information needs to reach people in systems they will use and at locations that enable them to make appropriate decisions.

Work Zone/Event Coordination. There is need for better coordination between agencies on work zones and construction, and providing information on actual versus planned lane closures. In addition, there are often special events that significantly impact traffic levels on roadways providing access to park sites. In some cases, estimated traffic impacts of events are reported to some agencies but are not distributed to all affected agencies.

Emergency Response. With the Golden Gate Bridge frequently cited as a terrorist target, the park must be sensitive to evacuation and emergency response needs on its lands. There will be a need to ensure rapid coordination and dispatch of appropriate resources to respond to large-scale emergencies, and to provide visitors and others with appropriate information to allow them to alter their travel behavior and visitation activities as needed.

6.2. SEKI Problem Categories

Limited Parking. Parking lots at popular destinations (e.g., Grant Grove, Giant Forest, and Sherman Tree) fill quickly and become congested. Visitors park in unauthorized areas (e.g., along roadways or on unpaved areas adjacent to parking lots) and create safety problems. Some park visitors may be unable to visit popular destinations at peak time because of parking shortages. In visitor surveys during May and July 2002, 27 percent of park visitors indicated that parking was congested or somewhat congested within the park. From the same surveys, it was indicated that 62 percent of visitors did not obtain parking information.

Transit Service. The park is currently exploring a fixed-route shuttle system between Giant Forest, Wolverton, and the Wuksachi Lodge area. A transit shuttle had been operated by the concessionaire but was discontinued because of low ridership. If the park pursues a transit system, there is a need for shuttle information (e.g., where is parking, where are shuttle stops, how often do shuttles run, when is the next shuttle arriving, etc.). There is currently no public transportation access to the park, although plans for high-speed rail service in the Central Valley may provide opportunities for transfers to buses that would provide public transportation connections into the park.

Weather Forecasts and Road Conditions. Snow, ice and fog are common weather concerns in the park during certain times and can lead to hazardous road conditions. Park managers place chain restrictions on some roads and close other roads that are considered unsafe. Most park visitors only find out about these weather conditions and road restrictions/closures once they are in the park. The information that chains are required would be useful to disseminate in the gateway communities so that tourists without chains could stop and rent them and not have to return to the community after finding out the information at the entrance gate. Visitor surveys indicated that 19 percent of visitors obtained road condition or weather information only once they arrived at the park.

Queues at Entrance Stations. During peak times, park visitors may wait 20 to 25 minutes or more at park entrances to pay entrance fees. Increasing day use means a higher percentage of park visitors will be passing through entrance stations every day. In visitor surveys during May and July 2002, 10 percent of park visitors indicated that the roads leading to the park were congested or somewhat congested. Safety is also an issue because vehicles approaching this entrance station are not expecting a long line of stopped vehicles.

Safety Challenges due to Incidents. Generals Highway from the Foothills Visitors Center to Giant Forest is a steep, narrow and winding road. Incidents or other extreme events (e.g., vehicle accidents, fire, etc.) along this stretch of roadway could seriously impact the flow of traffic to and from Giant Forest.

Work Zone Information. Park managers anticipate visitor delays and coordination issues due to reconstruction activities that will be occurring within the park over the next 10 or more years. There will be ongoing construction projects that will almost continually impact visitor travel on park roads. Tourists need to be provided with more information on these work zones and the information needs to be provided in systems that tourists will use and at locations that enable them to make the proper decision.

Campground Information and Reservations. Tourists need more information about campgrounds and reservations. Several campgrounds in SEKI do permit advance reservations, although most of them are still first-come, first served. Many visitors ask about the campground availability, while some drive to numerous campgrounds around the park to find available campsites. The National Park Service is currently in the process of making their campground reservations available on the U.S. Department of Agriculture Forest Service campground reservation system as well. The campground information needs to be provided in systems that tourists will use and at locations that enable them to make an informed decision.

Degradation of Air Quality. This park has air quality issues that are caused by activities to the west. Although the park has air quality monitoring stations at Giant Forest and Ash Mountain that collect data, currently the only way to disseminate information about air quality is through the visitor centers. This method of dissemination is not the most efficient way of reaching the most tourists.

Roadway Congestion. Roadway congestion may occur during high visitation times at many locations throughout the park. A lot of these visitors are passing through the park on their way to Hume Lake. Therefore the suggestion has been made that this traffic should be re-routed away from the Grant Grove area and instead approach Hume Lake from the southern route. Congestion is exacerbated by large recreational vehicles and buses that take longer to navigate turns and climb grades.

Roadway Design and Infrastructure. The roadways in SEKI were designed to have the least amount of impact on resources and therefore when designed, the roadways followed the natural curves in the area. This has led to dangerous conditions for recreational vehicles and buses as the roads are not only curvy, but have steep grades and are narrow. Another danger on this roadway is that the weather conditions within the park are significantly different then in the surrounding communities. The roads are generally perceived as treacherous due to mountain driving, icy conditions, and lack of road marker visibility due to snow that most local visitors are unfamiliar with. Lastly, the roadway infrastructure itself is deteriorating due to a combination of winter conditions and the amount of vehicle traffic through the park.

7. NATIONAL ITS ARCHITECTURE

The transportation problems identified for Golden Gate National Recreation Area and Sequoia and Kings Canyon National Parks, along with other national parks in California, may lend themselves to solutions using intelligent transportation systems (ITS). In order to ensure that the maximum benefit of these ITS solutions is realized, it is important that they conform to the National ITS Architecture. This chapter will therefore describe what the National ITS Architecture is, and how national parks in California can integrate into this architecture.

7.1. Overview of National ITS Architecture

7.1.1. Definition of National ITS Architecture

An ITS architecture provides a conceptual framework for how intelligent transportation systems may be designed and operated. From a design perspective, the architecture can be used to indicate the type of functions that are required, and consequently can help to define the technologies that may be most appropriate. From an operational perspective, the architecture provides a framework that promotes the sharing of information efficiently and effectively between different stakeholders within the same agency or across organizations.

The architecture is a framework that is technology-neutral; in other words, it recommends neither a specific system design nor a design concept. Rather, the architecture defines the structure around which multiple design approaches can be developed, each one specifically tailored to meet the needs of individual stakeholders, while maintaining the benefits of a common architecture. The architecture defines:

- the functions, such as gathering traffic information, that must be performed to meet stakeholder needs;
- the physical entities or subsystems where these functions occur, such as the roadside or the vehicle;
- the information flows between the physical subsystems; and
- the communication requirements for the information flows (e.g., wireline or wireless).

In addition, the architecture identifies and specifies the requirements for standards needed to support national and regional interoperability, as well as product standards needed to support economy of scale considerations in deployment.

The National ITS Architecture, a systems architecture developed for the U.S. Department of Transportation by a combined Lockheed Martin and Rockwell International team (representing the public sector, private sector, and academia), is the nationally adopted standard for describing the interrelationship of organizations and systems under specific ITS projects. The architecture may be considered from three primary views:

- the logical architecture, which presents a functional view of ITS;
- the physical architecture, which partitions the functions reflected within the logical architecture into systems and subsystems where functions are actually performed; and
- communications, which connect the various systems.

The following sections will describe each of these components in more detail.

Model of ITS Functions (Logical Architecture)

The logical architecture serves to present a functional view of the *ITS user services*, which in turn represent what ITS should accomplish from a user's perspective. The National ITS Architecture defines the logical architecture as being distinct from specific technologies and physical interface requirements. By doing this, the architecture is open and flexible enough to handle most legacy systems, does not inordinately constrain the market into certain technologies, and allows for easier implementation of future generations of technology.

Figure 7-1 shows a simplified top-level data flow diagram. The circles represent functions,

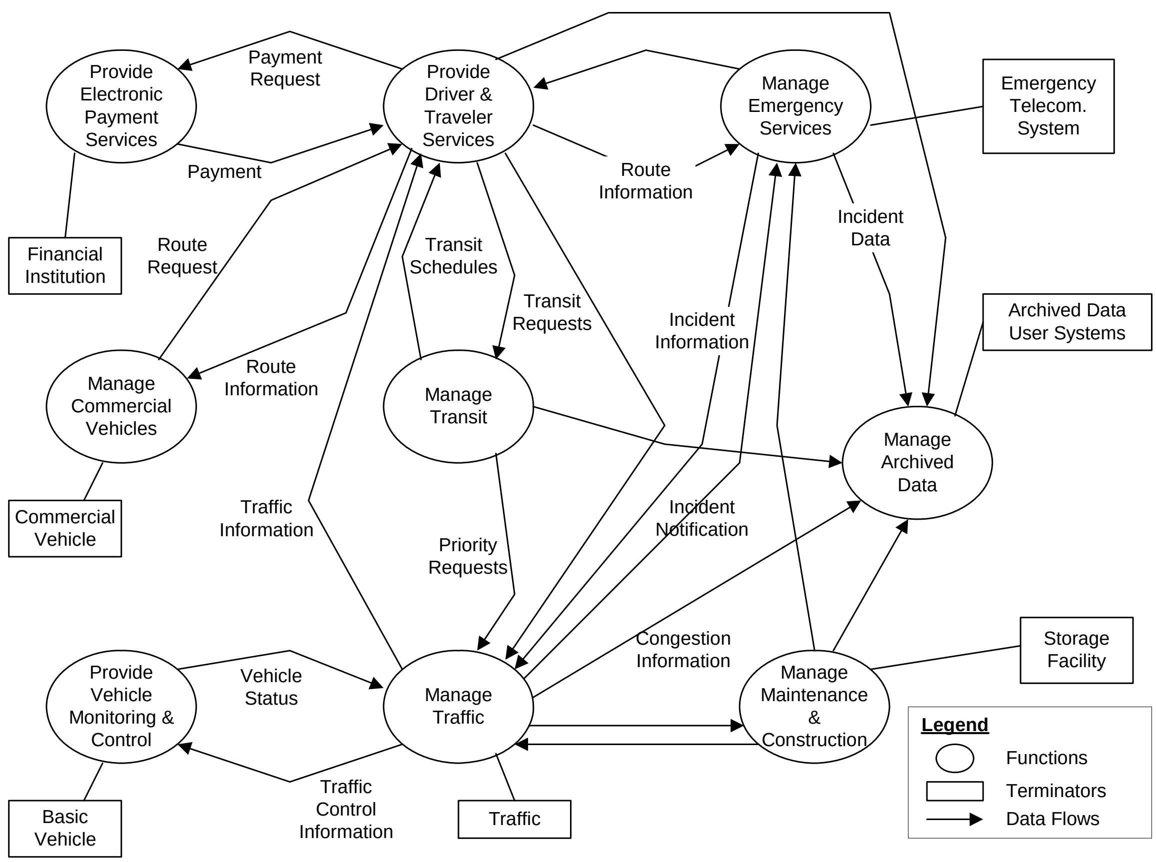


Figure 7-1: Top-level Data Flow Diagram

which may be broken down or decomposed into lower levels of detail, and rectangles represent terminators, which are defined in the following section. The lines between functions, and between functions and entities external to the architecture, represent data flows, with arrows indicating the direction of data flow. The data flows may also be decomposed. The lowest level of detail of functions and data flows may be used to define detailed functional requirements for new ITS deployments, which is critical to any ITS planning effort.

Model of ITS Physical Entities (Physical Architecture)

The logical architecture is useful in developing functional specifications, but it does not provide any information about where functions are to be performed. Therefore, the National ITS Architecture defines a physical architecture, which distributes the functions defined by the logical architecture into systems and subsystems, based on the similarity of functions and the location where functions are to be performed.

A high-level diagram of the physical architecture, commonly referred to as a “sausage diagram,” is shown in Figure 7-2. The physical architecture defines four types of systems:

- *center* subsystems, which deal with those functions normally assigned to public/private administrative, management, or planning agencies;

- *field* subsystems, which involve the deployment of various types of equipment (e.g.

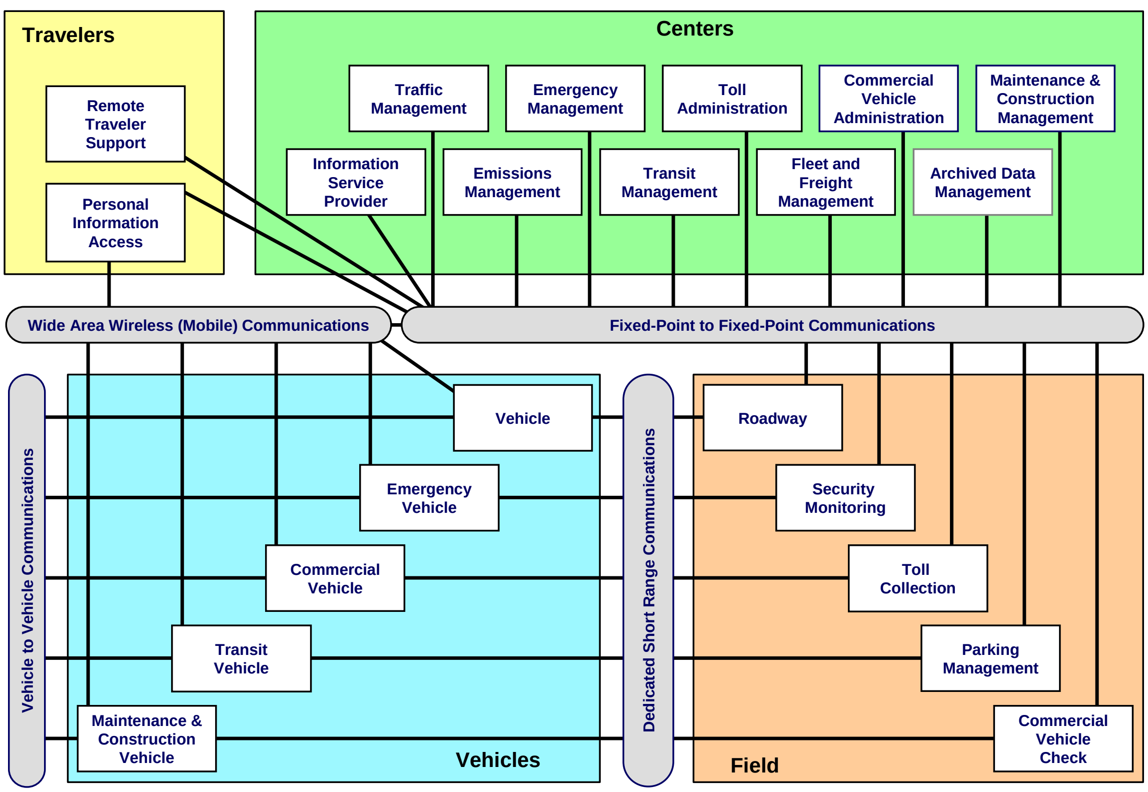


Figure 7-2: High-level Diagram of Physical Architecture

traffic detectors, changeable message signs, highway advisory radio, etc.) that must be positioned in a roadside location;

- *vehicle* subsystems, which are installed in a vehicle; and
- *traveler* subsystems, which provide interfaces to travelers.

These four types of systems are partitioned into 22 subsystems and 73 terminators. Subsystems are elements that are considered within the architecture; therefore, the architecture may get involved with how that entity receives, processes and distributes data/information. An example of a subsystem would include a park-owned highway advisory radio system, for which the park could specify how information is programmed onto the system and, to a certain extent, the audience of radio messages. Terminators are elements that are at the boundary of the architecture; therefore, the architecture is not concerned with what happens within those elements. An example of a terminator might be a weather data provider, which would provide information useful to the park. However, the architecture would not seek to improve upon how the weather service develops or processes its weather information.

In a physical architecture diagram, subsystems are represented by square-corner rectangles and terminators are represented by rounded-corner rectangles. Information flows between entities are depicted using connecting arrows. An example of this is shown in Figure 7-3.

Communications

Information must go between entities using some communications media; therefore, the National ITS Architecture also provides a framework to show what communication linkages are required. The physical architecture diagram (Figure 7-2) depicted, at a high level, the types of communication options that could be used to transmit information between different entities. There may be multiple communications technologies available that support this flexibility, although in a national park setting the number of technologies may be severely constrained by terrain, cost and availability. The flexibility in choosing between various options allows ITS system designers to select the specific technology that meets local, regional, or national needs.

7.1.2. Benefits of the National ITS Architecture

The National ITS Architecture is designed to be implemented at a sub-national level – state, regional or local – with projects implemented out of the architecture.

The benefits of an ITS architecture that demonstrates conformance with the National ITS Architecture include the following.

- Section 5206(e) of the Transportation Equity Act for the 21st Century (TEA 21) requires that ITS projects using funds from the Highway Trust Fund conform to the National ITS Architecture and standards. Therefore, regional and project architectures that can demonstrate conformance may have greater ability to leverage Federal funding for future ITS deployment.

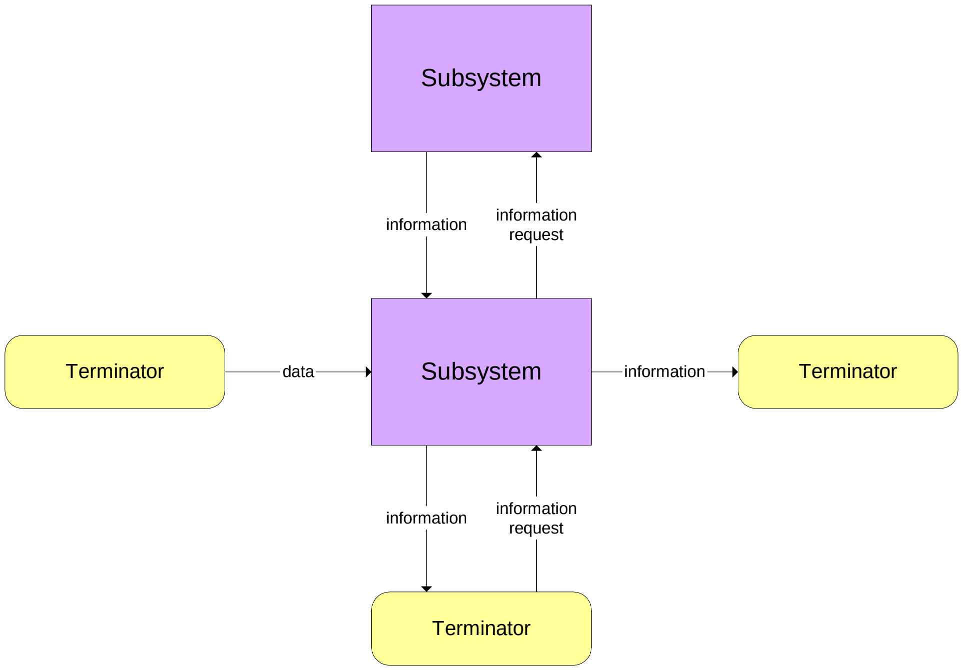


Figure 7-3: Generic Detailed View of Physical Architecture

- An architecture facilitates regional integration. It helps agencies and other stakeholders to identify and plan for the many integration and information-sharing opportunities which ITS offers.
- An architecture that conforms with the National ITS Architecture (including appropriate ITS standards) enables other ITS systems, which will be developed for use throughout the U.S., to operate in an integrated fashion with each other. This is important when considering continuity of the "look and feel" of systems from a user perspective across state, county, or other jurisdictional boundaries.
- Transportation improvements in the region are typically made incrementally as funding becomes available for various project components. An architecture can provide guidance for how these projects should fit together, improving interoperability between the projects, making efficient use of scarce resources, and facilitating future ITS expansion in the region.

These benefits will only be realized if the regional architecture is used in developing projects for the region and adapted as requirements change in the future.

7.1.3. Review of Conformity Requirement

In April 2001, the Federal Highway Administration (FHWA) issued a rule and the Federal Transit Administration (FTA) issued a related policy requiring state and local transportation agencies involved in ITS to develop a regional ITS architecture based on the National ITS Architecture, and to use a systems engineering methodology for developing ITS projects (49, 50). The rule requires the completion of a regional architecture by April 8, 2005 for all regions that had on-going ITS projects as of April 8, 2001. All major ITS projects must be designed according to its region's ITS architecture; if no regional architecture exists, project architectures must still be developed in order to lay the groundwork for future integration.

The rule also requires that all ITS projects be developed using a systems engineering process. Systems engineering is defined as "an interdisciplinary collaborative approach to derive, evolve, and verify a life cycle balanced system solution that satisfies customer expectations and meets public acceptability." It is an iterative process that addresses the lifecycle of a product to ensure that current and future needs of ITS implementations are met. The minimum elements that must be considered include:

- identification of the portions of the regional ITS architecture that are being implemented (in the absence of a regional architecture, this would include the applicable portions of the National ITS Architecture);
- identification of participating agencies' roles and responsibilities;
- requirements analysis and specification;
- identification of applicable ITS standards and test procedures;
- procurement options;
- analysis of alternative system configurations and technology options to meet requirements; and
- procedures and resources necessary for operations and management of the system.

The resulting project architecture will include the following elements:

- a description of the scope of the ITS project;
- an operational concept that identifies roles and responsibilities of participating agencies and stakeholders in the operation and implementation of the project;
- functional requirements for the ITS project;
- interface requirements and information exchanges between the ITS project and other planned and existing systems; and
- identification of applicable ITS standards.

The Regional ITS Architecture Guidance Document, available from the U.S. Department of Transportation's ITS Joint Program Office, provides more detailed information on these requirements (51).

7.2. Regional Architecture Development in California

Caltrans has pursued development of regional ITS architectures across the state, according to the geographical boundaries shown in Figure 7-5 (see page 106). According to the requirements of the conformity rule, ITS project architectures related to national parks in these areas must fit with their respective region's National ITS Architecture in order to be eligible for funding through highway trust funds (52).

The regional architectures are maintained by the regional transportation planning agency (RTPA) that has jurisdiction over that area. Figure 7-6 (see page 107) provides a map showing the boundaries of RTPAs within the state of California.

7.3. Methodology for Architecture Development

One goal of this research project is to develop ITS themes that describe in broad terms what ITS may accomplish in a national park setting. The methodology for developing ITS themes that are consistent with both the National ITS Architecture and identified transportation needs is shown in Figure 7-4. The transportation problems and challenges associated with each park were identified through park outreach and visitor surveys. These problems were mapped to *ITS objectives* – goal statements for what ITS should strive to achieve in a park setting.

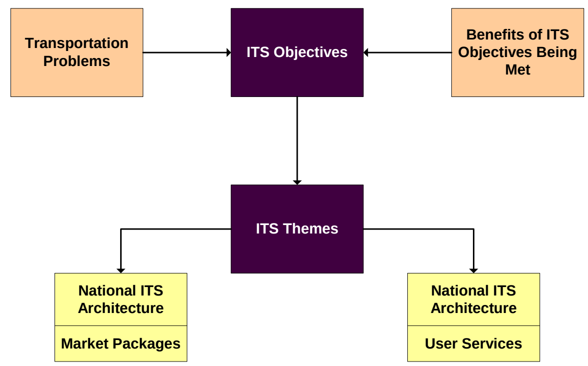


Figure 7-4: Methodology for Developing ITS Themes

ITS themes were developed from the ITS objectives. These themes were developed by examining which portions of the National ITS Architecture could be used in meeting park-specific needs and goals. These themes were then mapped back to the National ITS Architecture through listing which market packages contributed information flows and concepts to each ITS theme and identifying which user services were closest to describing what ITS was doing from the user's perspective.

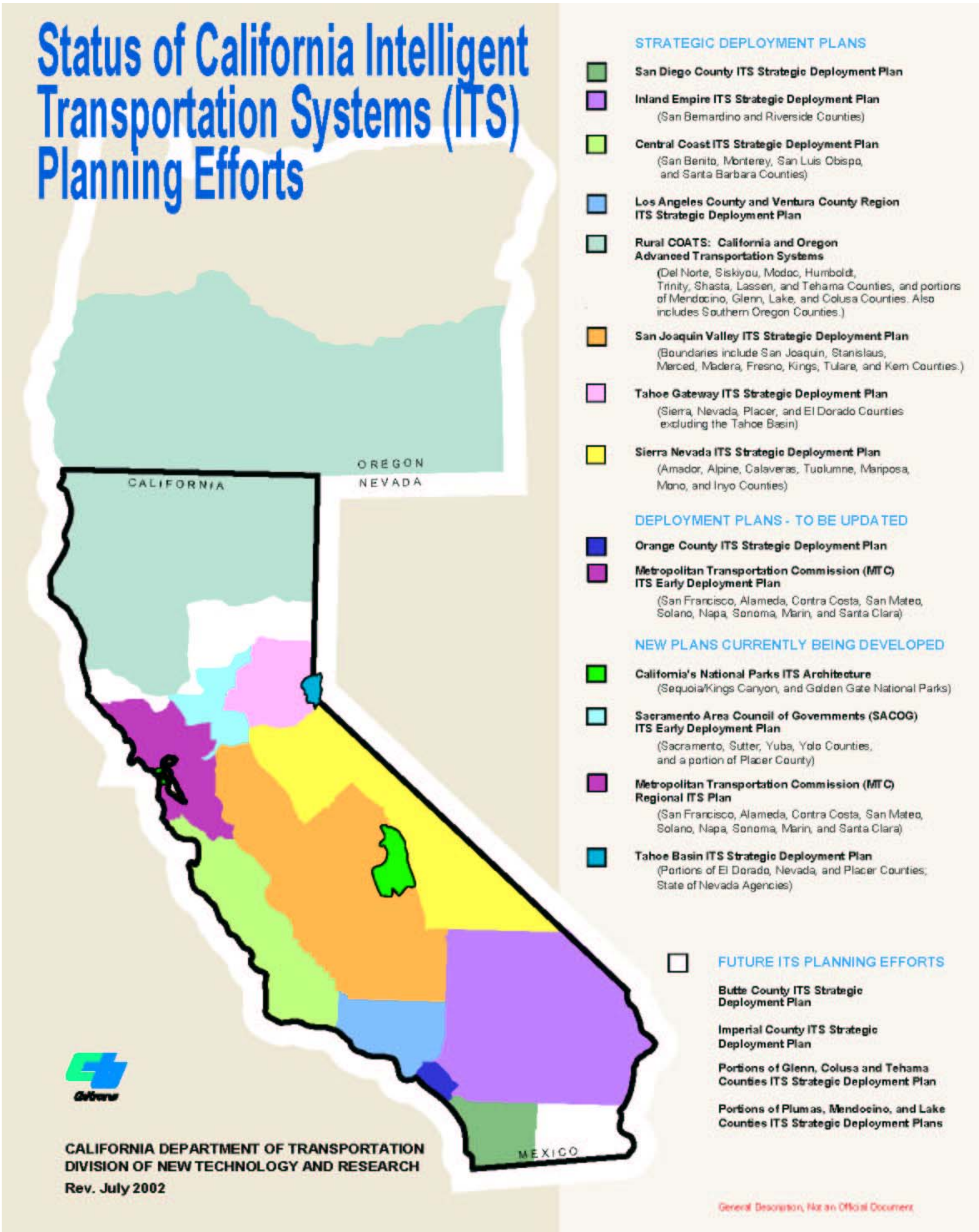


Figure 7-5: Map of Caltrans-funded Regional ITS Planning Efforts

(Source: Caltrans Division of Research and Innovation)

Figure 7-6: Map of MPOs and RPTAs in California

(Source: 52)

8. ITS OBJECTIVES

The next step in developing ITS recommendations for each park, after identifying the transportation needs, was to develop a series of objective statements for what ITS should attempt to accomplish in national parks. The transportation problems identified for the two demonstration parks were used as a foundation for these objectives, which are listed in Table 8-1. These objectives were sorted under three broad headings – visitor experience, resource protection, and transportation system – to provide a clearer understanding of how ITS projects may benefit a park.

In addition to these park-specific objectives, there are some overarching objectives of any ITS implementation in a national park setting.

- ITS should preserve and enhance the visitor experience. This includes recognition of the aspects of the transportation system that are part of the visitor experience. It also includes an understanding of how park visit patterns and visitor demographics are changing, and how these may impact transportation and information needs.
- ITS should collect and disseminate information in an aesthetically sensitive and technologically appropriate manner. One example of this type of approach is a changeable message sign deployed at Great Smoky Mountains National Park, shown in Figure 8-1.

Figure 8-1: Changeable Message Sign at Great Smoky Mountains NP.

(Source: National Park Service)

Table 8-1: ITS Objectives for National Parks.

Goal 1: Enhance the visitor experience

- Objective 1.1: Provide real-time, accurate, convenient and relevant information to visitors to help them make travel decisions
  - Objective 1.1.1: Develop predictive information that will help visitors plan their trips better
  - Objective 1.1.2: Provide appropriate information at major transportation decision points
  - Objective 1.1.3: Provide information to help visitors avoid congested locations and times
  - Objective 1.1.4: Provide weather, road condition, and chain requirement information
  - Objective 1.1.5: Provide construction and work zone information
  - Objective 1.1.6: Provide information on parking availability
  - Objective 1.1.7: Provide information at various park sites about transit arrivals and schedules
  - Objective 1.1.8: Provide air quality information
- Objective 1.2: Improve visitor safety
  - Objective 1.2.1: Improve the safety of vehicles at or approaching congested entrance stations
  - Objective 1.2.2: Improve the safety of vehicle travel on park roadways
  - Objective 1.2.3: Improve the safety of vehicle travel through work zones in the park
  - Objective 1.2.4: Improve the safety of bicyclists and pedestrians approaching popular destinations
- Objective 1.3: Enhance visitor access to the variety of natural, cultural, recreational and educational opportunities available at the park and surrounding areas
  - Objective 1.3.1: Improve access options for visitors without automobile access
  - Objective 1.3.2: Provide transit service that enables visitors to see attractions that may not have been possible because of unavailability of parking
- Objective 1.4: Improve visitor convenience
  - Objective 1.4.1: Reduce the delay to visitors waiting in long lines at entrance stations
  - Objective 1.4.2: Decrease the difficulty in finding available campsites
  - Objective 1.4.3: Allow visitors to make reservations for experiencing certain park activities
  - Objective 1.4.4: Provide customized and enhanced interpretation through in-vehicle or handheld systems

Goal 2: Assist in resource protection

- Objective 2.1: Encourage use of alternative modes of transportation to, from or within the park
  - Objective 2.1.1: Increase usage of transit, pedestrian and bicycle modes for park access
  - Objective 2.1.2: Increase usage of alternative transportation systems within park
  - Objective 2.1.3: Promote information about non-automobile alternatives
- Objective 2.2: Monitor and reduce vehicle emissions
  - Objective 2.2.1: Reduce emissions of idling vehicles in parking areas
  - Objective 2.2.2: Reduce emissions of idling vehicles at entrance gates
  - Objective 2.2.3: Improve the monitoring of air quality in the park
- Objective 2.3: Protect the road infrastructure as a park resource
  - Objective 2.3.1: Re-direct oversize vehicle traffic to reduce roadway impacts
  - Objective 2.3.2: Reduce time required for snow removal and other roadway maintenance

Table 8-1: ITS Objectives for National Parks. (cont.)

Goal 3: Improve management of the park's transportation system

- Objective 3.1: Manage congestion within the park
  - Objective 3.1.1: Predict occurrence and duration of congestion based on historical and real-time information
  - Objective 3.1.2: Monitor transportation operations and congested areas
  - Objective 3.1.3: Reduce congestion on park roadways
- Objective 3.2: Manage incidents to reduce their impact on the park's transportation system and promote visitor safety
  - Objective 3.2.1: Improve the response time to incidents along park roadways
  - Objective 3.2.2: Provide for prompt and efficient evacuation of visitors during major emergencies
- Objective 3.3: Manage construction and work zone activities and special events to minimize visitor inconvenience
  - Objective 3.3.1: Enhance interagency coordination and communication regarding work zones and special events
  - Objective 3.3.2: Reduce the vehicle delay through work zones within the park
  - Objective 3.3.3: Use archived data to help to promote improved planning for the impacts of special events on the local transportation system
- Objective 3.4: Manage parking facilities within the park
  - Objective 3.4.1: Reduce congestion in and around parking areas
  - Objective 3.4.2: Reduce parking outside of designated parking areas
  - Objective 3.4.3: Improve management of existing parking facilities to optimize parking usage
- Objective 3.5: Manage transit systems providing access to park sites
  - Objective 3.5.1: Improve efficiency and level of service of transit operations within the park
  - Objective 3.5.2: Enhance the monitoring and coordination of various transit operations serving the park
- Objective 3.6: Manage data to promote better transportation planning in the park
  - Objective 3.6.1: Enhance the reliability, accuracy, and timeliness of visitation statistics
  - Objective 3.6.2: Collect additional statistics to help in transportation planning (e.g. distinguish between travelers and visitors, determine linked trips and trip patterns, count non-motorized travel)
- Objective 3.7: Manage the transportation impact of the park's visitation on surrounding communities
  - Objective 3.7.1: Manage adverse traffic impacts on local communities while preserving the economic benefits of tourist activity
  - Objective 3.7.2: Promote sharing of information regarding tourist activities between the park and local communities

9. ITS THEMES

The two parks analyzed in this research project – Golden Gate National Recreation Area and Sequoia and Kings Canyon National Parks – both have numerous transportation problems that may be addressed through the use of intelligent transportation systems. While there is ambiguity about the specific technologies that may be used, general concepts may be developed as to what ITS may seek to do in order to address each problem. These concepts, called ITS themes, may provide a useful starting point for parks to assess how they wish to proceed with ITS investment.

This chapter presents ITS themes for the two demonstration parks, as well as themes that may have applicability to other parks within California. A description of each theme is provided, along with a diagram showing how information would flow between different organizations and agencies to support the theme's functionality. Scenarios are used to provide a better sense of what these themes might accomplish if they were implemented. Several technology implementations are presented for each theme, providing options for how these themes may be practically implemented. Finally, issues pertaining to theme implementation are identified.

9.1. ITS Themes in GGNRA

Several ITS themes were identified based on the ITS objectives for GGNRA. The ITS themes are listed in Table 9-1 along with the transportation problems these themes may help to address. The themes are also listed in Table 9-2, along with the ITS objectives they are related to, and the associated user services and market packages from the National ITS Architecture. To facilitate conformity with the National ITS Architecture, the market packages that are used in the themes are listed in Appendix I. Additional detail about the physical entities (subsystems and terminators) and information flows are included in Appendices J and K, respectively.

Table 9-1: ITS Themes Addressing Transportation Problems at GGNRA.

Theme / Problem	Roadway Congestion Forecasting	Parking Management and Information	Parking Intercept	Transit Trip Planner	Data Collection and Storage	Pre-trip Traveler Information	Major Emergency Response
Roadway Congestion	✓	✓	✓	✓		✓	
Inadequate Access			✓	✓		✓	
Limited Parking	✓	✓	✓			✓	
Transit Coordination and Information			✓	✓		✓	
Lack of Planning Data	✓	✓			✓		
Traveler Information	✓	✓	✓	✓		✓	
Work Zone/Event Coordination	✓					✓	
Emergency Response							✓

Table 9-2: ITS Themes for Golden Gate National Recreation Area

ITS Themes	ITS Objectives[10]	User Services	Market Packages
Roadway Congestion Forecasting	1.1.1, 1.1.3, 3.1.1, 3.1.2, 3.3.3	**1.6** – Traffic Control **7.1** – Archived Data Function	**AD2** – ITS Data Warehouse **ATMS01** – Network Surveillance **ATMS09** – Traffic Forecast and Demand Management **MC04** – Weather Information Processing and Distribution **MC08** – Work Zone Management
Data Collection and Storage	3.6.1, 3.6.2	**7.1** – Archived Data Function	**AD1** – ITS Data Mart **AD2** – ITS Data Warehouse
Parking Management and Information	1.1.1, 1.1.6, 1.2.4, 3.1.1, 3.4.1, 3.4.2, 3.4.3, 3.7.1	**1.1** – Pre-trip Travel Information **1.5** – Traveler Services Information	**AD2** – ITS Data Warehouse **ATMS06** – Traffic Information Dissemination **ATMS16** – Parking Facility Management **ATMS17** – Regional Parking Management
Parking Intercept	1.1.2, 1.1.3, 1.1.6, 1.1.7, 2.1.1, 2.1.3, 3.1.2, 3.4.1, 3.4.3	**1.2** – En-route Driver Information **1.5** – Traveler Services Information	**APTS1** – Transit Vehicle Tracking **APTS8** – Transit Traveler Information **ATMS06** – Traffic Information Dissemination **ATMS16** – Parking Facility Management **ATMS17** – Regional Parking Management
Pre-Trip Traveler Information	1.1.1, 1.1.3, 1.1.4, 1.1.5, 1.1.6, 1.1.7, 2.1.3, 3.7.2	**1.1** – Pre-trip Travel Information **1.5** – Traveler Services Information **2.2** – En-route Transit Information **8.1** – Maintenance and Construction Management	**APTS1** – Transit Vehicle Tracking **ATIS2** – Interactive Traveler Information **ATMS01** – Network Surveillance **ATMS09** – Traffic Forecast and Demand Management

[10] See page 109 for the list of ITS objectives.

Table 9-2: ITS Themes for Golden Gate National Recreation Area (cont.)

ITS Themes	ITS Objectives	User Services	Market Packages
Transit Trip Planner	1.1.1, 1.1.2, 1.1.7, 1.3.1, 1.3.2, 2.1.1, 2.1.2, 2.1.3, 3.3.3, 3.5.2	**1.1** – Pre-trip Travel Information **2.2** – En-route Transit Information	**APTS1** – Transit Vehicle Tracking **APTS8** – Transit Traveler Information **ATIS2** – Interactive Traveler Information
Major Emergency Response	3.2.2	**1.2** – En-route Driver Information **1.7** – Incident Management	**ATIS1** – Broadcast Traveler Information **ATMS06** – Traffic Information Dissemination **ATMS08** – Incident Management System **EM1** – Emergency Response

9.1.1. Roadway Congestion Forecasting

Description

This ITS theme involves the utilization of information on current roadway conditions, along with archival information on "normal" traffic characteristics and the anticipated impacts of special events and construction, to assess current and near-term congestion levels. This information would assist park managers in preparing for congestion activity, and would help visitors to better plan their trips to park sites.

Architecture Concept

Figure 9-1 provides an ITS architecture framework for the roadway congestion forecasting theme. The key system elements are shown in Table 9-3. As can be seen, the success of this ITS theme depends upon the ability to collect and process traffic data from a variety of sources, and to compare this data against historic traffic patterns to identify the effects of work zones, weather, and special events on traffic. GGNRA would represent the most logical champion for this theme; however, GGNRA does not currently have access to the real-time traffic data that would be required to support this theme. Consequently, GGNRA would need to partner with Caltrans District 4, GGBHTD, Marin County and other local road managers to gain access to both real-time and archived traffic volume and speed data from roads serving park areas. The park would need to work with these agencies to collect information on work zone and

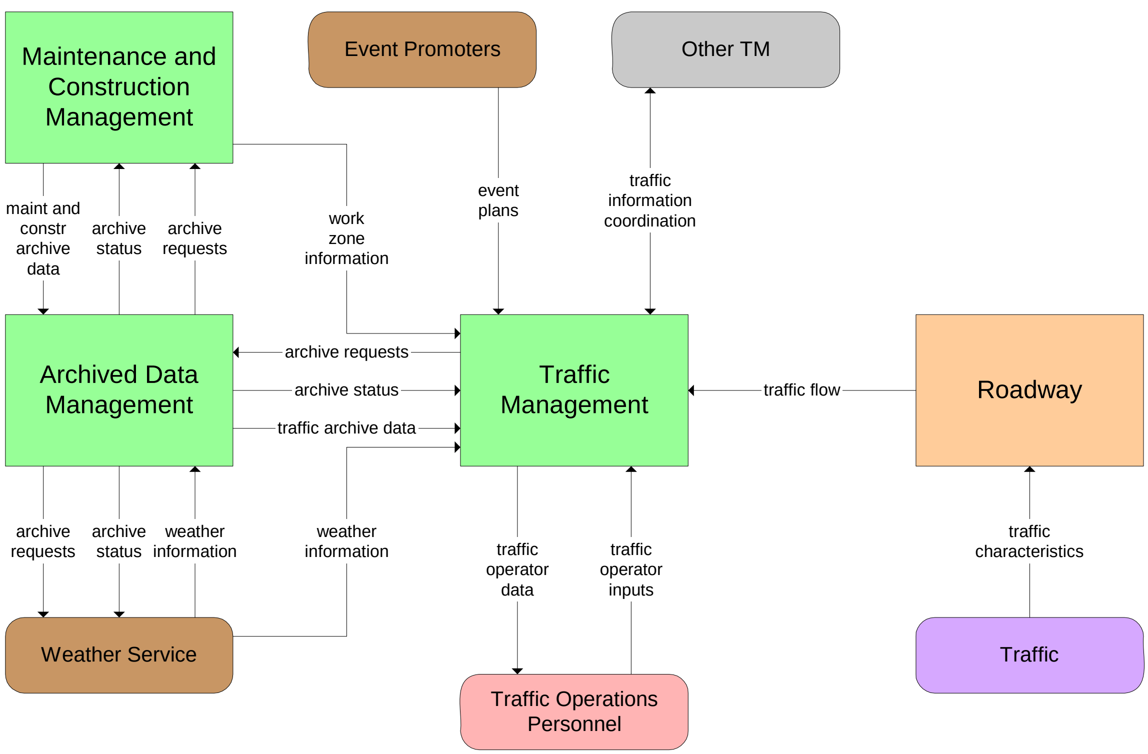


Figure 9-1: Roadway Forecasting Architecture Schematic

Table 9-3: Roadway Congestion Forecasting, Key Stakeholders

Element	Role	Stakeholder(s)
Archived Data Management	Collect historic traffic data, correlated with special events and work zone activity	GGNRA Park Management
Event Promoters	Provide information on events, and estimated traffic impacts	GGNRA sites such as Fort Mason, Presidio, Crissy Field; other regional traffic generators
Maintenance and Construction Management	Manage work zone activities that may affect capacity on roadways serving park	GGNRA; Caltrans District 4; Golden Gate Bridge, Highway and Transportation District; Marin County; and others
Other TM	Represents other traffic management agencies with which GGNRA may coordinate	Caltrans District 4 TMC, San Francisco Division of Parking and Traffic TMC, and others
Roadway	The system which carries vehicle traffic to and by park sites	Caltrans District 4; Golden Gate Bridge, Highway and Transportation District; Marin County; and others
Traffic	Represents vehicle traffic on roads accessing park sites	Visitors & non-park traffic
Traffic Management	Assesses current and future congestion on park roadways	GGNRA Park Management
Traffic Operations Personnel	Human operator who interprets data processed by traffic management system	GGNRA Park Staff
Weather Service	Provide historical context for expected parking utilization	National Weather Service or other providers

construction activities that may periodically limit access to park sites. Park management would also need to work closely with organizations sponsoring special events on or near park sites to better consider the traffic impacts of these events. This is already done to a certain extent with organizations affiliated with GGNRA, such as Fort Mason and the Presidio, but should be expanded to include other organizations and agencies, such as the city of San Francisco. The information flows to support this ITS theme are summarized in Table 9-4.

Scenario

Visitor. This ITS theme would not have any direct impact on the visitor experience except as the park uses information developed by the theme. Ultimately, as park staff are better able to anticipate congested periods, staff can communicate this information to visitors before their visit using a Web site, to visitors on their way to the park by the use of highway advisory radio, or to

Table 9-4: Roadway Congestion Forecasting, Information Flows

Information Flow	Description
archive requests	A request to receive historical parking, traffic and weather information, or on the type of information to be archived
archive status	A fault report for inaccurate or missing archive data
event plans	Plans for major events possibly impacting traffic
maint and constr archive data	Completed work zone construction activities
traffic archive data	Data describing the use and vehicle composition on transportation facilities
traffic characteristics	Physical traffic characteristics like occupancy, volume, density, and average speed
traffic flow	Processed traffic data which helps to identify congested locations
traffic information coordination	Traffic information exchanged between park and TMCs
traffic operator data	Traffic operations data presented to the operator
traffic operator inputs	Requests for traffic information and other traffic operations data entry
weather information	Accumulated forecasted and current weather data
work zone information	Plans for work zones that may impact traffic

visitors at park sites by giving information to park rangers or volunteers who interact with visitors.

Park Management. Most of the time, park staff at GGNRA have known when those high-visitation days will occur – summer weekends are a sure bet, as well as other times when the weather is good. Staff would get frustrated, though, when roadway congestion occurred at times or with magnitudes that were not expected. After these congested periods were resolved, staff would have informal debriefings where they would try to make notes for how to anticipate these things in the future. However, the system was very informal and did not allow the park to be as proactive with roadway congestion as they would like.

The implementation of this roadway congestion forecasting system has provided park staff with a more systematic method of anticipating traffic bottlenecks on roadways at or near park sites. During one recent warm and sunny Saturday afternoon, for example, there was a lane closure on State Route 1 between Muir Woods and Stinson Beach, an arts festival at Fort Mason, and a bicycle race through Marin County. Information about the traffic impacts of these activities – how much traffic tends to go to park sites on good weather days, how long lane closures would persist, how much traffic would be going to the arts festival – was collected by the roadway congestion forecasting system. The system accessed historical information about when similar events had occurred in the past, and the actual hourly traffic volumes on roadways near the park on these days. Armed with this information, the park anticipated that congestion would be very severe, especially in front of Crissy Field and on SR 1 between US 101 and Tamalpais Junction. This put them in a better position to respond through a variety of methods, including providing information to visitors on their web site, and working with transit providers to provide increased frequency of service to park sites on that Saturday.

Technology Implementations

As was discussed in the scenarios, GGNRA park staff have, through their experience, become adept at predicting roadway congestion. The goal of this theme is simply to improve the efficiency and accuracy of this assessment through automated data collection and processing.

Collect Traffic Data

Many road agencies have automated traffic counting programs to assist in planning and traffic management purposes. Traffic data may be collected using a variety of technologies, including *inductive loops*, *video image processing*, *microwave and radar detection*, and others. Early staging of this ITS theme should rely on existing traffic counters operated by Caltrans, Marin County and others, and should seek to develop memoranda of understanding that would allow GGNRA to use and archive selected traffic volume and speed data. Over time, GGNRA could work in partnership with these agencies to implement additional counters at locations that would provide benefits for each agency.

Collect Work Zone Data

Each road agency with a maintenance and construction program will have documentation about how traffic will be staged through the work zone. A geographically-based database may be developed that would code anticipated work zone activities based on the dates of activity, the geographic limits of the project, anticipated lane closure durations, and associated speed reductions. Some or all of the road agencies may already have the information to populate this database. GGNRA would then need to develop and maintain a database application that could pull information from the road agencies' databases and reorganize the data into a uniform format. This type of database activity has been used by several states including the Oregon Department of Transportation with its Highway Travel Conditions Reporting System (HTCRS), and multi-state efforts including the Condition and Accidents Reporting System (CARS) and the Highway Conditions Reporting System (HCRS).

Collect Special Event Data

The software technology that is used to collect and merge special event information could be identical to that used for collecting work zone data. However, this aspect of the theme will likely be more challenging to implement because of the greater number of organizations that can sponsor special events, and the more varied level of traffic impact estimates that would be developed for these events. GGNRA should first work with its own park partners to develop tools that would allow park partners to quickly enter this information into a database.

Collect Weather Data

GGNRA would need to develop a relationship with the National Weather Service or other weather providers that would allow the park to acquire and archive real-time weather data. It should be emphasized that the variation of weather within the park means that GGNRA should seek a variety of weather site locations to provide more accurate information on the possible weather impacts on visitation traffic. It would be helpful if GGNRA can get forecast data as well (24-to-48 hours) since this may allow park staff a greater time window for an appropriate proactive strategy.

Process Archived Data

This system requires the efficient processing and analysis of both real-time and archived traffic, weather, work zone and special event information, likely through a database-based expert systems tool. As it collects increasing volumes of information, the software can "learn" how traffic volumes vary on park-area roadways by correlating traffic volumes with time of year, weather, construction activities, special events, and other factors, and quantifying relationships among these factors.

Present Results to Park Staff

The thrust of this ITS theme is simply the collection, fusion, analysis and presentation of information that will help park staff to better anticipate when and where congestion will occur, and for how long. Since GGNRA does not currently have staff who are fully dedicated to daily traffic operations activities, it is important that this information be presented in a manner that is similar to other information that they receive, and that it is presented in a "push" fashion – in other words, the system will notify park staff when congestion is an issue.

Issues

Technological Issues

- This theme requires a copious amount of quality data from a variety of sources. The availability of hourly traffic data on park-area roadways is of particular concern.
- Software development will be a significant cost associated with this project – the integration and efficient processing of these data sources will not happen without dedicated equipment and staff resources.
- GGNRA may need to work with road agencies and event promoters on developing databases that could provide the information GGNRA needs.
- Careful consideration needs to be given to how GGNRA would disseminate this information if it were available – e.g. to which park staff in which locations. This staff needs to be involved in identifying requirements about how information is provided and in what formats.

Institutional Issues

- GGNRA will need to develop agreements that permit it to use traffic data collected by others, including Caltrans and Marin County.

- The type and format of information required on work zone and special event impacts may be different than the road agencies and event promoters are used to providing. Therefore, GGNRA will need to work with these organizations to develop processes for providing the park with the appropriate data in a timely and organized fashion.

9.1.2. Data Collection and Storage

Description

ITS data may be collected and archived to serve a variety of planning purposes. For example, data on traffic volumes and speed may be stored along with weather information to develop correlations between weather conditions and traffic levels at various sites. Data on transit usage for routes serving the park may be useful in identifying trends in transit utilization that could result in improved transit service and efficiency. This theme would involve collecting and organizing all relevant data in a manner that is useful to local and regional National Park Service staff and others who would benefit from this information.

Architecture Concept

Figure 9-2 provides an ITS architecture framework for the data collection and storage theme. The theme can be implemented in phases quite easily, based on the type of information that is available. For example, the park already collects statistics on the number of visitors at selected sites (e.g. Muir Woods); however, they currently lack information on the number of non-auto visitors to the park, especially at sites where there is no controlled access (e.g. Marin Headlands). The key system elements are as shown in Table 9-5. Because they could have significant local use of this information, GGNRA would represent the most likely champion for this theme. However, since most park system data is collected through NPS regional service centers and

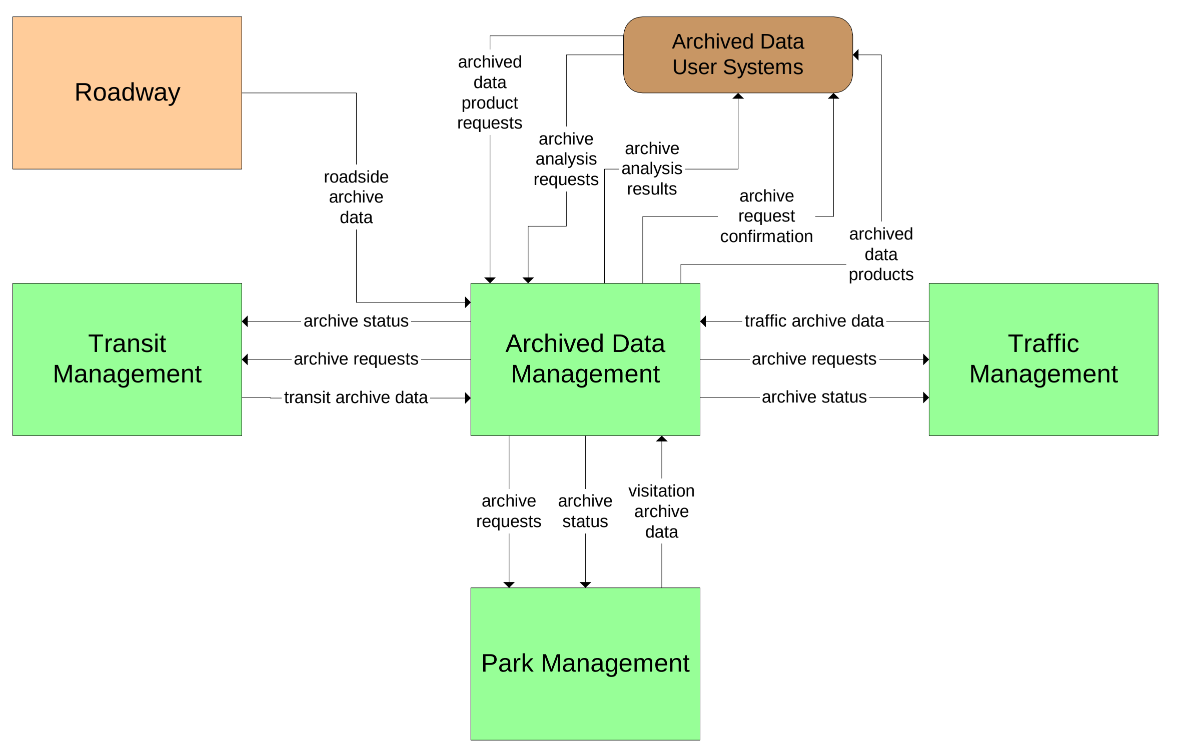


Figure 9-2: Data Collection and Storage Architecture Schematic

Table 9-5: Data Collection and Storage, Key Stakeholders

Element	Role	Stakeholder
Archived Data Management	Collect historical parking, traffic and weather data	GGNRA Park Management
Archived Data User Systems	Uses data collected by GGNRA	GGNRA Park Management; NPS Western Resource Center; Caltrans District 4; and others
Park Management*	Collects visitation statistics (visitors, cars, tour buses, transit riders, bicyclists, pedestrians)	GGNRA Park Management
Roadway	Collects raw traffic data	GGNRA; Caltrans District 4; Marin County; San Francisco County; and others
Traffic Management	Provides processed traffic data (volume, speed, etc.)	Caltrans District 4; Marin County; San Francisco County; and others
Transit Management	Operates transit routes serving park and collects ridership data	San Francisco MUNI, GGBHTD, and other transit providers serving park lands

* – Extension to National ITS Architecture

Caltrans District 4, this center and Caltrans would need to have an integral role in this theme as well. The "Archived Data User Systems" element represents a broad variety of potential users of this information, including state and county governments; these agencies' needs should be considered in theme implementation. The information flows to support this ITS theme are summarized in Table 9-6.

Scenario

Visitor. This theme would not have a direct, immediate impact on visitors. Over time, however, as the park gets better information on the visitors who are going to the park, the characteristics of their visit, and their transportation choices, the park will be better able to provide a visitation experience that is consistent with park objectives and visitor goals.

Park Management. With the collection and storage of data, the park will be able to better plan not only for a normal day, but also for special events. The data proposed to be collected will give the park more accurate visitor statistics, transit volumes, and parking information. This will allow park staff to better manage the number of transit lines along with the frequency of bus routes (e.g. if the statistics collected show that the bus is full the early part of the day, they will know they should add more buses to accommodate visitors), allow them to distribute visitors to less crowded areas of the park, and allow them to better plan for parking alternatives.

Table 9-6: Data Collection and Storage, Information Flows

Information Flow	Description
archive analysis requests	A user request that initiates advanced processing and analysis of archived data
archive analysis results	Processed information products
archived data product requests	A user-specified request for archived data products
archived data products	Raw or processed data products provided to a user upon request
archive request confirmation	Confirmation that an archive request has been received and processed
archive requests	A request to receive historical parking, traffic and weather information, or on the type of information to be archived
archive status	A fault report for inaccurate or missing archive data
roadside archive data	Current traffic conditions, environmental conditions, and any other data that can be directly collected at the roadside sensors
traffic archive data	Data describing the use and vehicle composition on transportation facilities
transit archive data	Data regarding transit demand, operations, and system performance
visitation archive data*	Data regarding visitation

* – Extension to National ITS Architecture

Technology Implementations

The primary focus of this theme is not developing new sources of information for collecting data, but rather providing a framework for storing and using this information once it is collected. However, there are unique considerations for each type of data that should be mentioned.

Collect Traffic Data

Many road agencies have automated traffic counting programs to assist in planning and traffic management purposes. Traffic data may be collected using a variety of technologies, including *inductive loops*, *video image processing*, *microwave and radar detection*, and others. Early staging of this ITS theme should rely on existing traffic counters operated by Caltrans, Marin County and others, and should seek to develop memoranda of understanding that would allow GGNRA to use and archive selected traffic volume and speed data.

Collect Transit Data

Each transit agency will have documentation about ridership per bus lines per stop. This data along with any feedback received via survey or comments through the dispatcher should be cataloged. As the buses start being equipped with real-time arrival technology (e.g. NextBus™), there will also be the possibility of tracking when buses arrived at their stops and the opportunity to adjust the bus schedule based on this archived data. Lastly, fee data should be collected to see if there is a correlation between fees and ridership.

Collect Visitation Data

Because GGNRA does not charge a fee to visitors (except the fee demonstration project at Muir Woods), the park has a difficult time developing methods for estimating the number of visitors accessing park sites. The following methods are among those used at park sites currently (53, 54).

- At some GGNRA sites a direct visitor count is available, including Alcatraz (with concessionaire data) and Crissy Field for special events.
- Several park sites, including Upper and Lower Fort Mason, Baker Beach, Sutro Heights, Stinson Beach, Muir Beach and others, use inductive loop counters to measure traffic at the entrance to the site. A reduction is made due to nonreportable vehicles, and then the volume is divided by a persons-per-vehicle factor which varies according to the site (e.g. Lower Fort Mason multiplier is 1.5 persons per vehicle, whereas Stinson Beach is 2.8 persons per vehicle during the summer months).
- Trail counts at Fort Point are used to estimate the number of joggers/hikers at Crissy Field.
- The number of visitors entering Ocean Beach by foot or bicycle is estimated using a regression equation off of the estimated number of visitors arriving by vehicle.
- Muir Woods multiplies the number of paying visitors by an adjustment factor to account for non-paying visitors.

Several methods exist for automated detection of vehicles, including inductive loops, video detection, radar and microwave detection and others. None of these methods, however, can identify the number of passengers per vehicle; moreover, it would be difficult to detect the percentage or volume of nonreportable vehicles – i.e. background traffic near but not going from or to park sites – apart from installation of additional sensors.

Automated detection of pedestrians and bicycles, using inductive loops or video, offers some promise. This technology has typically only been used in a channelized traffic environment, like a sidewalk or a bicycle lane near an intersection, so it remains to be seen whether these could be used in a park setting with acceptable levels of accuracy.

Collect Other Data

There are a variety of other types of data that the park and park partners might find useful for planning purposes, including but not limited to weather conditions, work zone and construction activity, special events, and parking lot utilization. These sources of data may be added incrementally based on park needs. In each case, the park will need to work with the data provider to develop protocols for data sharing so that GGNRA can process the data into a form consistent with other elements in its archived data.

Provide Archived Information Requests

Traffic, transit, visitation and a variety of other data sources may be stored in this database. The database should be structured to facilitate access by creating data fields (e.g. date, location) that would make sense to the park and other archive users.

Issues

Technological Issues

- Collection of more accurate visitation statistics, especially for bicycle and pedestrian visitors, is on the cutting edge of ITS technology. It is unclear whether this technology is mature enough to have a reasonable chance of success in a national park setting.

Institutional Issues

- There are critical issues related to sharing and ownership of data that would be provided to the National Park Service by non-National Park partners. These will need to be addressed on a case-by-case basis with each data provider.

9.1.3. Parking Management and Information

Description

This ITS theme fuses real-time information about parking availability with historical information about parking occupancy and turnover to estimate current and future parking availability at facilities throughout the park. Real-time information would be collected through automated systems that would communicate the information to a central location. Parking availability could be conveyed to visitors through a variety of means, such as park rangers, visitor centers, kiosks, and the Internet. This information could also be communicated via changeable message signs to park and ride sites located away from the park, which could allow visitors to switch to transit.

Architecture Concept

Figure 9-3 provides an ITS architecture framework for this theme. The key system elements are shown in Table 9-7. GGNRA would represent the most likely champion for this theme; however, they would likely need to work with Caltrans and Marin County to find appropriate methods of disseminating information on roadways approaching park sites. The information flows to support this ITS theme are summarized in Table 9-8.

Scenario

<u>Visitor</u>. Hector and Juanita are interested in taking their family to spend the day at a beach in Marin County. They always have an enjoyable time once they get to the beach, but the journey,

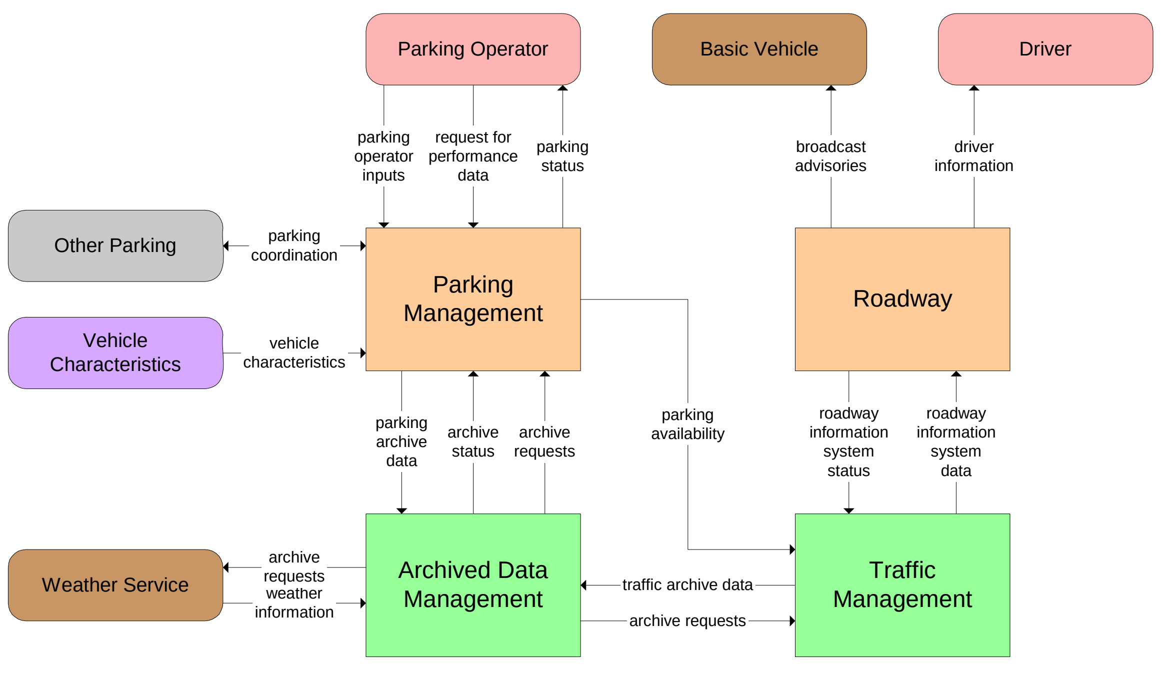


Figure 9-3: Parking Management and Information Architecture Schematic

Table 9-7: Parking Management and Information, Key Stakeholders

Element	Role	Stakeholder
Archived Data Management	Collect historical parking, traffic and weather data	GGNRA Park Management
Basic Vehicle	Receives information on parking availability	Visitors
Driver	Receives information on parking availability	Visitors
Other Parking	Represents other parking facilities with which GGNRA may coordinate	GGNRA Park Management & other parking facility managers
Parking Management	Tracks parking availability for all parking facilities related to GGNRA	GGNRA Park Management
Parking Operator	Human operator who tracks parking availability for the park	GGNRA Park Management
Roadway	Provides information to visitors on parking availability	GGNRA, Caltrans and/or Marin County
Traffic Management	Determines information to present to visitors based on parking availability	GGNRA Park Management
Vehicle Characteristics	Vehicle count information for parking lot occupancy counts	Visitors
Weather Service	Provide historical context for expected parking utilization	National Weather Service or other providers

and especially the ordeal of finding a parking spot, has made these trips increasingly stressful because of their young children. With the implementation of a parking management system at GGNRA's beaches in Marin County, Hector and Juanita have a more pleasant visitor experience. As they were driving toward Stinson Beach, Hector tuned to 1610 AM to listen to the HAR broadcast and found out that the parking lot at Stinson Beach was full. Juanita suggested they try Rodeo Beach, as recommended in the message and on the GGNRA website she viewed before they left home. Not only did they find a parking spot when they arrived, but they were able to spread out on the beach and have a wonderful afternoon with their children.

Park Management. Park staff at Muir Woods had been concerned about the days when the parking lot is full. Vehicles would line the shoulder area of the highway in either direction, which would exacerbate the already bad weekend congestion challenges and create a safety hazard as people sometimes had to walk on the highway to return to their car. However, since installing a parking management system, things have noticeably improved. On a sunny weekend afternoon in June, loop detectors at the entrance to the Muir Woods parking lot showed that the parking lot was getting full. When the lot reached capacity, the system activated a sign at the entrance to the parking area indicating that parking was full. Park staff at the Presidio (NPS

Table 9-8: Parking Management and Information, Information Flows

Information Flow	Description
archive requests	A request to receive historical parking, traffic and weather information, or on the type of information to be archived
archive status	A fault report for inaccurate or missing archive data
broadcast advisories	Analog messages sent by radio to visitors
driver information	Digital messages (e.g. changeable message signs) sent to visitors
parking archive data	Data used to analyze and monitor trends in parking demand and operational actions
parking availability	Current parking lot occupancy and availability.
parking coordination	Information that enables parking management activities to be coordinated within a region.
parking operator inputs	Local parking operator inputs that query current status and control the operation of the parking management system.
parking status	Parking lot operational status
request for performance data	Request for current parking service performance data
roadway information system data	Information used to initialize, configure, and control roadside systems that provide driver information (e.g., changeable message signs, HAR)
roadway information system status	Current operating status of equipment that provides real-time information (e.g. HAR, changeable message signs) to drivers
traffic archive data	Data describing the use and vehicle composition on transportation facilities
vehicle characteristics	Vehicle count data
weather information	Accumulated forecasted and current weather data

Dispatch Center) provided information via CMS and HAR prior to the SR 1/US 101 junction advising Muir Woods visitors of the parking challenges, so they could visit another GGNRA site before returning to Muir Woods later in the day.

Technology Implementations

Implementation of this theme would require several distinct components, each of which might have several technology implementations.

Collect Parking Data

Parking availability can be monitored using several different techniques. The current means of monitoring parking is to have park staff scan the parking areas throughout the day as they are doing other tasks. The parking availability may then be relayed by radio to visitors' centers or another central location. This is somewhat labor-intensive and utilizes valuable park staff time.

Remote monitoring of parking lots could be used to automate this process and provide current information on a regular basis. Vehicle sensors (e.g., inductive loop detectors) placed at parking lot entrances and exits can count the number of vehicles entering and exiting parking lots, thus estimating the number of available remaining parking spaces. This information on estimated parking availability could be communicated in real-time to a central location for further dissemination. Use of these sensors would be limited to parking areas that have distinct and limited entry and exit points so as to limit the number of required sensors. Another method is the use of pneumatic road tubes, which may be draped over and nailed into the roadway. While road tubes are relatively cheap and would not require pavement cuts, slow moving vehicle traffic in and out of parking areas may tear up the tubes easily, meaning that routine visual inspection and replacement of tubes may be required. Above-ground detection technologies, like video, microwave and radar detection, are typically more costly for installation but often have fewer ongoing maintenance needs. Video has been used successfully at signalized intersections where lower vehicle speeds are observed. In each of these cases, a structure would need to be provided for mounting the detectors. For security purposes, the minimum height of the detector should be at least ten feet. This may be installed onto an existing lighting structure.

Video cameras mounted on utility poles or other high objects could be used to gather information about parking availability. With video monitoring, park managers are able to get an actual view of parking areas, and would most likely get a better sense of parking conditions. However, park staff may be needed to view and interpret the video in order to further disseminate the parking information through voice or text messages (e.g. HAR or computer kiosks).

Information about parking availability should be saved for historical purposes. For example, parking utilization could be tracked over time, resulting in better predictions of when and how long certain parking areas will be congested. Historical parking availability information could be provided to visitors planning their daily itinerary.

Transmission of Parking Data

Various low-bandwidth wireless and wireline solutions may be used interchangeably for communicating information on parking availability to a central location.

Integration and Analysis of Parking Data

Hardware used for integrating and analysis of parking data may be physically located within any building. Hardware requirements will consist of a desktop computer and a dedicated phone line with the capability to poll various parking lots on their current parking usage or availability.

Dissemination of Parking Information to Visitors

Communication of parking lot status between park and agency stakeholders may be accomplished through a variety of automated or manual means, including automated fax service or a Web interface. Communication of parking lot availability to visitors should focus both on visitors in the immediate vicinity of parking lots, as well as visitors within a half-hour of the parking lots. Since parking lots are located within or near park lands, there are aesthetic concerns for how information is provided. Existing National Park Service-styled signage may be adapted to provide a simple message on parking availability. For example, information may be conveyed using flip signs or simple electronic signs (e.g. lighted sign that indicates “FULL” when parking is not available but is blank otherwise). A static sign below could direct motorists to tune into a HAR system. Voice annunciation software could be used to translate information from the parking system into a status report that could be automatically updated on the HAR as conditions change. HAR has the advantage of being able to provide more detailed information in a clearer and less visually intrusive fashion than can be done using road signs. This information could be presented in an automated fashion because of its real-time nature.

For visitors approaching the park, changeable message signs (which are common throughout the Bay Area) may be used. New signs may be deployed, or GGNRA may pursue an interoperability agreement with Caltrans that would permit GGNRA to use Caltrans CMS on weekends, when Caltrans usage would normally be reduced. Highway advisory radio would again be beneficial in order to supply more detailed information regarding parking availability.

Parking Management Strategies

In addition to providing information about parking availability, park managers should consider other strategies for helping to distribute parking demand throughout the day. For example, park managers might consider listing other areas of the park that are historically “underutilized” next to the congested parking information. Alternatively, the historically off-peak times of the day might be listed to encourage visits to popular locations earlier or later in the day. The availability of park transit within the park could also be promoted next to the parking information. The concept behind these parking management strategies is to provide information when parking availability is limited and then suggest or encourage alternatives. Numerous consumer surveys have demonstrated the value of traveler information such as this; even in cases where travelers have or choose no other alternative, they are at least mentally prepared for the anticipated delays.

Issues

Technological Issues

- Regardless of the method used, vehicle detection may be expected to have some imprecision. The system should include a process for daily re-calibration.

- It will be more challenging to automate information for visitors who are on their way to the park. It is recommended that the software have some thresholds for parking usage at various lots. When any thresholds are reached, park staff could be presented with a recommended message set to post on signs and the radio.

Institutional Issues

- There are critical issues related to infrastructure ownership between Caltrans, Marin County, California State Parks, and the National Park Service on non-National Park Service land. Guidelines for message sets, message priorities between the agencies, and maintenance responsibilities are among the issues that would need to be addressed.

9.1.4. Parking Intercept

Description

Even after a visitor has begun to drive to a park, it may be desirable to get them out of their vehicles because of congestion on roadways approaching park sites or at parking areas. This ITS theme would involve park staff using information on current congestion and parking availability to provide information to locations where drivers could park and then take transit. Information could be provided using highway advisory radio or changeable message signs at decision points to direct drivers to parking lots where they could use transit. The parking lots would then have information on the availability and real-time arrival schedule of transit.

Architecture Concept

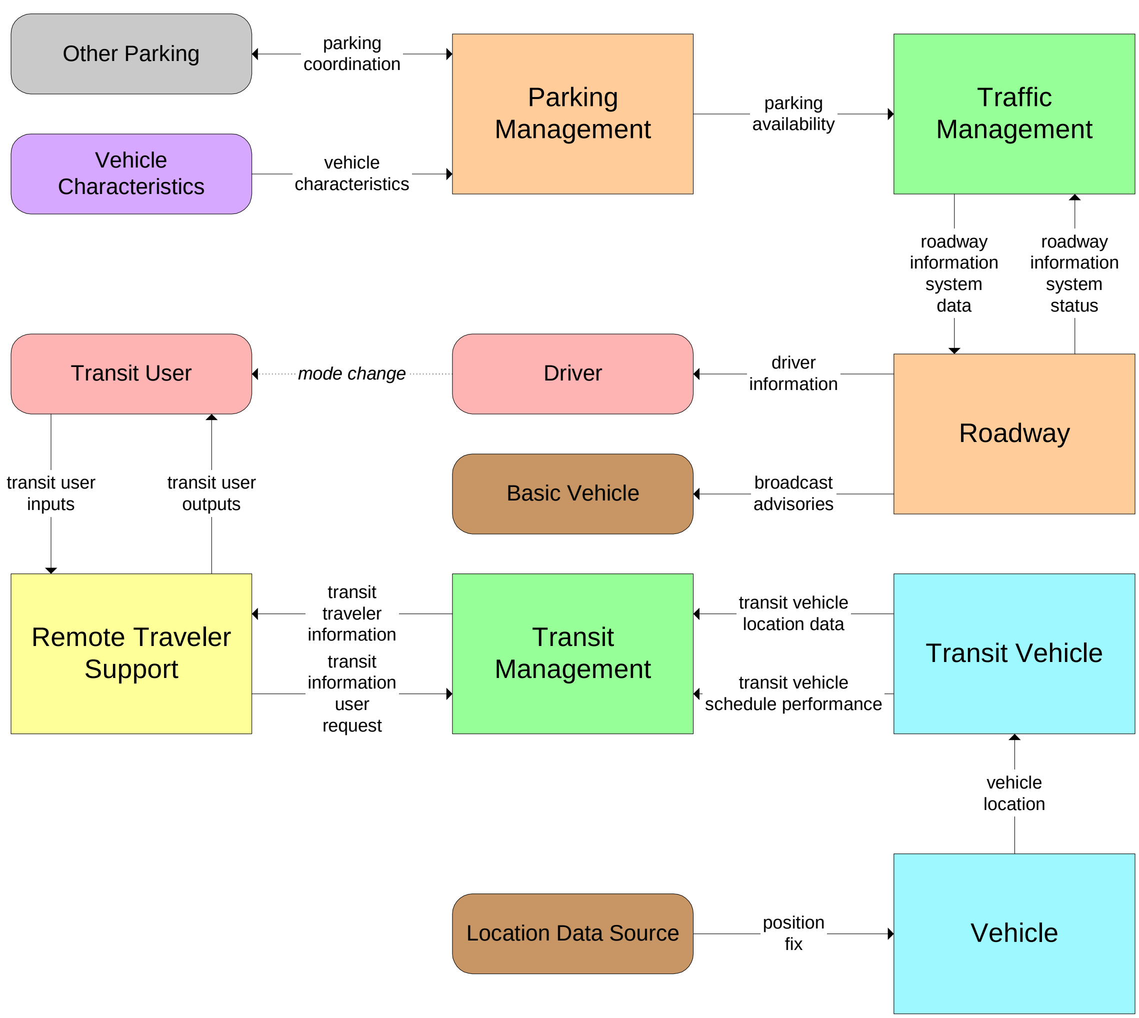


Figure 9-4: Parking Intercept Architecture Schematic

Figure 9-4 provides an ITS architecture framework for the parking intercept theme. The implementation of this theme would depend on additional transit service for GGNRA and land to designate as parking intercept facilities. The key system elements are as shown in Table 9-9. Because this could have significant impact on the park and would require coordination between multiple agencies, GGNRA would represent the most likely champion for this theme. However, since MUNI and GGBHTD run the bus system and parking would need to be borrowed/rented from local agencies such as Caltrans District 4 or schools, all of these agencies would need to

Table 9-9: Parking Intercept, Key Stakeholders

Element	Role	Stakeholder
Basic Vehicle	Receives information on parking availability	Visitors
Driver	Receives information on parking availability	Visitors
Location Data Source	Provides geographic reference base	GPS provider
Other Parking	Represents other parking facilities with which GGNRA may coordinate	GGNRA Park Management & other parking facility managers
Parking Management	Tracks parking availability for all parking facilities related to GGNRA	GGNRA Park Management
Remote Traveler Support	Provides information at transit stop of next scheduled transit arrival	Manager of Intercept Lot (GGNRA?)
Roadway	Provides information to visitors on parking availability	GGNRA, Caltrans and/or Marin County
Traffic Management	Determines information to present to visitors based on parking availability	GGNRA Park Management
Transit Management	Manages transit systems that provide service to intercept lot	GGNRA; GGBHTD; Marin County Transit; or other transit providers
Transit User	One who is parking their vehicle at the intercept lot and will use transit	Visitors
Transit Vehicle	Provides transit service between intercept lot and park sites	GGNRA; GGBHTD; Marin County Transit; or other transit providers
Vehicle	Vehicle equipment of transit vehicle	GGNRA; GGBHTD; Marin County Transit; or other transit providers
Vehicle Characteristics	Vehicle count information for parking lot occupancy counts	Visitors

have an integral role in this theme as well. The information flows to support this ITS theme are summarized in Table 9-10.

Scenario

Visitor. Hannah and Hunter are interested in going to Muir Woods for the afternoon. As they travel north on US 101, they notice a changeable message sign telling them that parking at Muir Woods is full, but they know that ahead are parking areas where they can park and get on a bus to take them to Muir Woods because they read about the bus and parking areas on the Muir Woods website and in the Muir Woods information received from the park. Never having done this before, Hunter is a little skeptical, but Hannah has her heart set on going so they decide to check out the new option. As they approach the parking area, they see that there is a parking spot open for them with no wait – they would have had a one-hour wait had they continued by car to Muir Woods – then as they get closer to the bus stop they notice that there are informational signs to let them know that the bus will be arriving in 10 minutes. Hunter thought these signs were great because otherwise they would have been left guessing when the last bus had been

Table 9-10: Parking Intercept, Information Flows

Information Flow	Description
broadcast advisories	Analog messages sent by radio to visitors
driver information	Digital messages (e.g. changeable message signs) sent to visitors
mode change	Visitor response to change from driving access to transit access
parking availability	Current parking lot occupancy and availability.
parking coordination	Information that enables parking management activities to be coordinated within a region
position fix	Information that provides a vehicle's geographical position
roadway information system data	Information used to initialize, configure, and control roadside systems that provide driver information (e.g., changeable message signs, HAR)
roadway information system status	Current operating status of equipment that provides real-time information (e.g. HAR, changeable message signs) to drivers
transit information user request	Request for real-time schedule and availability information
transit traveler information	Includes schedules, real-time arrival information, fare schedules, and general transit service information
transit user inputs	Requests for information from transit user
transit user outputs	Information for transit user in response to request
transit vehicle location data	Current location provided by a transit vehicle
transit vehicle schedule performance	Estimated times of arrival and anticipated schedule deviations reported by a transit vehicle
vehicle characteristics	Vehicle count data
vehicle location	Location of vehicle which is exchanged between vehicle subsystems

there and whether or not it was running on schedule. A little while later they were in Muir Woods enjoying the redwoods. Hunter decided that he was glad Hannah had talked him into trying the new system. They decided they would use it from now on as it saved them time and made their park experience more enjoyable.

Park Management. Park staff at Muir Woods had been concerned about the days when the parking lot is full. Vehicles would end up lining the shoulder area of the highway in either direction, which would exacerbate the already bad weekend congestion challenges. However, since offering a shuttle service with parking near the shuttle, things have improved. By providing visitors with information that the parking lot at Muir Woods was full and giving them the option of taking transit, park staff had decreased the safety risks from people parking along the roadside and walking in the roadway, decreased the impact to the environment from people parking where it is not appropriate, decreased the pollution in the park by making people aware of the public transit system, and enhanced visitors' experiences by decreasing the hassle of getting to the park.

Technology Implementations

Collect Parking Data

Several technologies may be used for this, which were described under the Parking Management and Information theme. These include human monitoring, inductive loops, pneumatic road tubes, video, microwave and radar detection.

Transmission of Parking Data

Various wireless and wireline solutions may be used interchangeably for communicating information on parking availability to a central location. A variety of technologies would be able to satisfy the minimal bandwidth needs of this data.

Integration and Analysis of Parking Data

Hardware used for integrating and analysis of parking data may be physically located within any building. Hardware requirements will consist of a desktop computer and a dedicated phone line with the capability to poll various parking lots for information on their current parking usage or availability.

Dissemination of Parking Information to Visitors

For the purposes of this theme, communication of parking lot availability to visitors should focus on visitors in the immediate vicinity of shuttle stop parking lots. As these lots will not be on park land, there will be fewer concerns related to aesthetics of design. Changeable message signs could be activated on high parking demand days to instruct motorists to tune to a highway advisory radio station. Voice annunciation software could be used to translate parking status information into a radio-ready message that could be automatically played and regularly updated. The highway advisory radio has the advantage of being able to provide more detailed information in a clearer and more aesthetically pleasing fashion than can be done using road signs. This information could be presented in an automated fashion because of its real-time nature.

The changeable message signs should be positioned on major access highways (like US Route 101) at least one mile prior to the decision point. To economize on cost, GGNRA could pursue an interoperability agreement with Caltrans to use the signs on high parking demand days. Static signs could also be used to direct motorists to check the HAR message; however, the use of CMS may be more likely to convey the perception of a real-time, critical message to visitors than a static sign.

Parking Facilities

GGNRA would need to partner with local agencies to determine appropriate locations that could be borrowed or rented for use as parking facilities (e.g. school parking lots, business parking lots, Caltrans parking lots, town owned lots, etc). These areas should be chosen based on proximity to the section of GGNRA that has parking challenges, the cost of using the facility, the days and times the facility would be available, the consistency of site availability (e.g. would a weekend school function preclude GGNRA usage of the site), and number of parking spaces. Securing the lots for long-term use (leases or arrangements of several years) would be a priority to ensure an adequate and reliable parking supply.

Transit Service

GGNRA would need to partner with MUNI and GGBHTD to determine if additional bus routes could be added or if existing bus routes could be altered to provide service to the intercept facility. Depending upon the volume of transit service provided to these parking facilities, GGNRA may want to work with the transit agency to enhance vehicles serving the lot to provide a continuation of the visitor experience (including storage for bicycles or other gear, additional audio interpretation of park sites, vehicles running on alternative fuel, etc.).

Estimation of Transit Arrival

To maximize efficiency, automated vehicle identification systems should be employed on these buses to ensure that visitors can be provided with real-time data on bus arrivals. This system will allow the buses to be tracked and estimates on bus arrival to be used at bus stops. In the absence of automated vehicle identification, software can be developed to indicate estimated arrival time based on static transit schedule information.

Dissemination of Transit Arrival Information to Visitors

Communication of bus status between park and bus stops may be accomplished through a variety of automated or manual means, including a ranger or volunteer standing at the bus stop letting people know when the next bus will be there or a small changeable sign that can be automatically changed to reflect when the next bus will arrive.

Issues

Technological Issues

- Automating a parking management system with an automatic vehicle location (AVL) system may be difficult if the systems are not compatible.

- Estimated bus arrival times may need some calibration based on weekend traffic congestion near the intercept facility and on transit routes serving the facility and park sites.

Institutional Issues

- There are critical issues related to ownership of infrastructure between Caltrans, Marin County, California State Parks, and the National Park Service on non-National Park Service land (e.g. a changeable message sign on US Route 101 used to provide information about the parking facility).

- The park should work with transit providers to ensure that an appropriate frequency of transit service is provided relative to the number of parking spaces available.

- The park will need to secure agreements with owners of land that may be used for parking facilities. These agreements will need to address how usage is to be shared, liability concerns, and the ownership and maintenance responsibilities of any permanent static or electronic signage installed at the parking facility.

9.1.5. Pre-Trip Traveler Information

Description

This ITS theme involves collecting and distributing all information that would help visitors to enjoy their visitor experience to GGNRA. It would provide a mix of static and dynamic information to assist them in planning their itinerary to and between GGNRA sites, along with adjacent tourist attractions of interest. The information would include travel time (reflecting congestion and construction activities), weather and parking information for GGNRA sites. It would include information on transit and non-auto alternatives. It would also provide links to more detailed information about GGNRA sites along with other attractions that may be of interest to visitors.

Architecture Concept

Figure 9-5 provides an ITS architecture framework for the pre-trip traveler information theme. The implementation of this theme would depend on having real-time, relevant, current

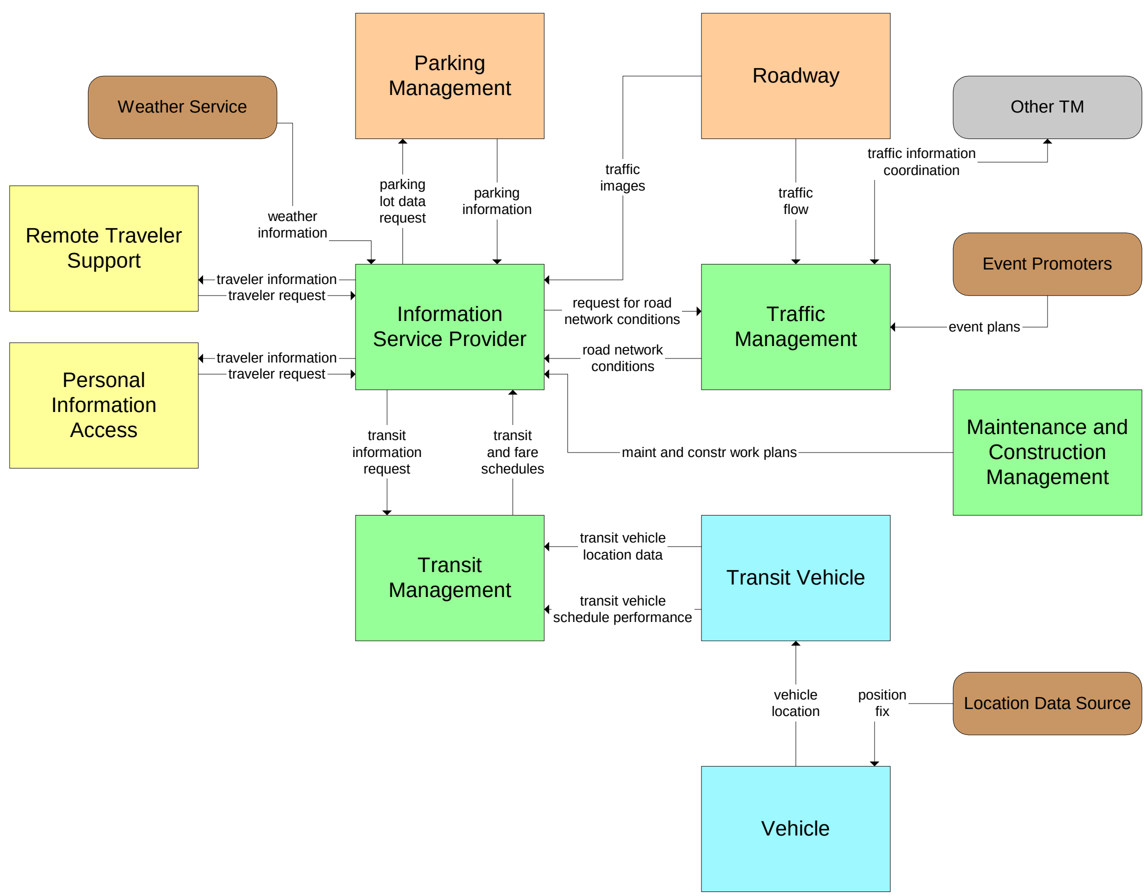


Figure 9-5: Pre-trip Traveler Information Architecture Schematic

Table 9-11: Pre-trip Traveler Information, Key Stakeholders

Element	Role	Stakeholder
Event Promoters	Provide information on events, and estimated traffic impacts	GGNRA sites such as Fort Mason, Presidio, Crissy Field; other regional traffic generators
Information Service Provider	Collects and repackages information to make it useful to visitor	GGNRA and/or private-sector non-profit providers
Location Data Source	Provides geographic reference base	GPS provider
Maintenance and Construction Management	Manage work zone activities that may affect capacity on roadways serving park	GGNRA; Caltrans District 4; Golden Gate Bridge, Highway and Transportation District; Marin County; and others
Other TM	Represents other traffic management agencies with which GGNRA may coordinate	Caltrans District 4 TMC, San Francisco Division of Parking and Traffic TMC, and others
Parking Management	Tracks parking availability for all parking facilities related to GGNRA	GGNRA Park Management
Personal Information Access	Provides pre-trip traveler information to visitors on their own device (personal digital assistant, cell phone, etc.)	Visitors
Remote Traveler Support	Provides pre-trip traveler information at fixed locations (hotels, airports, etc.)	Kiosk/terminal owners
Roadway	Provides images of roads, parking lots, and park sites; and provides raw traffic data	GGNRA, Caltrans and/or Marin County
Traffic Management	Provides traffic information	GGNRA Park Management
Transit Management	Operates transit service to GGNRA park sites and other regional destinations	GGNRA; GGBHTD; Marin County Transit; SF Muni; and/or other transit providers
Transit Vehicle	Provides transit access to GGNRA park sites	GGNRA; GGBHTD; Marin County Transit; SF Muni; or other transit providers
Vehicle	Vehicle equipment of transit vehicle	GGNRA; GGBHTD; Marin County Transit; SF Muni; or other transit providers
Weather Service	Provide current and forecast weather conditions	National Weather Service or other providers

information to distribute to visitors. In the absence of quality information to distribute to visitors, how and where information is distributed is of far less concern. The key system elements are shown in Table 9-11. Because this could have significant impact on distribution of visitors among the park's sites, GGNRA would represent the most likely champion for this theme. However, information may need to be gathered from other local agencies, such as Caltrans District 4, Marin County, California State Parks, MUNI, and GGBHTD; therefore these local agencies would need to have an integral role in this theme as well. The information flows to support this ITS theme are summarized in Table 9-12.

Table 9-12: Pre-trip Traveler Information, Information Flows

Information Flow	Description
event plans	Plans for major events possibly impacting traffic
maint and constr work plans	Future work zones with anticipated traffic impacts
parking information	Current parking availability
parking lot data request	Request for parking lot occupancy, fares, and availability
position fix	Information that provides a vehicle's geographical position
request for road network conditions	Request for traffic, weather, incident and other road information
road network conditions	Current and forecasted traffic, weather, incident and other road information
traffic flow	Processed traffic data which helps to identify congested locations
traffic images	Real-time or snapshot traffic images of traffic, parking facilities, or park sites
traffic information coordination	Traffic information exchanged between park and TMCs
transit and fare schedules	Specific transit and fare information including schedule adherence
transit information request	Request for transit information including schedule and fares
transit vehicle location data	Current location provided by a transit vehicle
transit vehicle schedule performance	Estimated times of arrival and anticipated schedule deviations reported by a transit vehicle
traveler information	Traveler information including but not limited to transit service
traveler request	Request by a traveler for information
vehicle location	Location of vehicle which is exchanged between vehicle subsystems
weather information	Accumulated forecasted and current weather data

Scenario

Visitor. Cole and Savannah were going to be on business in San Francisco for a couple of days, with one free day for sightseeing. Savannah, realizing that they only had one day to experience as much of the San Francisco area as possible, thought they should plan out their trip. Cole suggested using the Golden Gate National Recreation Area website. Savannah was amazed at the amount of information there was under the trip planning tab – they could plan their entire itinerary for one day from the same place! First they selected the places at Golden Gate that they wanted to visit ;) and the best sequence for visiting each place based on average driving times and parking congestion. The system also provided driving directions and parking information and/or transit options for visiting the selected park sites. Lastly, the website provided them with links to descriptions and history for the sites they selected. The most amazing part to Cole was that the Internet site said the same capabilities were available at the kiosk in the airport and hotel lobby. Consequently, if they needed to change anything they had the option to do so at other locations when a computer was not available to them.

Park Management. The dispatcher at GGNRA was constantly on the phone responding to calls about everything from hours of operation, where people should visit, what weather and traffic conditions were like, and safety information. With the new trip planning program on the Internet, the park dispatcher can direct callers to the Web site. Therefore, this decreases the amount of time the dispatcher spends answering general questions, leaving more time for the more specialized questions such as where to get permits, what areas of the park are accessible to persons with disabilities, and questions regarding emergency situations. Other benefits of this new system are that the visitors are being more dispersed around the park, are learning of new travel options, and are getting more information and therefore having a better visitor experience.

Technology Implementations

Collect Static Information

Information such as Golden Gate National Recreation Area park sites, fees, hours of operation, parking spots available to the public, distances between areas, driving directions, and speed limits between areas would need to be collected into a database. The same information would need to be collected for non-Golden Gate National Recreation Area attractions that are in the vicinity.

Collect and Analyze Traffic Data

Travel time estimates will require analysis of traffic volume and speed detection on the many roads accessing and/or connecting park sites. Many road agencies have automated traffic counting programs to assist in planning and traffic management purposes. However, this information will be useful in providing real-time travel time estimation only if it is available on a real-time basis to park staff. Early staging of this ITS theme should rely on existing traffic detection stations operated by Caltrans, Marin County and others, and should seek to develop memoranda of understanding that would allow GGNRA to use and archive selected traffic volume and speed data. Over time, GGNRA could work in partnership with these agencies to implement additional counters at locations that would provide benefits for each agency.

Collect Work Zone Data

Each road agency with a maintenance and construction program will have documentation about how traffic will be staged through the work zone. A geographically-based database may be developed that would code anticipated work zone activities based on the dates of activity, the geographic limits of the project, anticipated lane closure durations, and associated speed reductions. Some or all of the road agencies may already have the information to populate this database. GGNRA would then need to develop and maintain a database application that could pull information from the road agencies' databases and reorganize the data into a uniform format. This type of database activity has been used by several states including the Oregon Department of Transportation with its Highway Travel Conditions Reporting System (HTCRS), and multi-state efforts including the Condition and Accidents Reporting System (CARS) and the Highway Conditions Reporting System (HCRS).

Collect Special Event Data

The software technology that is used to collect and merge special event information could be identical to that used for collecting work zone data. However, this aspect of the theme will likely be more challenging to implement because of the greater number of agencies that can sponsor special events, and the more varied level of traffic impact estimates that would be developed for these events. GGNRA should first work with its own park partners to develop tools that would allow park partners to quickly enter this information into a database. The type of information that may be collected would include type of event, time and location of the event, how many people are expected to attend, and location and number of available parking spots. GGNRA could also develop forecasts to help project time periods when most people arrive and leave the venue, expected wait times for parking, and whether or not there will be enough parking spaces. The actual information could then be collected during one event and used the next time a special event occurs to obtain a more precise forecast.

Collect Weather Data

GGNRA would need to develop a relationship with the National Weather Service, Forest Service, Caltrans (for road weather information system [RWIS] usage), Bay Area Mesonet Initiative or other weather providers that would allow the park to acquire and archive real-time weather data. It should be emphasized that the variation of weather within the park means that GGNRA should seek a variety of weather site locations to provide more accurate information on the possible weather impacts on visitation traffic. It would be helpful if GGNRA can get forecast data as well (24-to-48 hours) since this may allow park staff a greater time window for an appropriate proactive strategy.

Collect Parking Information

Several technologies may be used for estimating current availability of parking, including human monitoring and a variety of automated technologies, detailed under the Parking Management and Information theme. To provide maximum utility to park visitors planning their trips, the parking information should include both current and forecast parking availability, based on weather, construction, special events and other factors.

Collect Transit Information

GGNRA should partner with area transit agencies (e.g. MUNI and GGBHTD) to obtain information on transit service to/from park sites. The type of information that would be needed would include static information such as bus routes and stops, transit fares, and the time schedule for bus stops. Additional information could include forecasting the arrival time of buses at their stops. These forecasts would be based on archived data collected via automated vehicle location systems, once these systems are installed, that would allow the buses to be tracked and their actual time of arrival at stops to be recorded, along with the scheduled (estimated) time of arrival.

Collect Non-motorized Transportation Information

The information to be collected for this part of the trip planning would include non-motorized forms of travel such as hiking, walking, biking, and horseback riding. The information that would need to be archived would include park sites where these activities are allowed, maps of the trails, where bikes and horses can be rented, rental prices, and any restrictions that exist. The main goal for this part of the trip planning is not only to give people information about what type of activities are available within one part of the park (i.e. Stinson Beach), but also alternative ways to get from one part of the park to another (i.e. hike between Muir Woods and Stinson Beach rather than drive).

Integration and Analysis of Archived and Real-time Data

This system requires the efficient processing and analysis of both real-time and archived static, traffic, work zone, special event, weather, parking, transit, and non-motorized travel information, likely through a database-driven expert systems tool. The system would need to provide general information as well as user-specific information. The type of data that would be provided through analysis would include, but is not limited to:

- travel times by correlating traffic volumes with time of year, weather, construction activities, and special events and other factors;
- parking information by correlating time of year, number of spaces available, weather, special events, and other factors;
- the best itinerary for the person using the system by analyzing sites they want to visit against travel times, time they want to spend at each site, and relative distance between sites chosen; and
- travel mode options by correlating what mode the person prefers to use, with the travel times, parking, costs and site destinations of other modes.

Dissemination of Information for Trip Planning to Visitors

The trip planning data may be disseminated to a user via interactive technologies such as the Internet, a kiosk, or the telephone. The kiosk and Internet would allow for immediate printing of the itinerary or downloading to a PDA; however the telephone would require additional resources for printing. The information could be forwarded to an email address or sent to a fax machine. This type of information could be used by an individual, a travel agent or auto club (e.g., AAA) making arrangements for a client. The information interface is especially critical. Kiosk and Web-based interfaces should use easy-to-understand icons and links that allow a visitor to develop an itinerary quickly.

Issues

Technological Issues

- This theme requires high-quality real-time information from a variety of sources. The park will need to catalog the data sources required for this theme, and identify deficiencies in quality, timeliness or both of each source.

- A database to collect and analyze the multitude and diversity of data sources will need to be created and maintained.

- Most itinerary-planning tools do not allow for the re-ordering of destinations based on real-time information. Therefore, the itinerary planning capabilities used in this theme would likely require significant development and testing to ensure that the results are meaningful and accurate.

- There will be a need to automate the database with the dissemination methods.

- Special attention needs to be given to developing an easy-to-use interface that will be accessible to a variety of park visitors and will be consistent with visitor expectations of a park experience.

Institutional Issues

- While a customized itinerary could be exceptionally valuable to visitors, there may be several issues with recommending an itinerary to visitors (e.g. liability, effects on local businesses, and other factors). The park should explore these issues before proceeding into development of the itinerary planning capability.

- This theme necessitates getting the key agencies to work together to provide sufficient real-time data to provide to visitors. This may require special agreements with a variety of stakeholders.

- The park may need to develop guidelines for which non-park stakeholders would be included in the itinerary planner. For example, should gateway communities be included? State and local park lands? Concessionaire-provided services?

9.1.6. Transit Trip Planner

Description

In conjunction with Bay Area transit agencies, this ITS theme would promote the coordination of transit schedule and vehicle location information to provide real-time information about transit service to various park sites. This feature would allow visitors to develop itineraries, and would allow visitors to factor in any special needs (e.g. bringing a bicycle) that may affect which services they can use. This would require transit providers to have accurate location information.

Architecture Concept

Figure 9-6 provides an ITS architecture framework for the transit trip planning theme. The implementation of this theme would depend on the extension of transit service in GGNRA. The key system elements are shown in Table 9-13. Because the Metropolitan Transportation Commission has developed a transit trip planning system (TakeTransit), they would represent the most likely champion for this theme. However, additional information may need to be gathered from transit providers including GGBHTD and MUNI, along with other organizations like the Presidio Trust; therefore, these local agencies would need to have an integral role in this theme

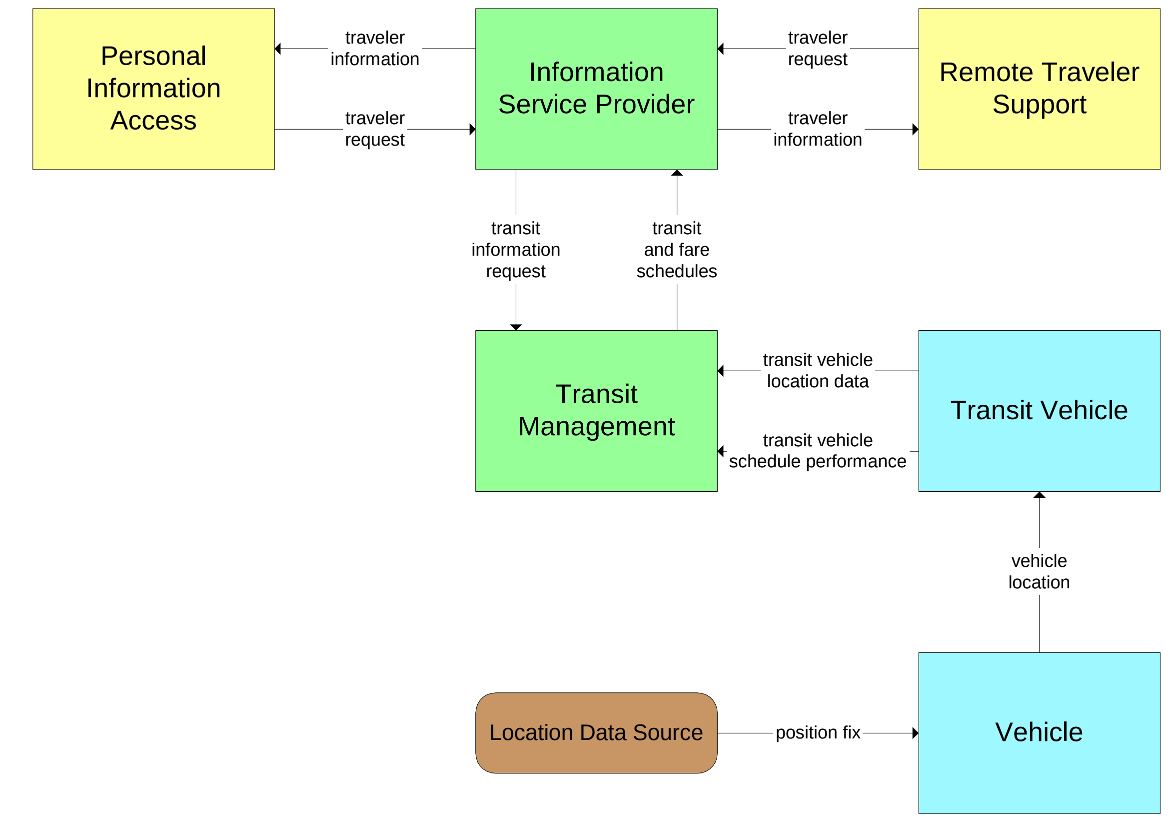


Figure 9-6: Transit Trip Planning, Architecture Schematic

Table 9-13: Transit Trip Planning, Key Stakeholders

Element	Role	Stakeholder
Information Service Provider	Collects and repackages information to make it useful to visitor	MTC, GGNRA and/or private-sector non-profit providers
Location Data Source	Provides geographic reference base	GPS provider
Personal Information Access	Provides transit information to visitors on their own device (personal digital assistant, cell phone, etc.)	Visitors
Remote Traveler Support	Provides transit information (schedules, real-time arrival info, etc.) at transit stops and other facilities (hotels, airport, visitor centers, etc.)	GGNRA; GGBHTD; Marin County Transit; SF Muni; and/or other transit providers Facility managers (hotels, airport, GGNRA, etc.)
Transit Management	Operates transit service to GGNRA park sites and other regional destinations	GGNRA; GGBHTD; Marin County Transit; SF Muni; and/or other transit providers
Transit Vehicle	Provides transit access to GGNRA park sites	GGNRA; GGBHTD; Marin County Transit; SF Muni; or other transit providers
Vehicle	Vehicle equipment of transit vehicle	GGNRA; GGBHTD; Marin County Transit; SF Muni; or other transit providers

as well. For GGNRA, the major benefit of expanding the existing transit trip planning system would be the extension of bus service to other parts of the park where service is limited. The information flows to support this ITS theme are summarized in Table 9-14.

Scenario

Visitor. Dakota's son is doing a book report on GGNRA for school and would like to take a tour of some of the places he has been studying. Dakota thinks this will be a great learning experience for his son, but living in the city, he does not own a vehicle to get them to the GGNRA sites further from the city. Dakota uses transit to get to and from work, as there is a bus stop just down the street from their house. He recalls hearing that transit service had been extended to reach most of the park sites and decides to call the MUNI dispatcher to check. The dispatcher tells him there is a new system on the Internet to help him and his son plan their trip based on the bus routes and schedules. After Dakota gets off the phone, he goes to the Web site and enters in the destinations they would like to visit (e.g. Muir Woods, Marin Headlands, Cliff House, Fort Mason, and the Presidio). In 10 minutes they have an itinerary for how to get where they want to go, what times they need to be at the bus stops, and what the fares are, so they are off on their tour. Maybe Dakota will even find souvenirs for his son to use in his shadow box for the project!

Table 9-14: Transit Trip Planning, Information Flows

Information Flow	Description
position fix	Information that provides a vehicle's geographical position
transit and fare schedules	Specific transit and fare information including schedule adherence
transit information request	Request for transit information including schedule and fares
transit vehicle location data	Current location provided by a transit vehicle
transit vehicle schedule performance	Estimated times of arrival and anticipated schedule deviations reported by a transit vehicle
traveler information	Traveler information including but not limited to transit service
traveler request	Request by a traveler for information
vehicle location	Location of vehicle which is exchanged between vehicle subsystems

Park Management. The park management has been giving out an increased number of pamphlets for GGNRA sites; however, they have not seen a dramatic rise in automobile traffic and overflow parking. They soon realize that all of the additional people are getting to park sites via transit, and many of them claim to be using the transit planner on the Web site! The park is benefiting from increased levels of people learning about park sites, but decreasing challenges with parking, vehicle congestion, and vehicle emissions. Another benefit to the park is that transit operators can easily gather statistics on how many people get off the bus at GGNRA sites, and this will improve the statistics that the park currently has on visitation.

Technology Implementations

The Bay Area has the benefit of TakeTransit, a transit trip planner coordinating transit information from many providers. The current coverage area of TakeTransit is shown in Figure 9-7. This theme should build upon this existing application with an emphasis on service to park sites.

Collect Transit Service Information

Information such as bus routes, schedules, fares, travel times for bus and ferry routes serving park sites, and stop and terminal locations in or near park sites would need to be entered into the system. This should include information on vehicle accessibility and the ability to transport bicycles.

Figure 9-7: Service Area for TakeTransit as of 3/31/03.

(Source: 55)

Dynamic service adjustments, such as increased service to park sites on high visitation days, should be incorporated as well. This may require modifications to the existing TakeTransit software; however, this would also permit incorporating shuttle service for special events (e.g. sporting events, conventions) not at park sites.

Collect Vehicle Location Information

The system will need to be able to track vehicle location for all vehicles serving park sites. Depending upon vehicle fleet characteristics, it may be necessary for additional information regarding each vehicle to be incorporated into the trip planner (for example, availability of bicycle racks, and accessibility).

Collect Visitor Itinerary Information

TakeTransit allows a user to specify locations of their origin and destination; however, origins and destinations may not include many park sites. This database information needs to be updated to reflect park sites. It should be noted that visitors may not be able to identify park sites by cities or specific street addresses, so a variety of name identifiers may need to be provided.

Integration and Analysis of Archived and Real-time Data

The trip planning system must be able to correlate the information input by the user with the archived data. The system would then give the user options based on preferences such as itinerary preference (e.g. lowest cost, least time, etc), fare category, and maximum walking distance.

Dissemination of Data for Trip Planning to Visitors

TakeTransit is currently organized as a Web-based tool; however, this may be migrated to other interactive technologies including the telephone.

Issues

Technological Issues

- To promote maximum usefulness of the system, demand-responsive transit service to park sites and other locations should be incorporated. This may require software modifications as well as AVL upgrades on vehicles used to provide demand-responsive service.

- TakeTransit may need modification to make it more accessible to the broad cross-section of international visitors who may wish to access park sites using transit. These modifications may have the additional benefit of promoting greater transit usage in the Bay Area overall by non-English speaking tourists and residents.

Institutional Issues

- GGNRA has had a difficult time getting the local transit agencies to extend services to other parts of GGNRA and some are even cutting back on service. Extension of TakeTransit to include service to park sites may enhance ridership levels to park sites and ultimately provide more revenue to stabilize or increase service levels. GGNRA will need to work closely with local transit agencies to identify potential routes and to promote route information to visitors, through TakeTransit, the park web site, park literature and other means.

- GGNRA will need to work closely with MTC on how TakeTransit can be enhanced to include more park sites and to better reflect visitor needs (e.g. bicycle access, other languages).

9.1.7. Major Emergency Response

Description

This ITS theme would help park management to respond to catastrophic man-made or natural disasters. Its primary emphasis would be evacuation of visitors in a safe and efficient manner to ensure their safety while allowing emergency response activities to continue. This theme would also allow for communication between emergency responders and park police as needed to ensure a coordinated response between all regional parties.

Architecture Concept

Figure 9-8 provides an ITS architecture framework for the major emergency response theme. The implementation of this theme would depend on an emergency response procedure being drafted for GGNRA. The key system elements are as shown in Table 9-15. Because GGNRA is located near the Golden Gate Bridge, commonly cited as a potential terrorist target, this plan would greatly affect GGNRA and therefore they would represent the most likely champion for this theme. However, information and feedback may need to be gathered from other local and national agencies as well, such as Caltrans District 4, the California Highway Patrol (CHP), other local law enforcement and emergency management agencies, the U.S. Department of Homeland

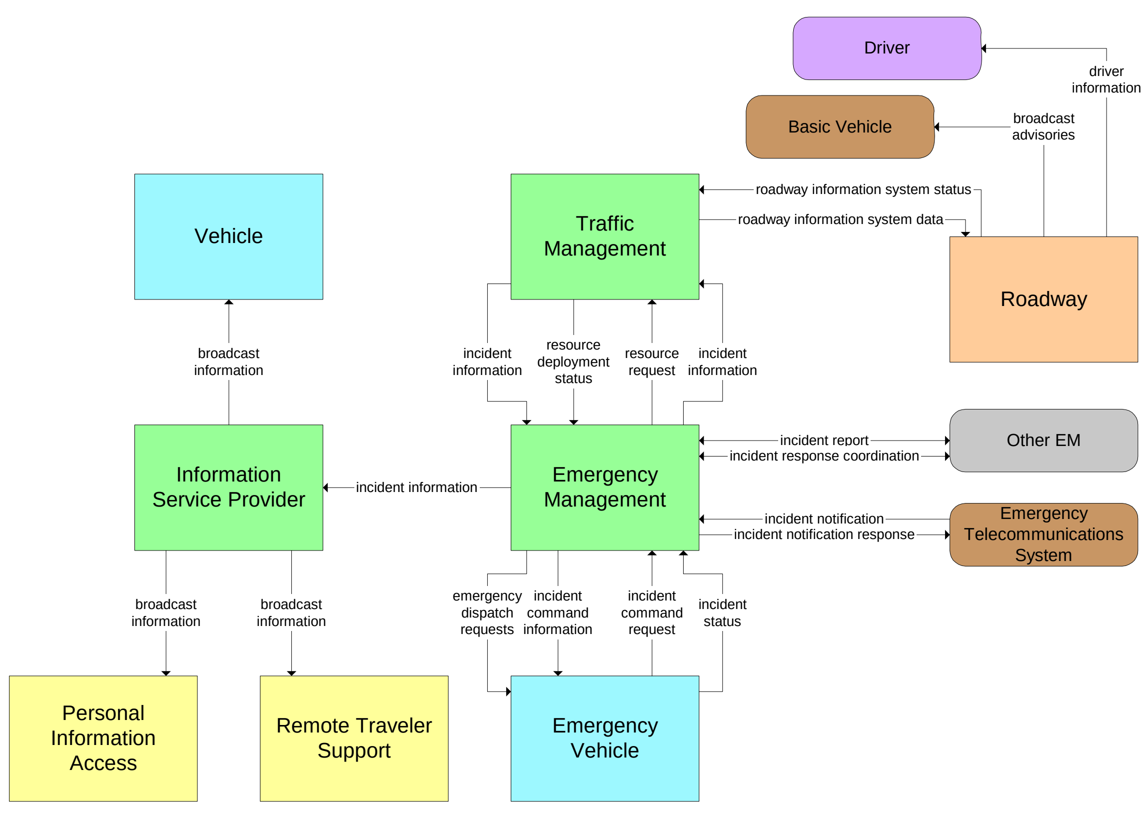


Figure 9-8: Major Emergency Response Architecture Schematic

Table 9-15: Major Emergency Response, Key Stakeholders

Element	Role	Stakeholder
Basic Vehicle	Receives information on emergencies	General Public
Driver	Receives information on emergencies	General Public
Emergency Management	Park staff responsible for responding to emergencies	GGNRA Park Police
Emergency Telecommunications System	911 or other service that provides information about emergencies	Local PSAP
Emergency Vehicle	Park vehicles used in emergency response	GGNRA Vehicles
Information Service Provider	Collects and repackages information to make it useful to visitor	GGNRA and/or private-sector non-profit providers
Other EM	Other regional agencies responsible for emergency response in vicinity of park sites	California Highway Patrol, California Department of Forestry, San Francisco Police, Marin County Sheriff and others
Personal Information Access	Provides pre-trip traveler information to visitors on their own device (personal digital assistant, cell phone, etc.)	Visitors
Remote Traveler Support	Provides pre-trip traveler information at fixed locations (hotels, airports, etc.)	Kiosk/terminal owners
Roadway	Provides information on emergencies to visitors via HAR and changeable message signs	GGNRA, Caltrans and/or Marin County
Traffic Management	Determines emergency information to present to travelers in vicinity of park sites	GGNRA, Caltrans and/or Marin County
Vehicle	Vehicle in vicinity of park sites that may be affected by emergency response	Visitors and general public

Security, and the military; therefore, these agencies would need to have an integral role in this theme as well. The information flows to support this ITS theme are summarized in Table 9-16.

Table 9-16: Major Emergency Response, Information Flows

Information Flow	Description
broadcast advisories	Analog messages sent by radio to visitors
broadcast information	General broadcast information about the major emergency and visitation/evacuation effects
driver information	Digital messages (e.g. changeable message signs) sent to visitors
emergency dispatch requests	Dispatch instructions to an emergency vehicle including location and available information concerning the incident
incident command information	Information that supports local management of an incident
incident command request	Requests for resources or commands that reflect local command of an evolving incident response
incident information	Notification of existence of incident and severity, location, nature, and expected duration of incident
incident notification	Incident notification including its nature, severity, and location
incident notification response	Verification and clarification of incident information received
incident report	Report of an identified incident including information necessary to initiate an appropriate response
incident response coordination	Procedures and information shared between agencies to support a coordinated response to incidents
incident status	Current incident response status
resource deployment status	Status of resources deployed by traffic management center to assist in incident response
resource request	A request for traffic management resources to aid incident response
roadway information system data	Information used to initialize, configure, and control roadside systems that provide driver information (e.g., changeable message signs, HAR)
roadway information system status	Current operating status of equipment that provides real-time information (e.g. HAR, changeable message signs) to drivers

Scenario

Visitor. Celeste and her daughter are flying kites near Fort Point on a beautiful Saturday afternoon. Everything seems perfect to them, however the rest of the nation is watching television as the terrorist level climbs in the U.S. The FBI has had tips that the Golden Gate Bridge is a possible target. Although authorities are diligently working to ensure nothing will occur, they believe it is best to clear the area to protect public safety. While the FBI wants to do this in a quick, yet safe manner, they are afraid that they may scare visitors at Fort Point and Vista Point while trying to evacuate them. Fortunately, an emergency response plan has been put in place for just this situation, and the FBI knows that their first priority is to call the person in charge at GGNRA to let them know they need to initiate the emergency response checklist.

Celeste and her daughter were safely evacuated from Fort Point, and they never felt panic because the situation seemed to be under control.

Park Management. This plan will allow park management to get staff and visitors out of the park in a safe and efficient manner in the event of a catastrophic man-made or natural disaster. This plan would give park management guidelines and checklists to facilitate calm and orderly public cooperation.

Technology Implementations

Create an Emergency Response Plan

This plan would be created by a third party, but should have the input of GGNRA, Caltrans District 4, CHP, other local law enforcement and emergency management agencies, the Department of Homeland Security, and the military. The plan would include names and phone numbers for contacts at each agency in the event of an emergency, alternative routes for evacuation for different situations occurring at each park site, and procedures for getting information out to visitors not only at park sites, but also en-route. Traffic management options should also be included to ensure that all visitors are not exiting the same way and that the greatest number of people can be evacuated in a reasonable amount of time. The plan would also contain message sets to be used in the event that highway advisory radio or changeable message signs will be used to disseminate the information. This plan should be written in a way that it will be useful and accessible in the time of need. The plan would also specify each player's roles and responsibilities in the case of an emergency (i.e. who would be responsible for traffic control, who is responsible for putting the message on the CMS, etc).

Dissemination of Evacuation Information to Visitors

The evacuation information may be disseminated to a user via highway advisory radio, 511, changeable message sign, the GGNRA website, and word of mouth.

Issues

Technological Issues

- Each organization involved in the emergency response plan should have adequate communications infrastructure to fulfill their roles and responsibilities in the emergency response plan. The plan should also include consideration of back-up plans in case the communications infrastructure is affected by the emergency (for example, cellular tower infrastructure shuts down).

Institutional Issues

- The plan should be reviewed regularly to ensure that all contact information and protocols are still appropriate.

- Though there is a consensus about protecting the public, it may be difficult to get all the players to agree on specific roles and responsibilities.
- Creating an emergency management plan has no value if it is not used. The agencies involved have to agree to use this plan in the time of need.

9.2. ITS Themes in SEKI

Several ITS themes were identified based on the ITS objectives for Sequoia and Kings Canyon National Parks. The ITS themes are listed in Table 9-17 along with the transportation problems these themes may help to address. The themes are also listed in Table 9-18, along with the ITS objectives they are related to, and the associated user services and market packages from the National ITS Architecture. To facilitate conformity with the National ITS Architecture, the market packages that are used in the themes are listed in Appendix I. Additional detail about the physical entities (subsystems and terminators) is included in Appendix J, and additional description of the information flows is provided in Appendix K.

Table 9-17: ITS Themes Addressing Transportation Problems at SEKI.

Problem \ Theme	Parking Management and Information	Transit Service and Traveler Information	Weather and Road Condition Information	Electronic Entrance Fee Collection	Road Monitoring and Incident Management	Road Construction Information and Coordination	Campground Reservations and Information	Emissions Monitoring	Oversize Vehicle Detection
Limited Parking	✓	✓							
Transit Service		✓							
Weather Forecasts and Road Conditions			✓						
Queues at Entrance Stations				✓					
Safety Challenges due to Incidents					✓				
Work Zone Coordination						✓			
Campground Information and Reservations							✓		
Degradation of Air Quality								✓	
Roadway Congestion	✓	✓			✓	✓			✓
Road Infrastructure									✓

Table 9-18: ITS Themes for Sequoia and Kings Canyon National Parks.

ITS Themes	ITS Objectives	User Services	Market Packages
Parking Management and Information	1.1.2, 1.1.3, 1.1.6, 1.2.4, 2.2.1, 3.4.1, 3.4.2, 3.4.3	**1.2** – En-route Driver Information **1.6** – Traffic Control **1.8** – Travel Demand Management **7.1** – Archived Data Function	**AD1** – ITS Data Mart **ATIS1** – Broadcast Traveler Information **ATMS06** – Traffic Information Dissemination **ATMS16** – Parking Facility Management **ATMS17** – Regional Parking Management
Transit Service and Transit Traveler Information	1.1.2, 1.1.7, 1.3.1, 1.3.2, 2.1.2, 2.1.3, 3.1.3, 3.4.1, 3.4.2, 3.5.1	**2.1** – Public Transportation Management **2.2** – En-route Transit Information **7.1** – Archived Data Function	**AD1** – ITS Data Mart **APTS1** – Transit Vehicle Tracking **APTS2** – Transit Fixed-Route Operations **APTS8** – Transit Traveler Information
Weather and Road Condition Information	1.1.2, 1.1.4	**1.1** – Pre-trip Travel Information **1.2** – En-route Driver Information	**ATIS1** – Broadcast Traveler Information **ATMS06** – Traffic Information Dissemination **MC03** – Road Weather Data Collection **MC04** – Weather Information Processing and Distribution
Electronic Entrance Fee Collection	1.2.1, 1.4.1, 2.2.2	**3.1** – Electronic Payment Services	**ATMS10** – Electronic Toll Collection **CVO06** – Weigh-In-Motion
Road Monitoring and Incident Management	1.2.2, 3.1.2, 3.2.1	**1.6** – Traffic Control **1.7** – Incident Management	**ATMS08** – Incident Management System
Road Construction Information and Coordination	1.1.2, 1.1.5, 1.2.3, 3.3.1, 3.3.2	**1.1** – Pre-trip Travel Information **1.2** – En-route Driver Information **8.1** – Maintenance and Construction Operations	**ATIS1** – Broadcast Traveler Information **MC08** – Work Zone Management **MC10** – Maintenance and Construction Activity Coordination
Campground Reservations and Information	1.1.1, 1.4.2	**1.5** – Traveler Services Information	**ATIS1** – Broadcast Traveler Information **ATMS06** – Traffic Information Dissemination **ATIS7** – Yellow Pages and Reservation

Table 9-18: ITS Themes for Sequoia and Kings Canyon National Parks. (cont.)

ITS Themes	ITS Objectives	User Services	Market Packages
Emissions Monitoring	1.1.8, 2.2.3	**1.9** – Emissions Testing and Mitigation	**ATIS1** – Broadcast Traveler Information **ATMS06** – Traffic Information Dissemination **ATMS11** – Emissions Monitoring and Management
Oversize Vehicle Detection	1.2.2, 2.3.1, 3.1.3	**1.2** – En-route Driver Information **4.1** – Commercial Vehicle Electronic Clearance	**ATMS19** – Speed Monitoring

9.2.1. Parking Management and Information

Description

This ITS theme involves the fusion of real-time information about parking availability along with historical information about parking occupancy and turnover to estimate current and future parking availability at popular destinations throughout the park. Real-time information would be collected through automated systems that would communicate the information to a central location. Parking availability information could be conveyed to visitors through a variety of means, including park rangers, visitor centers, and entrance gates. This information could also be communicated via changeable message signs to visitors prior to encountering the parking area. The theme also includes parking management strategies that attempt to distribute the demand for vehicle parking at popular park destinations.

A similar theme was recommended for GGNRA. The biggest difference between how this theme would be implemented at the two parks is that for GGNRA the emphasis is on providing information prior to entering the park site while at SEKI the information is needed within the park. At GGNRA, there is a need for information about full parking lots pre-trip (e.g. before leaving San Francisco) and en-route so that the visitor can choose a different park destination. This is essential at a park like GGNRA where park sites are very spread out and there are no entrance stations. For SEKI, this type of information would be provided at the entrance gate or within the park. If one parking lot is full, visitors to this park can just continue to the next site.

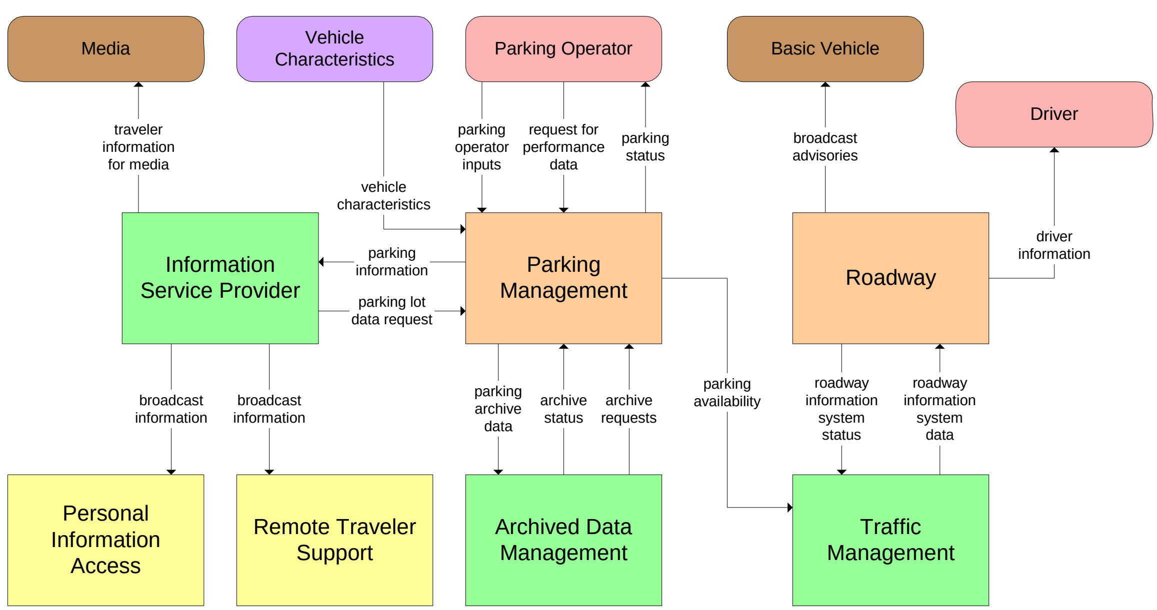


Figure 9-9: Parking Management and Information, Architecture Schematic.

Architecture Concept

Figure 9-9 provides an ITS architecture framework for the parking management and information theme. The key system elements are as shown in Table 9-19. SEKI would represent the most likely champion for this theme, as the logical places to distribute parking information are within the park. NPS could also provide the parking information to an information service provider (e.g., concessionaire, media, facility managers, Caltrans, and Tulare and Fresno Counties) for more widespread or outsourced information distribution. The information flows to support this ITS theme are summarized in Table 9-20.

Table 9-19: Parking Management and Information, Key Stakeholders.

Element	Role	Stakeholder
Archived Data Management	Collect historical parking data	SEKI Park Management
Basic Vehicle	Receives information on parking availability	Visitors
Driver	Receives information on parking availability	Visitors
Information Service Provider	Collects and repackages parking information to make it useful to visitor	SEKI Park Management
Media	Provides information on parking availability to general public	Radio, television stations
Parking Management	Tracks parking availability for all SEKI parking areas	SEKI Park Management
Parking Operator	Human operator who tracks parking availability for the park	SEKI Park Management
Personal Information Access	Provides parking information to visitors on their own device (personal digital assistant, cell phone, etc.)	Visitors
Remote Traveler Support	Provides parking information (schedules, real-time arrival info, etc.) at hotels, visitor centers and other locations	SEKI; concessionaires; facility managers (hotels, etc.)
Roadway	Provides information to visitors on parking availability	SEKI, Caltrans and/or Fresno and Tulare Counties
Traffic Management	Determines information to present to visitors based on parking availability	SEKI Park Management
Vehicle Characteristics	Vehicle count information for parking lot occupancy counts	Visitors

Scenario

Visitor. Bryan and Jenny, who live in Three Rivers, decided to spend the day at SEKI hiking and picnicking. Knowing that the park is generally crowded in the summers, they stopped at the visitor center to find out where parking would be available. Now that SEKI has a parking management and information system, this is easy. The kiosk in the visitor center told them that the parking near Moro Rock was full, but that Crystal Cave was open. As Bryan and Jenny drove by Moro Rock, they noticed that the kiosk had indeed been correct. As they pulled into the parking lot at Crystal Cave, they found plenty of parking and in return found a quieter section of the park where they could spend the afternoon.

Table 9-20: Parking Management and Information, Information Flows.

Information Flow	Description
archive requests	A request to receive historical parking information, or on the type of information to be archived
archive status	A fault report for inaccurate or missing archive data
broadcast advisories	Analog messages sent by radio to visitors
broadcast information	General broadcast information about parking availability
driver information	Digital messages (e.g. changeable message signs) sent to visitors
parking archive data	Data used to analyze and monitor trends in parking demand and operational actions
parking availability	Current parking lot occupancy and availability.
parking information	Current parking availability
parking lot data request	Request for parking lot occupancy, fares, and availability
parking operator inputs	Local parking operator inputs that query current status and control the operation of the parking management system.
parking status	Parking lot operational status
request for performance data	Request for current parking service performance data
roadway information system data	Information used to initialize, configure, and control roadside systems that provide driver information (e.g., changeable message signs, HAR)
roadway information system status	Current operating status of equipment that provides real-time information (e.g. HAR, changeable message signs) to drivers
traveler information for media	General traveler information that has been provided to the media
vehicle characteristics	Vehicle count data

Park Management. Park staff has been concerned about traffic and visitor impacts with visitation increasing and no increase in the number of parking spots. Currently when parking lots fill, there is no way to get the information out to the visitors prior to their arrival at the parking lot. People start to park along the side of the road, damaging park resources, because they figure that if the parking is full at the General Sherman Tree, it must be at the General Grant Tree also so why drive all that way to find out the same result?

By putting in a parking management and information system, not only can the park decrease visitor frustration by sending them to an alternate place that definitely has extra parking, but it will protect park resources by decreasing the number of people parking in non-designated areas. It will also make the park safer (e.g. decrease number of people walking from their cars alongside the road and decrease possible incidents due to traffic congestion from people searching for a parking spot). Lastly, it will help park rangers provide correct information to their visitors, and allow them to manage where visitors are going in the park and help ensure there is not an overabundance of people at the same popular destination.

Technology Implementations

Implementation of this theme – collect parking data, transmission of parking data, and integration and analysis of parking data – would be the same as with the Parking Management and Information theme in GGNRA (see page 126) with the exception of parking information dissemination.

Dissemination of Parking Information to Visitors

Once parking information is obtained, it can be distributed to park visitors so that they can do one or more of the following: 1) adjust their park destination and schedule to avoid congested parking areas; or 2) manage their expectations and perhaps mentally prepare for delay and congestion at popular destinations.

Communication of parking lot availability to visitors should focus both on visitors in the immediate vicinity of parking lots and visitors at entrance stations and visitor centers to enable them to adjust their stopping schedule at major destinations during their park visit. For example, visitor centers and entrance stations are logical and convenient places to provide parking information. Parking information can be provided in a variety of ways. Computer kiosks or TV monitors could be used in visitor centers to display parking information or even “live” images from parking areas near popular destinations. When information is disseminated within the park, there are aesthetic concerns for how information is provided. Existing National Park Service-styled signage may be adapted to provide a simple message on parking availability. This could be done using a rotating drum to alternate between “Full” and blank messages. A static sign below could direct motorists to tune into a highway advisory radio station. Voice annunciation software could be used to translate information from the parking system into a radio-friendly status report that could be automatically played and regularly updated (every ten minutes) on the highway advisory radio. The highway advisory radio has the advantage of being able to provide more detailed information in a clearer and less visually intrusive fashion than can be done using road signs. This information could be presented in an automated fashion because of its real-time nature. Changeable message signs that are built for National Park Service specifications may also be used. Highway advisory radio would again be beneficial in order to supply more detailed information regarding parking availability.

Communication of parking lot status between park and agency stakeholders may be accomplished through a variety of automated or manual means, including automated fax service or a Web interface.

Issues

Technological Issues

- Regardless of the method used, vehicle detection may be expected to have some imprecision. The system should include a process for daily re-calibration.

- Some types of in-pavement vehicle sensors may not be well suited for the winter conditions experienced in the park (e.g., heavy snowfall, snowplowing operations, etc.).

- Preferably, the dissemination of parking information would be automated and predictive, such that it is provided automatically to visitors in advance of a parking area actually reaching capacity.

Institutional Issues

- The use of video to monitor parking areas within the park is questionable because of stakeholder concerns (i.e., privacy concerns and aesthetic appearance of cameras).

9.2.2. Transit Service and Transit Traveler Information

Description

This ITS theme involves supporting the forthcoming park-wide transit service, as well as the implementation of real-time information collection and dissemination about transit scheduling and delays. Transit information could be conveyed to visitors through a variety of means, including park rangers, visitor centers, kiosks, and the Internet. This information could also be communicated via changeable message signs to park and ride sites located away from the park.

Architecture Concept

Figure 9-10 provides an ITS architecture framework for the transit service and transit traveler information theme. The key system elements are shown in Table 9-21. SEKI would represent the

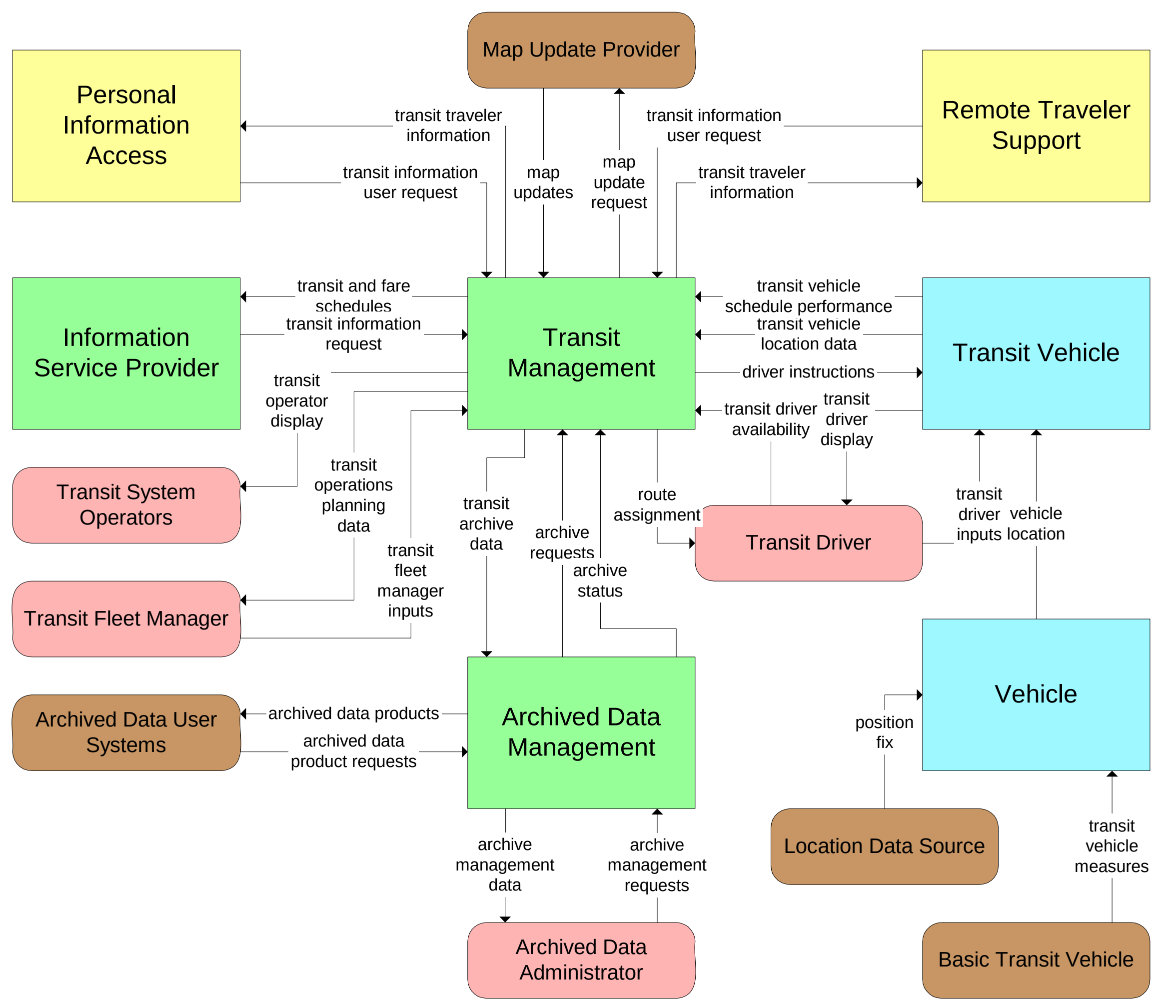


Figure 9-10: Transit Service and Transit Traveler Information, Architecture Schematic.

most likely champion for starting this theme. However, after deployment of the service, the concessionaire running the transit would be in charge of the traveler information portion of this theme and would likely need to work with SEKI, Caltrans, and facility managers to find appropriate methods of disseminating information on roadways approaching park sites. The information flows to support this ITS theme are summarized in Table 9-22.

Scenario

Visitor. Best friends Emily and Erin decided to go to SEKI for the weekend. When they got to the entrance gate they asked the ranger how parking throughout the park was. Due to the new parking and management system, the ranger told them that most parking areas were full, but suggested that they try the new transit service. Emily and Erin decided it would be easier to get around the park and see what they wanted without fighting for parking spaces so they took the ranger's advice. Not only did they see all the sites on their list, but with the real-time transit arrival information at the transit stops, they always knew when the next bus was arriving.

Park Management. Park staff has noticed that parking seems to fill up a lot quicker these days making it harder for people to access certain park sites. The implementation of transit service would help with that, plus it would reduce emissions by decreasing the number of cars within the park, and it would provide visitors who are not from the local area the chance to enjoy the park without renting a car. Transit service would also allow park employees to travel the park easier, decrease their need for private vehicles, and create new jobs for the area.

Technology Implementations

Transit Service Implementation and Operation

Figure 9-10 includes the information flows that would support fixed-route transit operations; however, as the implementation of transit service is beyond the scope of this report, these technologies will not be explored here. Park staff are currently exploring this service with other consultants. However, this report will delve into the technology implementations for transit traveler information to be deployed if a transit system is created for SEKI.

Table 9-21: Transit Service and Transit Traveler Information, Key Stakeholders.

Element	Role	Stakeholder
Archived Data Administrator	Manages transit data archive	SEKI Park Management or concessionaire
Archived Data Management	Collect historical transit data	SEKI Park Management or concessionaire
Archived Data User Systems	Uses transit data collected by SEKI	SEKI Park Management; concessionaire; NPS Western Resource Center; and others
Basic Transit Vehicle	On-board bus equipment to collect fares, provide traveler information, etc.	SEKI Park Management; concessionaire
Information Service Provider	Collects and repackages information to make it useful to visitor	SEKI Park Management; concessionaire
Location Data Source	Provides geographic reference base	GPS provider
Map Update Provider	Provides digitized updates of maps	Private-sector provider
Personal Information Access	Provides transit information to visitors on their own device (personal digital assistant, cell phone, etc.)	Visitors
Remote Traveler Support	Provides transit information (schedules, real-time arrival info, etc.) at fixed locations (hotels, visitor centers, etc.)	SEKI Park Management; concessionaire; facility managers (hotels, SEKI, etc.)
Transit Driver	Drives transit vehicles	SEKI Park Management; concessionaire
Transit Fleet Manager	Plans operation of transit fleets, including monitoring and controlling transit route and maintenance schedules	SEKI Park Management; concessionaire
Transit Management	Operates transit service within SEKI	SEKI Park Management; concessionaire
Transit System Operators	Responsible for day-to-day operations and monitoring of SEKI transit system	SEKI Park Management; concessionaire
Transit Vehicle	Provides transit access to SEKI park sites	SEKI Park Management; concessionaire
Vehicle	Equipment of transit vehicle	SEKI Park Management; concessionaire

Table 9-22: Transit Service and Transit Traveler Information, Information Flows.

Information Flow	Description
archive management data	Information used to support managing an ITS archive
archive management requests	Commands, requests, and queries that support administration and management of an ITS data archive
archive requests	A request to receive historical transit information, or on the type of information to be archived
archive status	A fault report for inaccurate or missing archive data
archived data product requests	A user-specified request for archived data products
archived data products	Raw or processed data products provided to a user upon request
driver instructions	Transit service instructions and other information for transit drivers
map update request	Request for a map update, including map layer updates
map updates	Map update, including new real-time map or map layer(s) update
position fix	Information that provides a vehicle's geographical position
route assignment	Route assignment information for transit driver
transit and fare schedules	Specific transit and fare information including schedule adherence
transit archive data	Data regarding transit demand, operations, and system performance
transit driver availability	Data used to develop driver assignments and operations schedules
transit driver display	Video or audio information to transit driver containing status of various ITS services
transit driver inputs	Transit driver emergency request as well as fare transaction data
transit fleet manager inputs	Inputs that establish system operating requirements and procedures
transit information request	Request for real-time schedule and availability information
transit information user request	Request for real-time schedule and availability information
transit operations planning data	Information supporting transit system planning and management
transit operator display	Display for transit operations personnel regarding performance of the transit fleet, current ridership and on-time performance
transit traveler information	Includes schedules, real-time arrival information, fare schedules, and general transit service information
transit vehicle location data	Current location provided by a transit vehicle
transit vehicle measures	Transit vehicle status measured by on-board ITS equipment
transit vehicle schedule performance	Estimated times of arrival and anticipated schedule deviations reported by a transit vehicle
vehicle location	Location of vehicle which is exchanged between vehicle subsystems

Collect Transit Service Information

Information such as bus routes, schedules, fares, and travel times for bus routes serving park sites and terminal locations in or near park sites would need to be entered into the system. This should include information on vehicle accessibility and the ability to transport bicycles. This information would be primarily static in nature updated as system service levels change.

Collect Parking Congestion Information

Collecting and distributing real-time information about parking congestion at specific sites within the park may encourage greater usage of transit. If the visitors knew that they could not drive to a site due to parking, but could visit if they took transit, it may cause them to switch modes. The means for doing this were described under the Parking Management and Information theme for GGNRA (see page 128).

Collect Vehicle Location Information

The system will need to be able to track vehicle location for all vehicles serving park sites. This information could be distributed to visitors to tell them when the next bus will arrive. This will allow them to know whether or not the bus is delayed and whether or not they missed the scheduled bus. This will require instrumentation of each vehicle with AVL equipment and the usage of either a satellite-based GPS or ground-based reference markers. Integrated systems are available that will track vehicle location and assist in service planning and monitoring as well.

Dissemination of Transit Traveler Information to Visitors

Transit information could be conveyed to visitors through a variety of means, including park rangers and visitor centers, kiosks, the Internet, as well as some limited information at transit stops. For information provided at transit stops, it is important that this be done in an aesthetically appropriate manner.

Issues

Technological Issues

- The feasibility of providing transit vehicle tracking should be explored. Potential transit users will be more likely to shift modes if they know when the next bus arrives.

- Potential transit users are also less likely to drive their private vehicles if they are aware that they will be unable to park their vehicle. Therefore, parking management and information may be an integral part of ensuring success of the SEKI transit system.

- The transit system should be designed to make it more accessible to the broad cross-section of international visitors who may wish to access park sites using transit.

Institutional Issues

- Gateway communities may have concerns about the effects of transit operations on local businesses if buses go outside of the park. SEKI will need to work closely with the gateway communities to ensure that their concerns are addressed.

9.2.3. Weather and Road Condition Information

Description

This ITS theme involves the monitoring and provision of up-to-date information on weather and road conditions. The road conditions include road closures, chain control restrictions, and/or road surface conditions. Weather conditions may be monitored using a variety of field-based environmental sensors. Weather and road condition information could be conveyed to visitors through a variety of means, including park rangers and visitor centers, kiosks, and the Internet. This information could also be communicated via changeable message signs prior to entrance into the park.

Architecture Concept

Figure 9-11 provides an ITS architecture framework for the weather and road condition information theme. The key system elements are as shown in Table 9-23. SEKI would represent the most likely champion for this theme; however, they would likely need to work with Caltrans, the media, and the National Weather Service to find appropriate methods of disseminating information on road and weather conditions both in the park and on roadways approaching park sites. The information flows to support this ITS theme are summarized in Table 9-24.

Scenario

Visitor. Josh and Claire are Montana natives and therefore are used to the always-changing winter driving conditions, so they had no concerns about visiting SEKI in the winter. As they were approaching the park, though, they wondered how bad the road conditions would be and whether chains would be required for their rental vehicle. (If they could find out while in Three Rivers, it would save them from coming back to town to rent them.) Remembering that Montana has a traveler information number, 511, to get this type of information, they wondered if SEKI

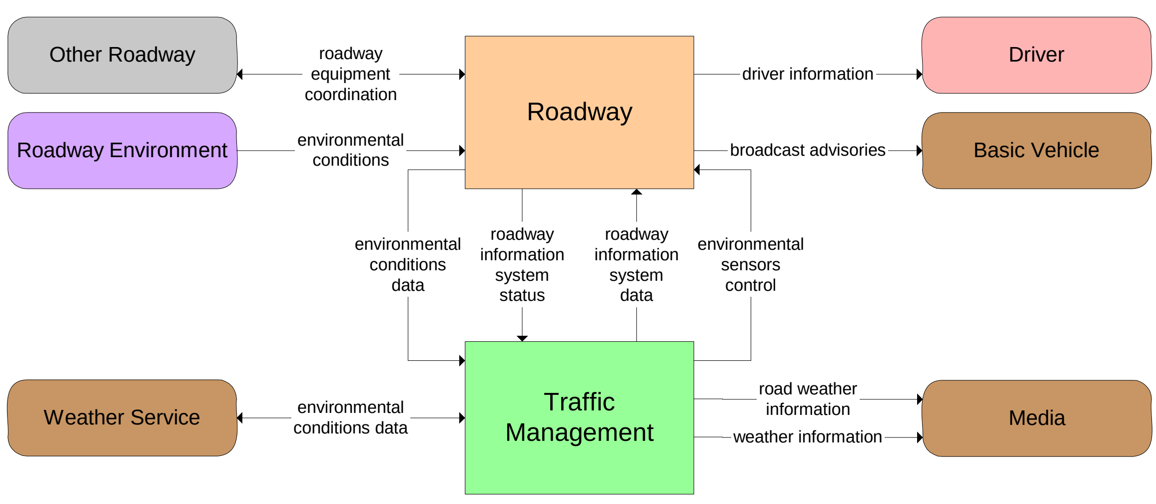


Figure 9-11: Weather and Road Condition Information, Architecture Schematic.

Table 9-23: Weather and Road Condition Information, Key Stakeholders.

Element	Role	Stakeholder
Basic Vehicle	Receives information on road weather conditions	Visitors
Driver	Receives information on road weather conditions	Visitors
Media	Provides information on road weather conditions (including chains requirements) to general public	Radio, television stations
Other Roadway	Collects road weather data	SEKI Park Management; Caltrans District 6
Roadway	Collects road weather data and provides en-route road conditions information	SEKI Park Management; Caltrans District 6
Roadway Environment	Physical condition and geometry of the road surface and the conditions surrounding the roadway	SEKI Park Management
Traffic Management	Collects road weather data and makes road status decisions (e.g. chains, road closures)	SEKI Park Management
Weather Service	Provide current and forecast weather conditions	National Weather Service or other providers

had the same. As they approached Three Rivers a changeable message sign said TUNE TO 1510 AM FOR ROAD CONDITIONS. When they tuned to the highway advisory radio, they discovered that they did indeed need chains, but that they should be able to make it to the lodge in SEKI. This information put their minds at rest and saved them from an additional trip into town.

Park Management. Due to the fact that SEKI has significantly different weather and driving conditions from the gateway communities, the staff who work at the entrance stations are used to telling people what the road conditions are and whether or not chains are required. They are also used to making people go back to town for the appropriate equipment and listening to many complaints. Being able to provide visitors with this information before they leave town will not only make the entrance station staff job easier, but it will improve the park experience for the visitors. Park staff feel that visitors will be more satisfied with their visit to the park if useful information can be provided to visitors sooner.

Table 9-24: Weather and Road Condition Information, Information Flows.

Information Flow	Description
broadcast advisories	Analog messages sent by radio to visitors
driver information	Digital messages (e.g., changeable message signs) sent to visitors
environmental conditions	Current road and surface weather conditions that are measured by environmental sensors
environmental conditions data	Current road and surface weather conditions that are measured and reported by environmental sensors
environmental sensors control	Data used to configure and control environmental sensors.
road weather information	Road conditions and weather information that are made available by road maintenance operations to other transportation system operators
roadway equipment coordination	Direct flow of information between field equipment
roadway information system data	Information used to initialize, configure, and control roadside systems that provide driver information (e.g., changeable message signs, HAR)
roadway information system status	Current operating status of equipment that provides real-time information (e.g., HAR, changeable message signs) to drivers
weather information	Accumulated forecasted and current weather data

Technology Implementations

Collect Weather and Road Condition Data

The National Weather Service provides basic weather observations and forecasts, which could be combined with local weather information gathered from park rangers and staff at various locations within the park. Road conditions, road closure, and chain requirement information would come from maintenance and other park staff. Fixed weather stations could be installed to gather information at isolated locations; however, the availability of power and communications will be an issue at isolated roadside locations.

Transmission of Weather and Road Condition Data

Various wireless and wireline solutions may be used interchangeably for communicating information on weather and road conditions to a central location. A variety of technologies would be able to satisfy the minimal bandwidth needs of this data.

Dissemination of Weather and Road Condition Information to Visitors

Once weather and road condition information is obtained, it can be distributed to park visitors so that they can do one or more of the following: 1) adjust their park visit and schedule to avoid hazardous weather or road conditions; or 2) come to the park better prepared (i.e., tire chains, 4-wheel drive, etc.).

Basic information on road conditions and closures within the park already exists but is disseminated in a limited number of ways, such as recorded phone messages (General Park Information at 559-565-3341), visitor centers and relatively static signs just outside of park boundaries (see Figure 9-12). The survey results indicated that at least half of the park visitors were not obtaining this information. This could be the result of visitors not being aware of the information service or not knowing they needed road condition information. Road and weather information should be provided at times and locations when travelers can adjust their trips accordingly or come to the park better prepared. Thus there is a need to provide road and weather information through several additional information distribution channels, such as Internet Web sites (e.g., the existing Park site at http://www.nps.gov/seki or other sites), changeable message signs (see Figure 9-13), highway advisory radio (HAR), and a more widely publicized phone message system.

Figure 9-12: Existing Static Road Conditions Sign along CA 180 near Dunlap.

Weather and road condition information should be provided at appropriate times and locations so as to be useful for travelers' decisions. Weather and road condition information could be conveyed to visitors through a variety of means, including park rangers, visitor centers, kiosks, and the Internet. This information could also be communicated via changeable message signs prior to entrance. Caltrans, the counties, tourist bureaus, lodging, business groups, gateway communities, and concessionaires should also be asked to disseminate this information.

Figure 9-13: Existing Caltrans Changeable Message Sign along CA 180 near Orange Cove.

Issues

Technological Issues

- Although additional road and weather monitoring stations at certain locations are desirable, existing resources may be best utilized by better distributing the information that is currently available. The cost for installing remote road and weather monitoring stations could be high because of their isolated location and the extra costs of providing power and communications.

Institutional Issues

- As indicated above, the park should explore distributing the existing road and weather information through other means. These other means will likely involve partnerships with Caltrans and other regional or local agencies that are also in the business of distributing road and traveler information. For example, Caltrans provides up-to-date road condition information at http://www.dot.ca.gov/hq/roadinfo/ and mountain pass closure information (historical and real-time) at http://www.dot.ca.gov/hq/roadinfo/clsdates.htm. The park should pursue partnerships with Caltrans and other agencies (local cities like Fresno) to share and distribute road condition information within the parks. Discussion at stakeholder meetings indicated some past institutional conflicts with the types of information and how they were being distributed. Park staff should resolve these issues in a regional setting and formalize information sharing and distribution policies with partner agencies. Agencies in the region (particularly Caltrans) should recognize the value of sharing information and information dissemination resources (such as Internet sites or changeable message signs).

9.2.4. Electronic Entrance Fee Collection

Description

This ITS theme involves the electronic collection of entrance fees, therefore reducing the number of people that would need to wait in line at the manual entrance station and improve the visitor experience. This would reduce delay to park visitors at entrance stations by providing an automated electronic payment option, and would improve the safety for vehicles approaching an entrance station and unexpectedly encountering stopped vehicles. A transponder could be developed for an individual park unit, but would have greater utility if it were implemented on a system wide basis, perhaps in conjunction with the NPS annual pass. In order to ensure that visitors get current park information, system logic would be built that would allow the park to identify when the transponder had last been used for entry into that park. This would ensure that regular visitors are made aware of when more current park information is available without having to wait in a long queue.

Architecture Concept

Figure 9-14 provides an ITS architecture framework for the electronic entrance fee collection theme. The key system elements are shown in Table 9-25. Because the entrance fee transponder would be focused specifically on SEKI, SEKI would represent the most likely champion for this theme; however, as this has the potential to become a device with interoperability at various NPS units, the National Park Service should be a significant stakeholder as well. The information flows to support this ITS theme are summarized in Table 9-26.

Scenarios

Visitors. This year when Jack and Jill bought their National Park Pass off the Internet, they got the option of getting a normal pass or a transponder. After reading about the transponder and

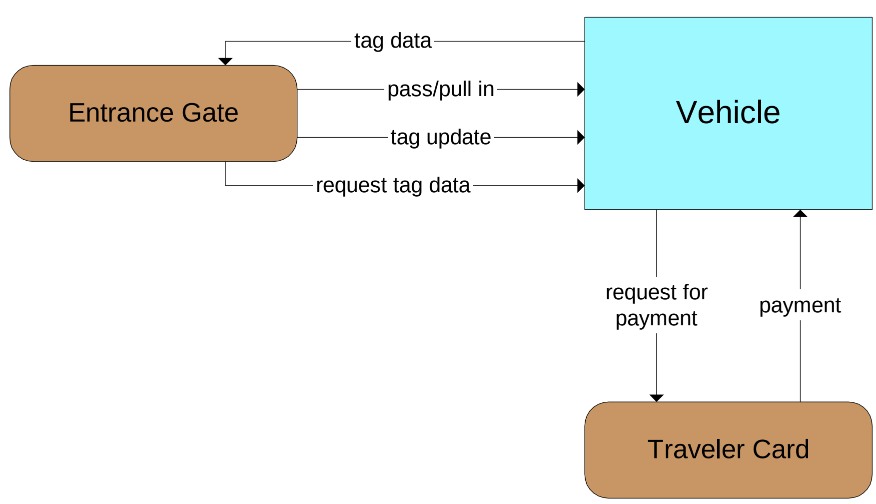


Figure 9-14: Electronic Entrance Fee, Architecture Schematic.

how it could save time at entrance gates to their favorite National Parks, they decided to get it. The first time they used it was at SEKI. The line to get into the park went two miles back. Luckily, Jack and Jill could use the automated line and had no wait. As they passed by the transponder reader, a light indicated to them there was new information on the park since their last visit to SEKI, six months earlier. The light indicated that they should stop to pick up a park newspaper at the visitor center because they had bypassed the manned entrance station. Jack and Jill decided that the park made a good investment when they decided to automate entrance fee collection, because they were able to avoid the long queue at the entrance gate and still obtain current information to make their park visit more enjoyable.

Park Management. The implementation of this program would allow for decreased delays at entrance stations and a more enjoyable visitor experience instead of having visitors scrambling to find cash. It would also allow for statistics to be collected on which parks people are visiting when they go to multiple parks.

Table 9-25: Electronic Entrance Fee Collection, Key Stakeholders.

Element	Role	Stakeholder
Entrance Gate	Automatically charges entry for vehicles with transponders	SEKI Park Management
Traveler Card	Transponder permitting automatic entry into park	NPS owns transponders; visitors maintain possession
Vehicle	Seeks entry into park with transponder	Visitor with transponder

Table 9-26: Electronic Entrance Fee Collection, Information Flows.

Information Flows	Description
pass/pull in	Message to vehicle indicating whether they need to get updated park information
payment	Payment of some kind (e.g., toll, parking, fare) by traveler which, in most cases, can be related to a credit account
request for payment	Request to deduct cost of service from user’s payment account
request tag data	Request for transponder information
tag data	Unique tag ID and related vehicle information
tag update	Update data held in tag which can be read by another device

Technology Implementations

For parks charging admission at a manned ranger station, this theme could decrease visitors' wait time at entrance stations as those with electronic entrance fee cards could go through a different line and therefore be processed more quickly.

Electronic Transponders/Collect Entrance Fees

Instead of purchasing a National Parks Pass, those interested in participating in this program would purchase a transponder that would allow them into all of the parks just like a park pass, but would also allow them to bypass the long lines at the park entrances.

Electronic transponders are commonly used in many toll highway applications and have reduced delays at toll collection plazas when implemented. The electronic transponder technology is proven and has even been tested in other commercial environments, such as fast food drive-thru lanes. Most transponders or tags are typically the size of a credit card and mounted onto the vehicle windshield. Regular and/or frequent park visitors could establish a tag account and create an initial balance in the account, with entrance fees deducted from the account balance as a debit transaction. Park or concessionaire staff could also obtain a tag to bypass entrance lines on the way to work.

Electronic Payment Infrastructure

The electronic payment infrastructure includes roadside equipment (i.e., antenna, electronic controller and communications hardware, environmental enclosure) and back-office computer systems (i.e., valid user account database, financial transaction system). The roadside equipment would be placed in a separate bypass lane to enable vehicles with tags to skip long lines at entrance stations. The roadside equipment could be connected to the back-office computer systems via a wireline or wireless connection. Wireless connections would be advantageous where entrance stations are somewhat removed from other office facilities.

Two closed circuit cameras would also be needed for each bypass lane to record license plates of cars that go through this lane without a valid transponder. Equipment would also be needed to track when the last time the transponder had been to this park. If new park information had become available since then, a message would light up to inform the driver to stop at a visitor's center to collect this information.

Partner with Financial Institutions

NPS would need to partner with financial institutions to provide visitors with options for using the card. This would ensure that parks with fee demonstration projects could charge a fee to transponder holders. Options could include putting money on the card and being able to purchase until you spend the set amount of money, having the transponder linked to a credit card or checking account, using it like a credit card where you would get a bill every month, or putting a set amount of money on the card and when it gets below a limit, charging the credit card or debiting the checking account so that the transponder's stored value is reset to a user-specified amount.

Issues

Technological Issues

- Some parks do not have multiple lanes at their entrance gates, which may remove much of the benefit of installing this system to reduce entrance gate congestion. A bypass lane would be needed alongside the regular cash payment lane. Limited construction right-of-way may preclude the ability to provide a bypass lane far enough back to avoid long queues on busy days.

- The existing national park pass would need significant modification to function as an in-vehicle transponder.

- Yellowstone National Park has implemented electronic bypass transponders for employees and concessionaires at the North and Northeast entrance stations. Early results from this implementation indicate that if the reader is not positioned correctly it will err by reading vehicles other than those in the front of the queue. Also, without usage of transponders by visitors, the impact on entrance queues has been minimal.

- The NPS has considered the sale of a “smart card” that is similar in function to the current National Parks Pass. Such a smart card could also presumably be used as an electronic transponder to pay entrance fees in most National Parks.

Institutional Issues

- There may be some privacy issues with attempting to take statistics off the transponders that are used.

- Each park unit may have its own vision for how a transponder would be used; however, a national vision and standard must be developed to ensure maximum benefit and efficiency of transponders implemented at any particular park.

- The park will own the transponders, but the visitors will use them. Therefore, will people need to pay an additional charge for the transponder, or just that of the normal National Park Pass? In California, transponder users are not charged a deposit if they secure the transponder with a credit card and have fewer than three transponders on their account. For transponder accounts paid for using cash or checking accounts, a deposit is required. In New York drivers are not charged for the transponder, while in Massachusetts they are.

- Park staff has indicated that they like to present an “entrance experience” to visitors entering the park by personal contact with uniformed park staff that can answer questions and provide up-to-date information on roads and weather. Thus park staff are hesitant to eliminate this personal interaction at the entrance stations.

- Park and concessionaire employees reportedly already bypass entrance queues so they would not benefit from the electronic entrance bypasses.

9.2.5. Road Monitoring and Incident Management

Description

This ITS theme would help park management to respond to natural disasters (e.g. fires, landslides, avalanches) and accidents on Generals Highway. Its primary emphasis would be improving monitoring activities along Generals Highway to ensure a prompt response to incidents. By getting visual confirmation on incidents earlier, park management can reduce delay in responding to incidents, improving visitor safety and reducing incident-induced congestion.

Architecture Concept

Figure 9-15 provides an ITS architecture framework for the road monitoring and incident management theme. The key system elements are as shown in Table 9-27. Because monitoring activities would occur only within park boundaries, SEKI would represent the most likely champion for this theme. However, park management will also wish to be in contact with park police and park maintenance staff as needed to respond to specific incidents, so these stakeholders would need to have an integral role in this theme as well. The information flows to support this ITS theme are summarized in Table 9-28.

Scenario

Visitor. Rick and Carla went to SEKI for the afternoon. They had heard that conditions in the park were dry, but were not aware of any roadways being closed due to fire. While they were at the park, however, a forest fire started near Generals Highway. Rick and Carla knew from previous experience that their cell phone was of no use in this part of the park, and they saw that traffic was backed up so that no vehicles could easily get through. Fortunately, SEKI had implemented the road monitoring and incident management theme and therefore the fire was noticed immediately. Rangers were already on their way to the location to block off the road.

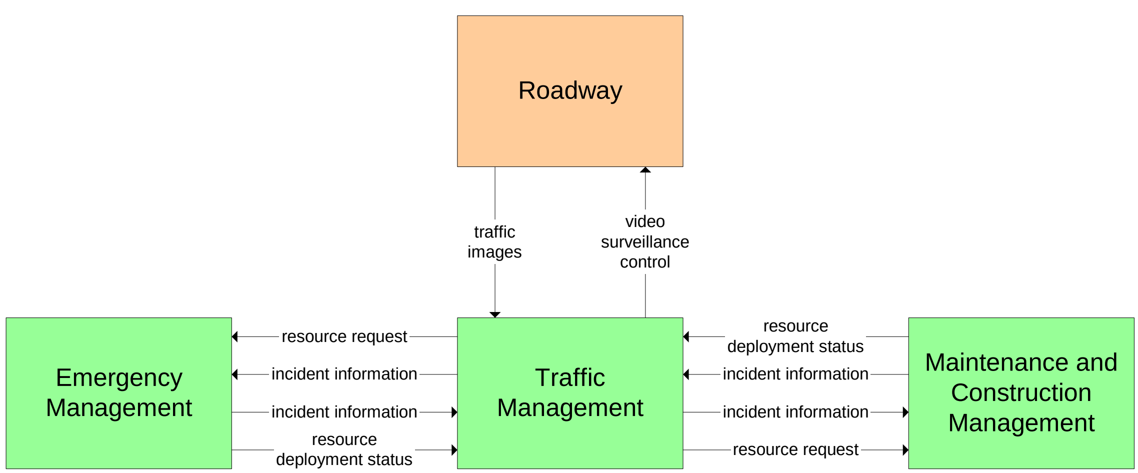


Figure 9-15: Road Monitoring and Incident Management, Architecture Schematic.

Table 9-27: Road Monitoring and Incident Management, Key Stakeholders.

Element	Role	Stakeholder
Emergency Management	Park staff responsible for responding to emergencies	SEKI Park Police; others as needed
Maintenance and Construction Management	Responsible for park maintenance activities, including clearing park roadways	SEKI Park Management
Roadway	Provides images of traffic on Generals Highway	SEKI Park Management
Traffic Management	Monitors congestion and incidents on Generals Highway and initiates incident response as needed	SEKI Park Management

Table 9-28: Road Monitoring and Incident Management, Information Flows.

Information Flow	Description
incident information	Notification of existence of incident and severity, location, nature, and expected duration of incident
resource deployment status	Status of resources deployed by traffic management center to assist in incident response
resource request	A request for traffic management resources to aid incident response
traffic images	Real-time or snapshot traffic images of traffic, parking facilities, or park sites
video surveillance control	Information used to configure and control video surveillance systems

Other park staff worked to provide information to visitors via HAR and CMS regarding why the road was blocked and where they should detour to. The additional warning allowed Rick and Carla to make a safe exit from the park.

Park Management. Currently, there is no way to detect incidents or natural disasters, determine their location, or provide the information to the visitors except by personal observation and word of mouth. With this system in place, the rangers will be able to monitor the park to allow a quicker response to incidents and natural disasters, provide information to travelers well in advance of the delay, and have the information provided to tourists by technology, therefore leaving more rangers to deal with the incident or natural disaster.

Technology Implementations

Monitor Road

This service could take advantage of the clear views of the Generals Highway as it climbs to the Giant Forest area. One of the best vantage points may be on South Mountain near Milk Ranch Peak, where an electronic relay station is currently positioned. A video camera with telephoto lens and pan/tilt/zoom capabilities could be used to remote monitor the steep, sharp switchbacks as Generals Highway climbs from the Ash Mountain entrance to Giant Forest. Because of the clear line-of-sight, numerous wireless video transmission technologies could be used here. The video camera and power source would be located at this or other nearby vantage points, and the video monitors could be located near a central dispatch area in the Ash Mountain maintenance complex.

Identify Incidents and Natural Disasters

A ranger would need to be present at the monitoring station to either look manually (with binoculars) or technologically (by watching television monitors) to identify incidents and natural disasters that occur within the park boundary. This information would then need to be transferred to SEKI park police, SEKI park management, and the travelers. This information could be transmitted using a variety of wireless or wireline technologies (e.g. phone, Internet, automatically triggered CMS).

Create an Incident Response Plan

This plan would be created by a third party, but should have the input of SEKI, Caltrans, local Police, CHP, other local law enforcement and emergency management agencies, and the US Forest Service. The plan would include names and phone numbers for contacts at each agency in the event of an incident, alternative routes based on incident location and severity, and procedures for getting information out to visitors both within and outside the park. The plan would also contain message sets to be used in the event that highway advisory radio or changeable message signs will be used to disseminate the information. This plan should be written in a way that it will be useful and accessible in the time of need. The plan would also specify each player’s roles and responsibilities in the case of an emergency (i.e. who would be responsible for traffic control, who is responsible for putting the message on the CMS, etc).

Dissemination of Incident Information to Visitors

Evacuation and incident information should be provided at appropriate times and locations so as to be useful for travelers’ decisions. Evacuation and incident information could be conveyed to visitors through a variety of means, including word of mouth, park rangers, visitor centers, kiosks, highway advisory radio, and the Internet. This information could also be communicated via changeable message signs prior to entrance. Depending upon incident severity, Caltrans, the counties, tourist bureaus, lodging, business groups, gateway communities, and concessionaires should also be asked to disseminate this information.

Issues

Technological Issues

- The implementation of this theme largely takes advantage of a key vantage point that is already utilized for an electronic relay station. As such, it represents a relative low-cost “target of opportunity.”

- Each organization involved in the incident response plan should have adequate communications infrastructure to fulfill their roles and responsibilities in the emergency response plan. The plan should also include consideration of back-up plans in case the communications infrastructure is affected by the emergency (for example, cellular tower infrastructure shuts down).

Institutional Issues

- NPS staff has indicated that vehicle crashes or incidents along this part of Generals Highway are not very severe due to the slow vehicle speeds. However, the steep and winding grade of the road as well as the steepness of roadside embankments certainly has the potential for more severe incidents.

- The use of video monitoring would require park staff to watch monitors. This could be difficult to do with existing staff, or it may be ineffective if existing staff are busy with other job duties.

- The incident response plan should be reviewed regularly to ensure that all contact information and protocols are still appropriate.

- Though there is a consensus about protecting the public, it may be difficult to get all the players to agree on specific roles and responsibilities.

- Creating an incident response plan has no value if it is not utilized. The agencies involved have to agree to use this plan in the time of need.

9.2.6. Road Construction Information and Coordination

Description

This ITS theme involves the coordination of road construction information between park staff and local agencies so that visitors are provided with better information on construction and work zone activity in or near the park. This theme would help park visitors to better plan their visit to avoid construction delay areas. This theme would also assist in coordinating construction project activities between construction personnel, park staff, and concessionaire employees.

Architecture Concept

Figure 9-16 provides an ITS architecture framework for the road construction information and coordination theme. The key system elements are as shown in Table 9-29. Because of their familiarity with how visitors will be impacted by construction, SEKI would represent the most likely champion for this theme. However, the park would need to work closely with Caltrans to ensure that staff is aware of road construction projects outside the park that may affect park access. The park will also need to work with a variety of information outlets, including the media, to determine the best way to disseminate the information. The information flows to support this ITS theme are summarized in Table 9-30.

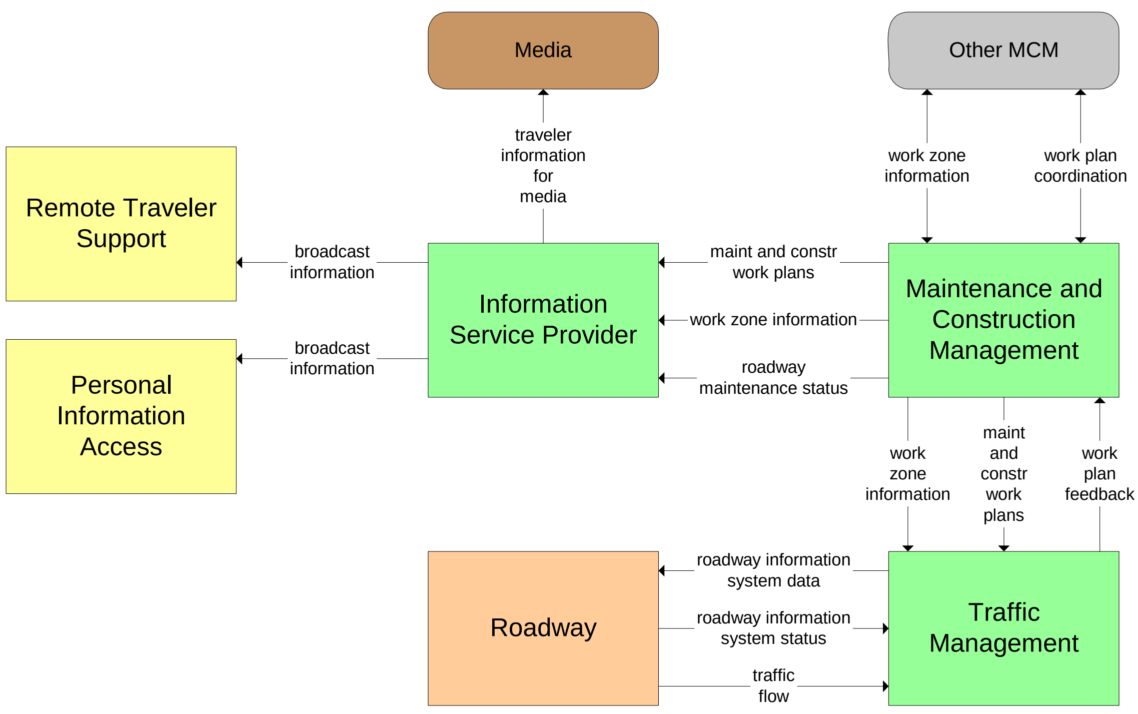


Figure 9-16: Road Construction Information and Coordination, Architecture Schematic.

Table 9-29: Road Construction Information and Coordination, Key Stakeholders.

Element	Role	Stakeholder(s)
Information Service Provider	Provides information regarding current road construction activity in or near park	Caltrans; SEKI Park Management
Maintenance and Construction Management	Manages work zone activities that may affect capacity on roadways serving park	SEKI Park Management; Caltrans District 6
Media	Provides information on road construction to general public	Radio and television stations, newspapers
Other MCM	Manages and coordinates work zone activities that may affect capacity on roadways serving park	SEKI Park Management; Caltrans District 6
Personal Information Access	Provides road construction information to visitors on their own device (personal digital assistant, cell phone, etc.)	Visitors
Remote Traveler Support	Provides road construction information to visitors at fixed locations (visitor centers, hotels, etc.)	Facility managers (SEKI Park Management, concessionaire, hotels, etc.)
Roadway	Includes capability to inform drivers of construction activity	SEKI Park Management; Caltrans District 6
Traffic Management	Reviews work zone plans and provides road construction information to public en-route	SEKI Park Management; Caltrans District 6

Scenario

Visitor. As residents of Fresno, Kade and Shelley were considering a trip to SEKI for the afternoon. Their only concern was the construction they knew was bound to be going on in the park. They hated not knowing where in the park the construction was and how long they would be delayed. They decided to go to the park anyway and were pleasantly surprised to learn that the park had implemented a road construction information and coordination system. Because of this, they were informed of the construction and the potential delays. They also had options of how to get the information. The changeable message sign on SR 180 provided information as did a kiosk at the visitor center and a message on the highway advisory radio. The radio message informed them that the information could also be gathered on public-access television stations in the valley. Kade and Shelley had a great time in the park even with the construction activity, and now feel better prepared for their next trip.

Table 9-30: Road Construction Information and Coordination, Information Flows.

Information Flow	Description
broadcast information	General broadcast information about road construction
maint and constr work plans	Future work zones with anticipated traffic impacts
roadway information system data	Information used to initialize, configure, and control roadside systems that provide driver information (e.g., changeable message signs, HAR)
roadway information system status	Current operating status of equipment that provides real-time information (e.g. HAR, changeable message signs) to drivers
roadway maintenance status	Summary of maintenance fleet operations affecting the road network
traffic flow	Processed traffic data which helps to identify congested locations
traveler information for media	General traveler information that has been provided to the media
work plan coordination	Coordination of work plan schedules and activities between maintenance and construction organizations
work plan feedback	Feedback on proposed construction and maintenance work schedules and activities
work zone information	Plans for work zones that may impact traffic

Park Management. This new system will allow the park to coordinate with other stakeholders that may be doing construction in the area, such as contractors and Caltrans. It will allow SEKI to provide real-time information about construction activities to the tourists through a variety of means and it will allow the park to manage/detour traffic around the construction for safety and delay reasons if needed.

Technology Implementations

As with the other information types, most of the information that is available is typically not widely disseminated. The road construction information could be disseminated in the same way that road condition information is distributed.

Collect and Coordinate Work Zone Data

Each road agency with a maintenance and construction program will have documentation about how traffic will be staged through the work zone. A geographically-based database may be developed that would code anticipated work zone activities based on the dates of activity, the geographic limits of the project, anticipated lane closure durations, and associated speed reductions. Some or all of the road agencies may already have the information to populate this database. SEKI would then need to develop and maintain a database application that could pull information from the road agencies' databases and reorganize the data into a uniform format. This type of database activity has been used by several states including the Oregon Department of Transportation with its Highway Travel Conditions Reporting System (HTCRS), and multi-state efforts including the Condition and Accidents Reporting System (CARS) and the Highway Conditions Reporting System (HCRS).

Dissemination of Road Construction Information to Visitors

Road construction information should be provided at appropriate times and locations so as to be useful for travelers' decisions. The road construction information could be disseminated in the same way that road condition information is distributed. It could be conveyed to visitors through a variety of means, including park rangers, visitor centers, kiosks, and the Internet. This information could also be communicated via changeable message signs prior to entrance. Caltrans, the counties, tourist bureaus, lodging, business groups, gateway communities, and concessionaires should also be asked to disseminate this information.

Issues

Technological Issues

- A database to collect and analyze the multitude and diversity of data sources for construction activity will need to be created and maintained. This will need to be developed in a manner that minimizes double-entry by SEKI or other stakeholders, otherwise it will likely not be used.

Institutional Issues

- As with other road condition and closure information, park staff should formalize information sharing and distribution policies with Caltrans and other agencies that are likely partners in disseminating road information within the park.

- This theme necessitates getting the key agencies to work together to provide sufficient real-time data to provide to visitors. This may require special agreements with a variety of stakeholders.

9.2.7. Campground Reservations and Information

Description

A campground reservations system would assist park visitors in ensuring that they will have overnight accommodation in the location of their choice. Campground information and availability would also be useful but is difficult to collect and provide on a frequent basis. Presumably the availability of campsites would be determined by park staff that are in the general area of the campgrounds and can determine if campsites are available. This could be integrated with the U.S. Department of Agriculture Forest Service campground reservation system (into which National Park Service campground reservations will be integrated). This could provide an improved visitor experience for those people who have reservations and therefore do not have to search for a place to stay.

Architecture Concept

Figure 9-17 provides an ITS architecture framework for the campground reservations and information theme. The key system elements are as shown in Table 9-31. Because the reservation system would highly affect the park, SEKI would represent the most likely champion

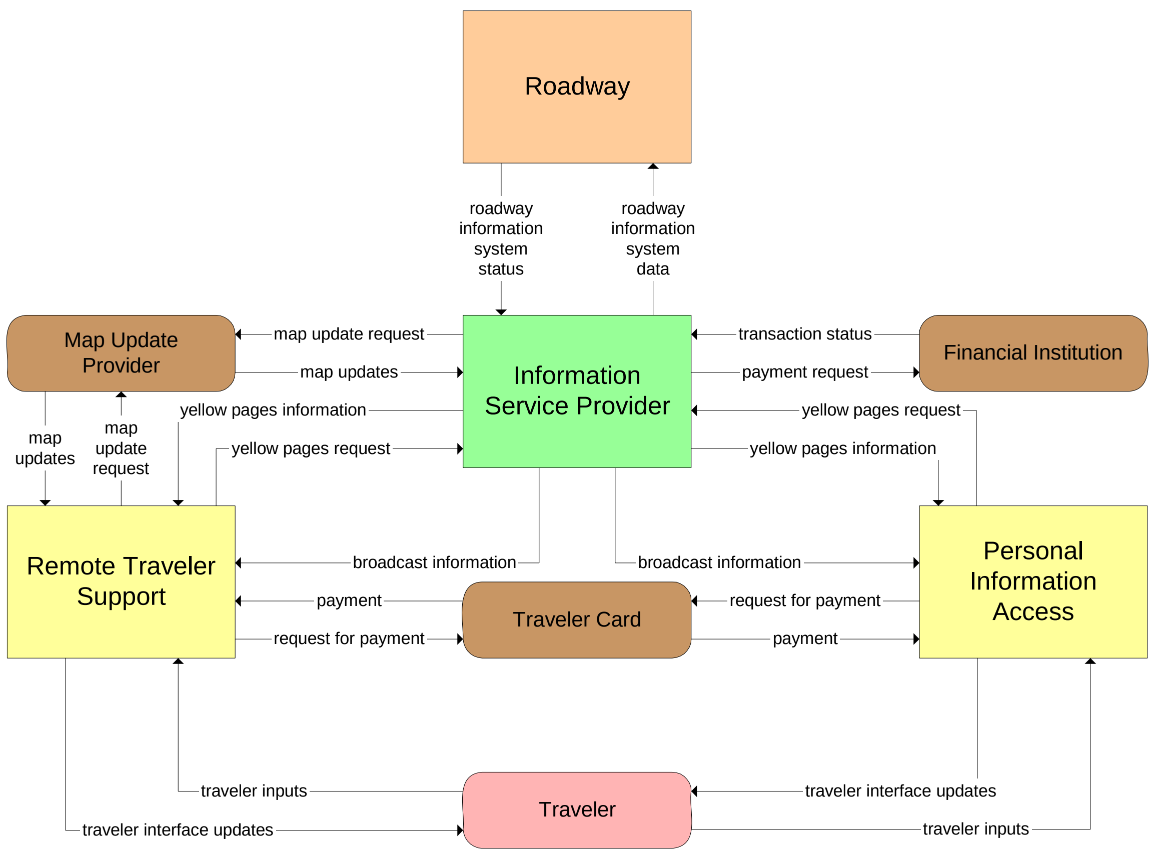


Figure 9-17: Campground Reservations and Information, Architecture Schematic.

Table 9-31: Campground Reservations and Information, Key Stakeholders.

Element	Role	Stakeholder
Financial Institution	Provides funds to cover transaction cost	Financial Institutions
Information Service Provider	Manages campground reservations in SEKI	SEKI Park Management
Map Update Provider	Provides digitized updates of maps	Private-sector provider
Personal Information Access	Provides information to visitors on their own device (personal digital assistant, cell phone, etc.)	Visitors
Remote Traveler Support	Provides information to visitors at fixed locations (hotels, airports, etc.)	Kiosk/terminal owners
Roadway	Provides campground availability information at entrance gates	SEKI Park Management
Traveler	Desires to camp in the park	Visitors
Traveler Card	Used by traveler to pay for campgrounds (as needed)	Visitors

for this theme. However, the U.S. Department of Agriculture Forest Service, financial institutions, and kiosk/terminal users would likely need to have an integral part as well. The information flows to support this ITS theme are summarized in Table 9-32.

Scenario

Visitor. James and Jaime were planning an overnight trip to SEKI. They wanted to ensure that they would be able to get a camping spot this time. Last time they went they drove around the entire park always getting to the campgrounds right after the last spot had been taken. This time they decided to use the campground reservation system they read about in the brochure that came with their National Park Pass. By making their campground reservation over the phone, not only did it ensure that they would have a campsite, but it kept James from getting frustrated trying to find a site and ruining the entire weekend.

Park Management. A campground reservation system would allow park management to provide real-time information to visitors about campground capacity and would allow the park to keep better records about what days/times the campground tends to fill up. This would also help park employees enhance the visitor experience by removing the stress of finding a campsite. The system has the potential to reduce manpower requirements by providing increased automation of reservations.

Table 9-32: Campground Reservations and Information, Information Flows.

Information Flow	Description
broadcast information	General broadcast information about campground availability
map update request	Request for a map update, including map layer updates
map updates	Map update, including new real-time map or map layer(s) update
payment	Payment of some kind (e.g., toll, parking, fare) by traveler which, in most cases, can be related to a credit account
payment request	Request for payment from financial institution
request for payment	Request to deduct cost of service from user's payment account
roadway information system data	Information used to initialize, configure, and control roadside systems that provide driver information (e.g., changeable message signs, HAR)
roadway information system status	Current operating status of equipment that provides real-time information (e.g. HAR, changeable message signs) to drivers
transaction status	Response to transaction request. Normally dealing with a request for payment.
traveler inputs	Request by a traveler to summon assistance, request travel information, make a reservation, or request any other traveler service
traveler interface updates	Visual or audio information (e.g., routes, messages, guidance) to the traveler
yellow pages information	Information on campground availability
yellow pages request	Request for information through a yellow pages type service

Technology Implementations

Make Reservation Request

To avoid visitor dissatisfaction, it is important to provide a variety of convenient methods for visitors to make reservations for park services. The Internet, visitor center kiosks, telephone, and PDAs are among the technologies that may be appropriate. The reservation system will need to be developed so that it can seamlessly work with each of these technology types and others that may develop over time. The information should be available in a menu system that would allow visitors to choose a campground and then to get more detailed information on reservations. The phone system menu should be set-up similar to a 511 system menu. The visitor will also need to receive confirmation of their reservations.

It will be necessary to include a credit card number as a part of the reservation request to pay for the campsite. The system will need to have adequate security to protect these financial transactions against fraud and theft.

Collect and Process Reservation Request

Because of its reliance on real-time information, the theme will require that the campgrounds use a computerized reservation database. This may require some park services to upgrade from a manual, pen-and-paper system to a computerized system, complete with purchase of computers, a simple database, and network communications. This theme should seek to integrate existing reservation systems that various park services have instead of creating new ones.

The information for reservation requests would include the number of campsites, the cost of campsites, person limit for campsites, check-in and check-out times, and special information for campsites (e.g. handicap accessible, showers available, and firewood available).

The park unit should seek to partner with the U.S. Department of Agriculture Forest Service to see if the park's reservation information could also be included in the Forest Service's system, or if a separate reservation system should be set-up within the park.

Provide Campground Information

Reservation systems could provide real-time feedback about the status and availability of campground locations. In addition to this, the park currently has a manually updated display board at the Ash Mountain entrance that indicates campground availability. This could be automated using an electronic message sign and information gleaned off the reservation system.

Issues

Technological Issues

- The collection of campsite availability data would most likely have to be done manually by park staff that is in the vicinity of the campsites. It would be difficult to perform and provide that information on an up-to-date basis.
- It appears that the most efficient manner to address the campground availability is through a reservations system. This enables overnight visitors to confirm the availability of campsites at their desired location.
- Maintenance and operations of these systems may be costly. Automated database-driven systems should be used to the extent possible.
- There is no single point of failure for this system as there are multiple automated connections that could make the system "go down." Therefore, back-up systems should be in place to ensure that reservation activities can continue to occur seamlessly in the event of failure of any system component.

Institutional Issues

- Although the system will benefit most visitors, there will be those that do not know about it and show up without reservations and get upset.

9.2.8. Emissions Monitoring

Description

This ITS theme involves the monitoring and dissemination of emissions information. Currently there are several monitoring stations around SEKI. The information collected from these systems is currently disseminated by word of mouth at the visitor centers. This theme will allow people to understand what the air quality is and determine whether or not they should proceed with their visit. Improved monitoring may provide benefit to regional air quality monitoring agencies.

Architecture Concept

Figure 9-18 provides an ITS architecture framework for the emissions monitoring theme. The key system elements are as shown in Table 9-33. SEKI would represent the most likely champion for this theme, as they are responsible for informing visitors of air quality concerns and maintaining monitoring equipment within the park. However, the park would likely need to work with the state forest, the San Joaquin Valley Air Pollution Control District (SJVAPCD), media, kiosk/terminal owners, and Caltrans to provide greater regional integration. The information flows to support this ITS theme are summarized in Table 9-34.

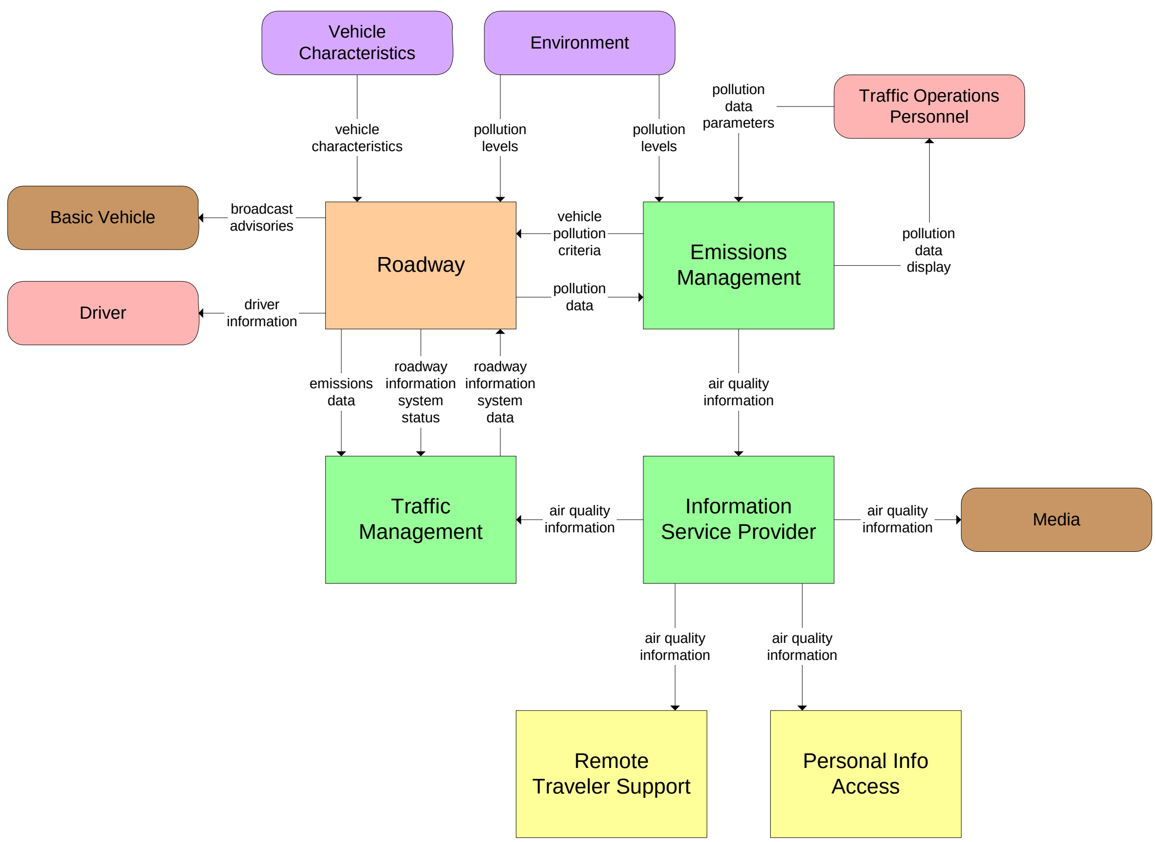


Figure 9-18: Emissions Monitoring, Architecture Schematic.

Table 9-33: Emissions Monitoring, Key Stakeholders.

Element	Role	Stakeholder
Basic Vehicle	Receives park-specific air quality information	Visitors
Driver	Receives park-specific air quality information	Visitors
Emissions Management	Interprets status of air quality to provide emissions information	San Joaquin Valley Air Pollution Control District (SJVAPCD)
Environment	Represents the natural surroundings in which ITS operates (including pollutant levels, temperature, etc.)	SEKI
Information Service Provider	Translates information on current air quality into format useful to visitors	SEKI Park Management
Media	Provides emissions information to public	Newspapers, radio, television stations
Personal Information Access	Provides information to visitors on their own device (personal digital assistant, cell phone, etc.)	Visitors
Remote Traveler Support	Provides information to visitors at fixed locations (hotels, airports, etc.)	Kiosk/terminal owners
Roadway	Roadway equipment which monitors emission levels	SEKI Park Management
Traffic Management	Provides oversight of emissions management in SEKI and communicates information to visitors	SEKI Park Management; Caltrans District 6
Traffic Operations Personnel	Provide pollution parameters for use by emissions management	SJVAPCD Staff
Vehicle Characteristics	Represents vehicle characteristics such as dimensions, weight, and number of axles that allow an individual vehicle to be measured or classified	Visitors

Scenario

Visitor. Tim wanted to take his daughter Maggie hiking at SEKI for the day, but was afraid that the emissions levels in the park would be too high for Maggie to hike comfortably due to her asthma. Tim wished there was a way to determine this before getting his three-year-old daughter's hopes up about hiking. When Tim arrived at the entrance gate, the ranger told him what the emissions levels were that day for various parts of the park. Tim asked the ranger how this information had become available, and the ranger replied that an emissions monitoring

Table 9-34: Emissions Monitoring, Information Flows.

Information Flow	Description
air quality information	Aggregated region-wide measured air quality data and possible pollution incident information
broadcast advisories	Analog messages sent by radio to visitors
driver information	Digital messages (e.g., changeable message signs) sent to visitors
emissions data	Emissions data collected by roadside equipment
pollutant levels	Atmospheric pollutant levels as monitored by air quality sensors
pollution data	Measured emissions data comprised of various atmospheric pollutants
pollution data display	Reference and current pollution details for a given area
pollution data parameters	Nominal pollution reference levels for an area
roadway information system data	Information used to initialize, configure, and control roadside systems that provide driver information (e.g., changeable message signs, HAR)
roadway information system status	Current operating status of equipment that provides real-time information (e.g., HAR, changeable message signs) to drivers
vehicle characteristics	Characteristics of a vehicle that can be measured to classify it
vehicle pollution criteria	Vehicular pollution acceptance criteria

system had been put into place with sensors located at some key locations within the park. The ranger also explained to Tim that this information was available via the visitor center, HAR, CMS, and the Internet for future reference. Luckily, the emissions levels were low enough that day that Maggie could safely hike, but Tim was glad that he could get the information prior to their next trip.

Park Management. Park staff are interested in providing an enjoyable visitor experience for tourists who are worried about current emissions levels. Currently there are several monitoring stations around SEKI. The information collected from these systems is only disseminated by word of mouth at the visitor centers. The park staff would prefer that this information be disseminated more widely so visitors understand the circumstances before arriving at the park. This is especially critical for visitors who have respiratory concerns as they try to see sights in the higher altitude portions of the park.

Technology Implementations

Collect Emissions Data

This would require the installation of additional environmental systems throughout the park that can monitor emissions; however, the availability of power and communications will be an issue at isolated roadside locations.

Transmission of Emissions Data

Various wireless and wireline solutions may be used interchangeably for communicating information on emissions to a central location. A variety of technologies would be able to satisfy the minimal bandwidth needs of this data.

This information may need to be shared on a real-time basis outside the park to and from SJVAPCD. Because of the limited data requirements, a dial-up modem connection should be adequate.

Dissemination of Emissions Information to Visitors

Information on emissions would be disseminated automatically if pollutant levels exceeded certain predetermined thresholds. This information could be disseminated via rangers, visitor centers, kiosk, highway advisory radio, and changeable message signs.

Issues

Technological Issues

- The installation of additional environmental monitoring equipment would have a significant cost with the lack of power and communications in the area.

Institutional Issues

- Although emissions information should be provided to the state of California, how much of this information should go to the visitors? Will knowing the emissions/air quality at a national park (which is supposed to be clean and environmentally healthy) give visitors second thoughts about visiting the park?

9.2.9. Oversize Vehicle Detection

Description

This ITS theme involves the detection of oversized vehicles prior to entry to the park. As vehicles exceeding certain predetermined weight, length and width thresholds are identified, this information would be relayed to rangers at the entrance gate. At the gate, the driver of the oversize vehicle would either be informed that the vehicle was too large for all park roads, or receive a map showing park roads where the vehicle was allowed to go, along with a listing of consequences and enforcement actions of the vehicle continuing on off-limit roadways. This would provide better information to travelers as to which specific roads they would be allowed on, and would provide a better experience for other visitors trying to navigate narrow park roadways in the presence of oversize vehicles.

Architecture Concept

Figure 9-19 provides an ITS architecture framework for the oversize vehicle detection theme. The key system elements are as shown in Table 9-35. SEKI would represent the most likely champion for this theme since they would be most familiar with the specific road capacity capabilities within the park. The park should work with the Forest Service and Caltrans as well to develop a consistent set of regulations regarding vehicle size, so that oversize vehicles can receive better information further in advance of the park. The information flows to support this ITS theme are summarized in Table 9-36.

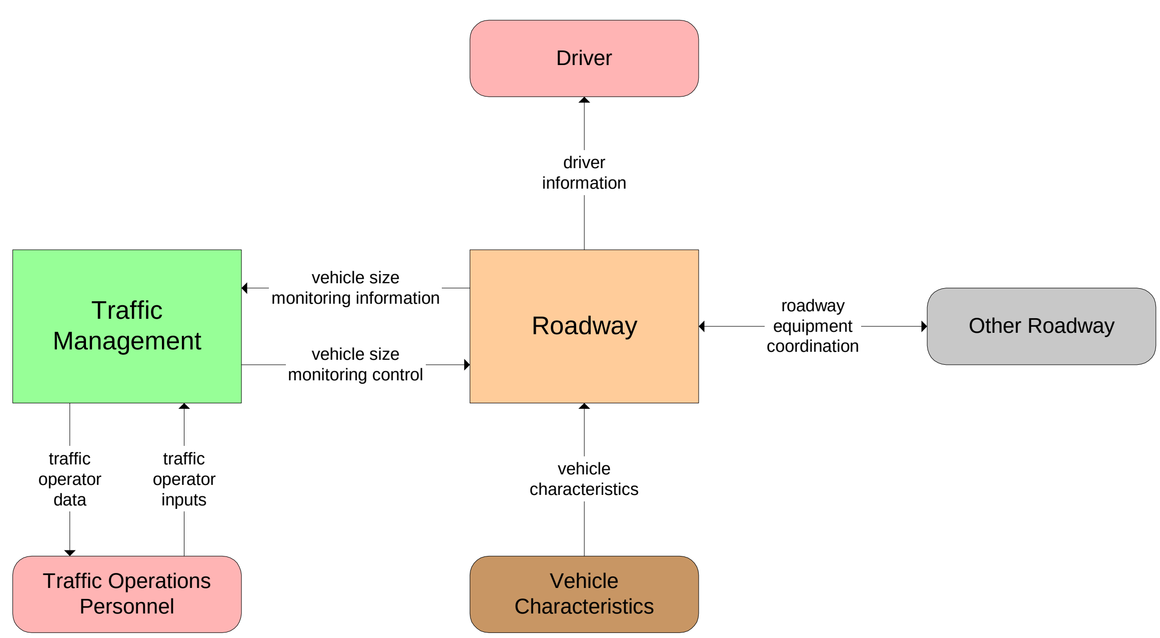


Figure 9-19: Oversize Vehicle Detection, Architecture Schematic.

Table 9-35: Oversize Vehicle Detection, Key Stakeholders.

Element	Role	Stakeholder
Driver	Receives message if vehicle exceeds recommended or allowed size	Visitors
Other Roadway	Provides notification to drivers of oversize vehicles	SEKI Park Management
Roadway	Measures vehicle size and provides message to drivers if vehicle size is excessive	SEKI Park Management; Caltrans District 6
Traffic Management	Receives warnings of oversize vehicles	SEKI Park Management
Traffic Operations Personnel	Reviews data regarding oversize vehicles	SEKI Park Management
Vehicle Characteristics	Represents vehicle characteristics such as dimensions, weight, and number of axles that allow an individual vehicle to be measured or classified	Visitors

Scenario

Visitor. Jenna and Ned were traveling the country with their kids for the summer. When they take this type of trip they generally drive in their RV so they have all the amenities of home. The last time they went to the one of the National Parks, they got their RV stuck due to the narrow, winding roads. In addition to their own embarrassment, they received the angry glares from other visitors whose visit was marred by the oversize vehicle. Had they noticed that there was a vehicle size limit, they would not have tried to travel that particular roadway; however, they probably missed seeing the vehicle size limit sign when they were looking at the wildlife. This year, when they got to the gate at SEKI, the ranger handed them a map showing where their vehicle was restricted in the park. When Ned inquired as to how they knew the vehicle was too long, but not too wide, the ranger told him about the oversize vehicle identification system he had driven by on the way to the entrance gate. Jenna and Ned were not upset about the new system; instead they were glad to have the information they needed to enjoy the parts of the park where their vehicle was allowed, but also to keep their family safe and not get into the same predicament as the previous year.

Park Management. Having this system in place would allow park rangers to know exactly which vehicles were too long and wide for areas in the park. This would mean that they would have fewer errors where they had not warned a driver who then got stuck. This would also allow the rangers to keep statistics of how many oversize vehicles were traversing the park. This information could later be used for better maintenance planning, as bigger vehicles tend to deteriorate the pavement more quickly.

Table 9-36: Oversize Vehicle Detection, Information Flows.

Information Flow	Description
driver information	Digital messages (e.g. changeable message signs) sent to visitors
roadway equipment coordination	Direct flow of information between field equipment
traffic operator data	Traffic operations data presented to the operator
traffic operator inputs	Requests for traffic information and other traffic operations data entry
vehicle characteristics	Characteristics of a vehicle that can be measured to classify it
vehicle size monitoring control	Information used to configure and control automated vehicle size monitoring systems
vehicle size monitoring information	System status including current operational state and logged information including measured vehicle sizes

Technology Implementations

This theme would result in the implementation of a system to detect oversize vehicles outside of the entrance gate. The system would alert an entrance station employee who could then generate a map for the driver identifying roads where his or her vehicle is allowed to travel.

Collect Vehicle Measurement

Various technologies are hypothesized to measure vehicle length. Some potential technologies include radar, video detection, piezo electric sensors, and microwave sensors. These technologies would need to be able to measure the vehicle while in motion at normal highway speed. They would also need to be able to identify measurements for unique vehicles so that the proper information can go to the proper source. To provide entrance gate staff with enough time to respond to the oversize vehicles, this information should be collected about one mile upstream of the entrance gate.

Transmission of Vehicle Measurement

The vehicle measurement data would need to be transmitted from the technologies to the entrance station. This data could be transmitted on an exception basis – in other words, data is only sent when the vehicle exceeds the length, width and/or weight thresholds. To ensure that the entrance gate receives this information promptly, various wireless and wireline solutions may be used interchangeably for communicating information on vehicle measurement to the entrance gate. In addition to this, data would need to be sent that would assist entrance gate staff in identification of the unique vehicle. This may be a static video image of the vehicle recorded by a digital camera, sent as a compressed image to the entrance gate and analyzed from there. Providing vehicle verification would require significant bandwidth, so dedicated or high-speed bandwidth would be required. Alternatively, a license plate reader may be used to transmit license plate data to the entrance gate. This would conserve on bandwidth but would require significant capital expense in obtaining the license plate reading equipment; moreover, the equipment may have more difficulty in finding plate locations on oversize vehicles like recreational vehicles.

Disseminate Information to Oversize Vehicle

Park size restriction information would then be provided to the driver of the oversize vehicle by the ranger at the entrance gate. Off-line, the park may develop a series of maps based on which of the vehicle's dimensions are in excess of recommendations and by how much. Printouts could also be developed dynamically, to reflect construction activities. To preserve park aesthetics, it is recommended that drivers would be provided this information in hard copy.

Issues

Technological Issues

- Although the technologies to measure vehicle length and width are being tested, none of them are proven. Vehicle weight technologies are more reliable, although it is not clear whether overweight vehicles are a significant issue on park roadways.

Institutional Issues

- Static signs with this information already exist. The problem may not be a lack of information as much as a lack of familiarity by drivers of oversize vehicles.

- It is unclear how many vehicles this would affect given that rangers can already do a quick, reasonably accurate assessment of vehicle size at the entrance gate.

- There is concern in the local community about the appearance of diverting traffic away from park sites.

9.3. Other Applicable ITS Themes for California National Parks

The ITS themes identified for Golden Gate National Recreation Area and Sequoia and Kings Canyon National Parks may have some applicability to other parks in the state of California, depending upon the challenges, transportation system characteristics, and visitor dynamics unique to each park. There are other themes, which were not identified for the two demonstration parks, that may have applicability to other parks within California. These themes do not trace back to documented park-specific needs, although some parks may find them appropriate for their challenges. These themes are listed in Table 9-37, along with a mapping to user services and market packages. To facilitate conformity with the National ITS Architecture, the market packages that are used in the themes are listed in Appendix I. Additional detail about the physical entities (subsystems and terminators) is included in Appendix J, and additional description of the information flows is provided in Appendix K.

Table 9-37: ITS Themes for Other California National Parks.

ITS Themes	ITS Objectives	User Services	Market Packages
Park Reservation System	1.4.2, 1.4.3	**1.5** – Traveler Services Information	**ATIS7** – Yellow Pages and Reservation
Park Vehicle Capacity	2.1.1, 3.1.3, 3.4.1	**1.2** – En-route Driver Information **1.6** – Traffic Control **7.1** – Archived Data Function	**AD1** – ITS Data Mart **ATIS1** – Broadcast Traveler Information **ATMS06** – Traffic Information Dissemination **ATMS17** – Regional Parking Management
Winter Road Opening	1.1.4, 2.3.2, 3.3.1	**1.1** – Pre-Trip Travel Information **6.1 –** Longitudinal Collision Avoidance **6.2 –** Lateral Collision Avoidance **6.4** – Vision Enhancement For Crash Avoidance **8.1** – Maintenance and Construction Operations	**ATIS1** – Broadcast Traveler Information **AVSS04** – Lateral Safety Warning **AVSS07** – Driver Visibility Improvement **AVSS09** – Advanced Vehicle Lateral Control **MC06** – Winter Maintenance
NPS/Gateway Community Smart Card	3.7.2	**3.1** – Electronic Payment Services	**ATIS7** – Yellow Pages and Reservation **ATMS10** – Electronic Toll Collection
Virtual Ranger	1.4.4	**1.2** – En-route Driver Information	**ATIS2** – Interactive Traveler Information

9.3.1. Park Reservation System

Description

Increased visitor traffic may adversely impact the quality of the visitor experience at selected sites within various national parks. This may occur as increased visitor volumes degrade park resources or create a more "crowded" feeling among visitors. In order to preserve the desired visitor experience, this ITS theme would establish a reservation system for visitors at selected park sites. This could be integrated with the U.S. Department of Agriculture Forest Service campground reservation system. This could also be integrated with transportation providers (including NPS visitor transportation systems, tour bus companies and others) to provide an improved transportation experience for their visitors as well.

Architecture Concept

Figure 9-20 provides an ITS architecture framework for the park reservation system theme. The theme can be implemented in phases, based on the type of information that is available. For example, some parks have reservation information for specific campgrounds currently available on their web sites. The key system elements are shown in Table 9-38. Because the reservation system would highly affect the park, the NPS park unit would represent the most likely champion for this theme. However, the U.S. Department of Agriculture Forest Service, private-sector merchants in gateway communities, NPS park unit concessionaires, private-sector non-

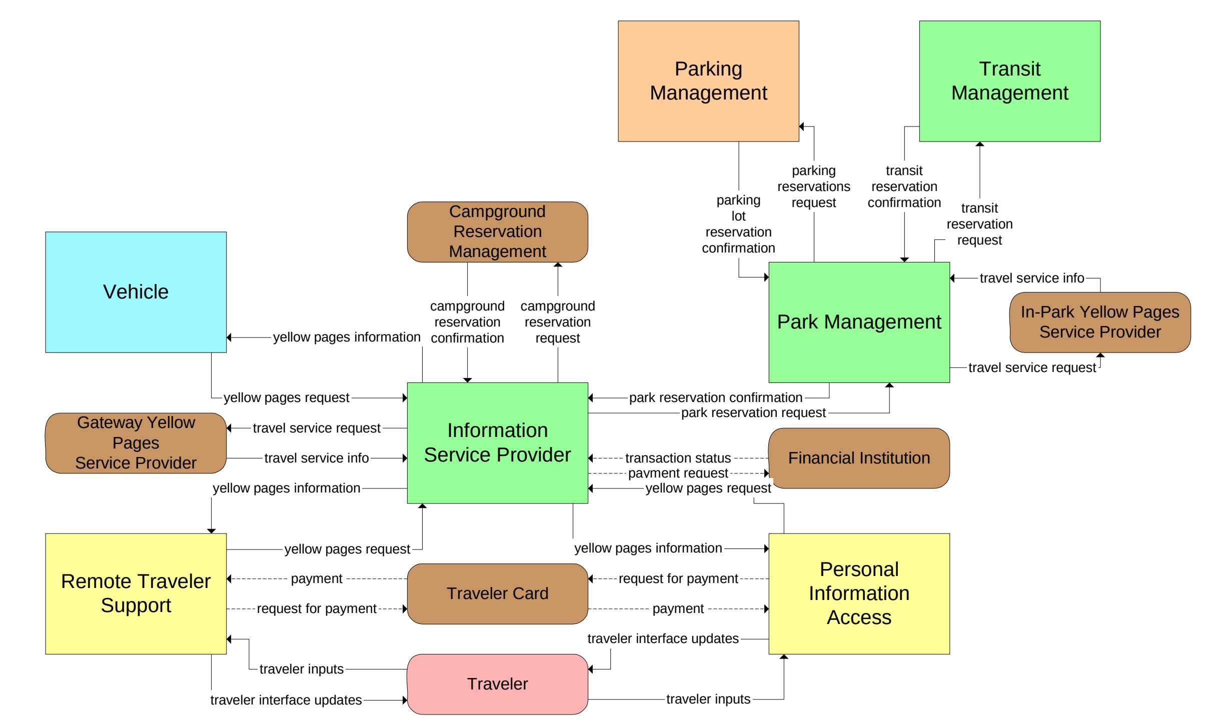


Figure 9-20: Park Reservation System Architecture Schematic

Table 9-38: Park Reservation System, Key Stakeholders

Element	Role	Stakeholder
Campground Reservation Management	An integrated portal for visitors to make campground reservations on Forest Service and NPS lands	USDA Forest Service, National Park Service, and others
Financial Institution	Provides funds to cover transaction cost	Financial Institutions
Gateway Yellow Pages Service Provider	Gateway businesses that provide any service oriented towards the visitor (e.g. food, lodging, points of interest, and recreation areas)	Private-sector merchants in gateway communities
In-Park Yellow Pages Service Provider	Park concessionaires that provide any service oriented towards the visitor (e.g. food, lodging, points of interest, and recreation areas)	NPS Park Unit, Concessionaires
Information Service Provider	Serves as gateway to visitor interested in making reservations	NPS Park Unit, concessionaires, and/or private-sector non-profit providers
Park Management	Manages limited-visitor activities at park, including site tours; one-stop for visitor to coordinate to provide parking, transit and other services as needed	NPS Park Unit
Parking Management	Monitors parking availability in the park	NPS Park Unit
Personal Information Access	Provides information to visitors on their own device (personal digital assistant, cell phone, etc.)	Visitors
Remote Traveler Support	Provides information to visitors at fixed locations (hotels, airports, etc.)	Kiosk/terminal owners
Transit Management	Manages transit services within the park	NPS Park Unit, Concessionaires
Traveler	Desires to participate in a limited-availability activity at the park	Visitors
Traveler Card	Used by traveler to pay for transactions (as needed)	Visitors
Vehicle	Provides information to visitors in their vehicles	Visitors

profit park partners, financial institutions, and kiosk/terminal owners would need to have an integral role in this theme as well. The information flows to support this theme are summarized in Table 9-39.

Scenario

Visitor. Jerry and Johanna were planning a vacation to a California National Park in the summertime. They were a little leery of doing this because they had heard that the parks get so crowded that you cannot find a parking spot, the campgrounds are full by the time you get there, and the interpretive activities fill up quickly. Fortunately, they read in the paper that the park they planned on visiting was trying a new reservation system to better serve the park visitors.

Table 9-39: Park Reservation System, Information Flows

Information Flow	Description
campground reservation confirmation	Confirmation for campground reservation
campground reservation request	Reservation request for campground
park reservation confirmation	Confirmation of park reservation request
park reservation request	Reservation request for participation in select park activities
parking lot reservation confirmation	Confirmation for parking lot reservation
parking reservations request	Reservation request for parking lot
payment	Payment of some kind (e.g., toll, parking, fare) by traveler which, in most cases, can be related to a credit account.
payment request	Request for payment from financial institution.
request for payment	Request to deduct cost of service from user’s payment account.
transaction status	Response to transaction request. Normally dealing with a request for payment.
transit reservation confirmation	Confirmation for transit reservation
transit reservation request	Reservation request for transit
travel service info	Reservation information or yellow pages data
travel service request	Request for reservation or other service (e.g., yellow pages)
traveler inputs	Request by a traveler to summon assistance, request travel information, make a reservation, or request any other traveler service.
traveler interface updates	Visual or audio information (e.g., routes, messages, guidance) to the traveler.
yellow pages information	Travel service information covering tourist attractions, lodging, restaurants, service stations, emergency services, and other services and businesses of interest to the traveler.
yellow pages request	Request for information through a yellow pages type service.

This reservation system would allow visitors to plan everything ahead of time and would hopefully enhance their experience. Jerry called the reservation line and within 10 minutes he had a campsite reserved, a dinner reservation at the park lodge restaurant, two seats on a bus tour, and reservations for the moonlight ranger-led walk. When they got to the park, they were so excited to be able to go to all of these activities without waiting in long lines. Their park experience this time was so much more serene, and they were able to enjoy the peace and beauty of their surroundings.

Park Management. With an automated reservation system in place, the park will be able to use their staff who would normally handle these tasks to do more interpretive programs for the park. The park will also be able to provide the visitors with more accurate real-time information about campgrounds, transit, restaurants, and programs being full or not. This will also allow park management to provide their visitors with a more peaceful and less congested experience of the park.

Technology Implementation

The primary focus of this theme is to enhance the visitor experience by providing a reservation system that limits the number of visitors in any one area of the park at a given time. This theme is not intended to steer visitors away from the park unit, but to help them more efficiently plan their trip and have a better experience with less crowding. The key to this system's implementation will be adequate and successful marketing. The system can work well if people know it exists; otherwise it will frustrate visitors who do not have reservations and have wasted a trip to the park.

Make Reservation Request

To avoid visitor dissatisfaction, it is important to provide a variety of convenient methods for visitors to make reservations for park services. The Internet, visitor center kiosks, telephone, and PDAs are among the technologies that may be appropriate. The reservation system will need to be developed in a fashion that it can seamlessly work with each of these technology types and others that may develop over time. The information should be available in a menu system that would allow visitors to choose an activity to reserve, and then to get more detailed information. The phone system menu should be set up similar to a 511 system menu. The visitor will also need to receive confirmation of their reservations.

For some reservation services, it may be necessary to include a credit card number as a part of the reservation request (for example, a room at a lodge in the park). The system will need to have adequate security to protect these financial transactions against fraud and theft.

Collect and Process Reservation Request

The theme depicts the park as being the clearinghouse for most reservation requests (except for campgrounds included in the Forest Service's reservation system). The park's reservation system will need to be able to route reservation requests into the appropriate reservation databases. This will require real-time access to the various reservation services that the park manages. This will likely need to be accomplished through a wide-area network since some park services, for example a lodge in the park, may continue to use their own reservation systems in addition to the park system.

Some reservations may involve a set of integrated requests (for example, a room reservation at a lodge inside the park during winter months might require reserving a snow coach). This system should make sure that these integrated requests can occur seamlessly in one stop.

Because of its reliance on real-time information, the theme will require that all associated park services use a computerized reservation database. This may require upgrading some park services from a manual, pen-and-paper system to a computerized system, complete with purchase of computers, a simple database, and network communications. This theme should seek to integrate existing reservation systems that various park services have instead of creating new ones.

Where reservation systems do not exist but are desired, the following types of information are suggested:

- Transit reservations. The park would need to partner with local transit agencies or concessionaires to obtain information such as bus routes and stops, fares and schedules. If tour bus options are available, the type of information that would be needed include the time the tour starts, the length of the tour, the sites on the tour, the start location, and the cost.

- Campground reservations. The information needed would include the number of campsites, the cost of campsites, person limit for campsites, check-in and check-out times, and special information for camp sites (e.g. handicap accessible, showers available, and firewood available).

  The park unit should seek to partner with the U.S. Department of Agriculture Forest Service to see if the other reservation information could also be included in their reservation system, or if a separate reservation system should be set-up within the park.

- Park activity reservations. Park activities that should be considered include interpretive programs, special programs, and special permits (e.g. filming and backcountry). The type of information that should be collected would include the type of activity, number of reservation spots available, time limit, activity beginning and ending times, cost, and location within the park.

- In-park services. The park would need to partner with park concessionaires to obtain their information for inclusion in this system. The type of partners may include food concessionaires for meal reservations and activity concessionaires (e.g. snowshoe rentals, horseback riding, boat rentals, etc). The type of information that should be collected would include type of activity, number of reservation spots available, time limit, dates and times, cost, and location within the park.

Collect Static Information on Gateway Community Services

The park could also choose to partner with gateway community concessionaires to obtain their information for inclusion in this system. The type of partners may include food concessionaires for meal reservations, activity concessionaires (e.g. snow shoe rentals, horse back riding, boat rentals, etc), and lodging. The type of information that should be collected would include partner, type of activity, number of reservation spots available, time limit, activity beginning and ending times, cost, and location. This information could be managed by the park's non-profit fundraising organization or the gateway community's chamber of commerce.

Issues

Technological Issues

- Maintenance and operations of these systems may be costly. Automated database-driven systems should be used to the extent possible.

- There is no single point of failure for this system as there are multiple automated connections that could make the system "go down." Therefore, back-up systems should be in place to ensure that reservation activities can continue to occur seamlessly in the event of failure of any system component.

Institutional Issues

- The park will need to establish guidelines about how commercial services are included in the system, be it a concessionaire inside the park or a merchant in the gateway community.

- In order for this system to work, memoranda of understanding will need to be created.

- Although the system will benefit most visitors, there may be complaints from those that do not know about it and show up without reservations.

9.3.2. Park Vehicle Capacity Management

Description

To preserve the visitor experience it may be desirable to limit the number of vehicles present within the park. This theme provides a structure for information exchange between entry points to monitor the number of vehicles within the park, and then to communicate this information to rangers at entrance stations and to information outside the park. Based on historical information, vehicles waiting outside the park could be provided with estimates of their wait time to be able to enter the park.

Architecture Concept

Figure 9-21 provides an ITS architecture framework for the park vehicle capacity management theme. The key system elements are shown in Table 9-40. Because the management system would highly affect the park, the NPS park unit would represent the most likely champion for this theme. However, NPS park unit concessionaires and private-sector non-profit providers, radio and television stations, Caltrans, the county, gateway communities and kiosk/terminal owners would need to have an integral role in this theme as well. The information flows to support this theme are summarized in Table 9-41.

Scenario

Visitor. Best friends Erin and Emily went to a California National Park unit one day during their spring break. As they approached the entrance gate, they noticed that there was a line of cars that

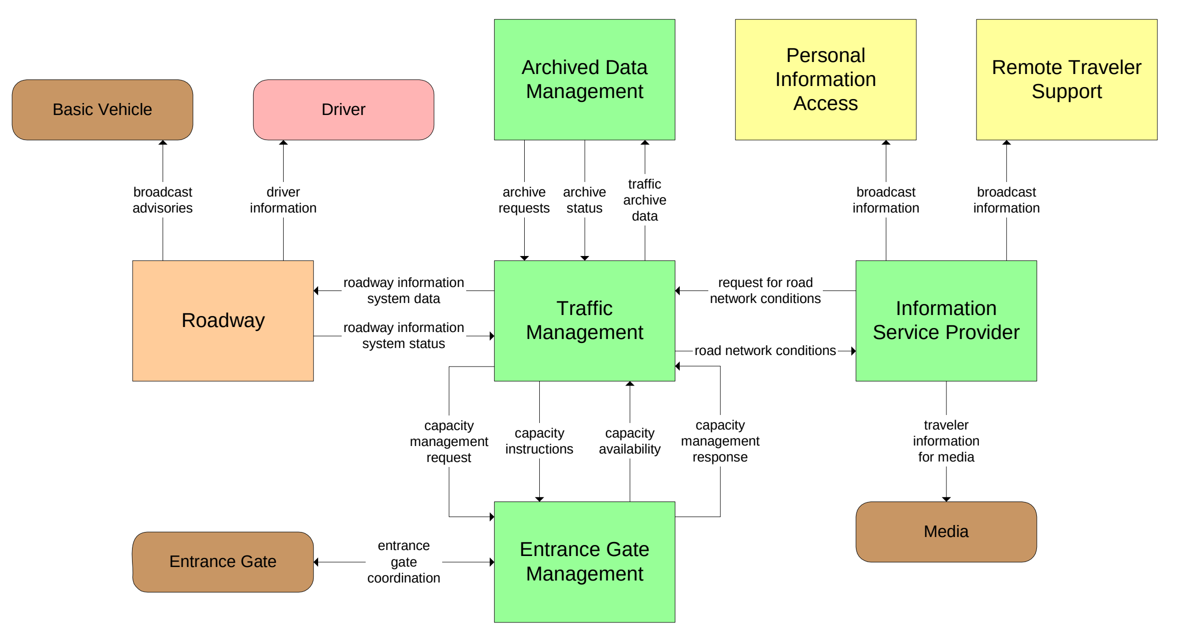


Figure 9-21: Park Vehicle Capacity Management Architecture Schematic

Table 9-40: Park Vehicle Capacity Management, Key Stakeholders

Element	Role	Stakeholder
Archived Data Management	Collects historic visitation data to analyze visitation characteristics (e.g. length of stay)	NPS Park Unit
Basic Vehicle	Receives information on park capacity availability	Visitors
Driver	Receives information on park capacity availability	Visitors
Entrance Gate	Manages an individual entrance gate at a park	NPS Park Unit
Entrance Gate Management	Manages all entrance gates at a park	NPS Park Unit
Information Service Provider	Serves as gateway to potential visitors to park	NPS Park Unit, concessionaires, and/or private-sector non-profit providers
Media	Provides information on park capacity availability to general public	Radio, television stations
Personal Information Access	Provides information to visitors on their own device (personal digital assistant, cell phone, etc.)	Visitors
Remote Traveler Support	Provides information to visitors at fixed locations (hotels, airports, etc.)	Kiosk/terminal owners
Roadway	Provides information to visitors on capacity availability	NPS Park Unit, Caltrans, County and/or gateway community
Traffic Management	Provides oversight for management of vehicle capacity in park, and communicates information to visitors	NPS Park Unit

did not seem to be moving. As they got closer, they saw a sign that read, “Park at Capacity, Closed to Vehicle Traffic, Wait 10 Minutes.” Erin and Emily did not know what to think, but they waited patiently. When it was their turn to go into the park they noticed that the park was easier to access due to less congestion. When they were leaving the park, they let the ranger know that they had had to wait, but it was worth it to have less crowding and a more peaceful visit in the park when they entered.

Table 9-41: Park Vehicle Capacity Management, Information Flows

Information Flow	Description
archive request	A request to receive historical parking, traffic and weather information, or on the type of information to be archived
archive requests	A fault report for inaccurate or missing archive data
broadcast advisories	Analog messages sent by radio to visitors
broadcast information	General broadcast information about the vehicle capacity within the park
capacity availability	Current availability of vehicle capacity within the park
capacity instructions	Information that allows individual entrance gates to be managed to support park-wide vehicle capacity objectives
capacity management request	Request to limit vehicle admissions to park
capacity management response	Response to request to limit vehicle admissions to park
driver information	Digital messages (e.g., changeable message signs) sent to visitors
entrance gate coordination	Information that enables entrance gate activities to be coordinated across all entrance gates within a park
request for road network conditions	Request for traffic, weather, incident and other road information
road network conditions	Current and forecasted traffic, weather, incident, and other road information
roadway information system data	Information used to initialize, configure, and control roadside systems that provide driver information (e.g., changeable message signs, HAR)
roadway information system status	Current operating status of equipment that provides real-time information (e.g., HAR, changeable message signs) to drivers
traffic archive data	Data describing the use and vehicle composition on transportation facilities
traveler information for media	General traveler information that has been provided to the media

Park Management. This system would allow the park unit to improve the visitor experience and protect resources by limiting the number of vehicles allowed to enter the park. This system would allow the park to provide the visitors at the gate with real-time information about how long their wait will be.

Technology Implementations

The primary focus of this theme is to enhance the visitor experience by providing a system that limits vehicle traffic in the park. This theme is not intended to steer visitors away from the park unit, but to help regulate the amount of vehicle traffic in the park to protect park resources and decrease air pollution. It may also be used as a method to encourage greater use of alternative modes to access the park, including transit. The key to this system's implementation will be the traveler information provided to visitors who are waiting to enter the park. The system will work well if people know it exists; otherwise, there will be angry visitors who will not know why they are waiting.

Assess Vehicle Entry into and Exit from Park

Most parks have manned entrance gates that can be used to count vehicle traffic entering and exiting the park on a given day. For parks with multiple entry points, it will be necessary to have real-time communications between entrance gates in order to know the number of vehicles currently within the park. Ideally, a wide-area network would be used to provide this information on a real-time basis. In parks without networking capability, rangers can use voice communications between entrance stations when it appears the park is nearing capacity.

Analyze Capacity

The traffic management portion of the theme represents the NPS staff who will provide oversight with the management of vehicles. This includes setting the capacity level for the park and approval of message sets used to distribute information to visitors in queue. The estimated vehicle capacity will likely be based on an analysis of the level of concern related to congestion or resource impacts as a function of traffic volumes on previous days. Entrance gate statistics describing time and park visitation levels along with factors affecting capacity (e.g. special events, dates, and season) will be archived so that this information can be analyzed for use in the future to predict how long vehicles tend to stay in the park, and therefore how long entering vehicles would need to wait. Existing visitation databases would be a helpful starting point for developing this information.

Disseminate Park Capacity Information to Visitors

There are several ways that information regarding the park being at capacity and estimated wait times can be distributed to visitors. These include through the media, through visitors' personal devices such as PDAs and cell phones, through remote traveler support such as information at hotels and airports, or through roadside devices such as highway advisory radio or changeable message signs. Information should include estimated delay times. If delay times are expected to be exceptionally long, visitors may be provided with information on alternate destinations in the area.

Issues

Technological Issues

- Transit intercept lots should be considered as an option for those waiting at gates for access to the park.
- The forecasting of wait times will be difficult until at least one year's worth of historical data has been collected.

Institutional Issues

- If this system is working in conjunction with a reservation system, there will need to be a way to give exceptions to visitors with reservations.
- This system could create a significant backup at park entrances and cause accidents.
- Gateway communities may have some resistance to this concept if it is perceived that this would ultimately lower visitation at the park.

9.3.3. Winter Road Opening

Description

Several California National Parks are impacted by heavy winter snows that close one or more park roadways and restrict or eliminate vehicular access. The Park Service seeks to re-open roads as quickly as weather permits. To do so requires safe and efficient utilization of snow removal equipment on roadways that are often difficult to navigate, as well as real-time information to visitors about road status. This theme would instrument plow equipment and the roadways to improve vehicle guidance on roadways. Using historical information, it would provide updated estimates on forecast opening dates depending upon progress of spring snow removal operations. The theme would also communicate road status to appropriate information outlets for visitors.

Architecture Concept

Figure 9-22 provides an ITS architecture framework for the winter road opening theme. The key system elements are shown in Table 9-42. Because the winter road opening and clearing is done by the park, the NPS park unit would represent the most likely champion for this theme. However, it is critical to keep visitors informed of the progress in winter operations; therefore, kiosk/terminal owners and newspaper, radio, and television media would need to have an integral role in this theme as well. The information flows to support this theme are summarized in Table 9-43.

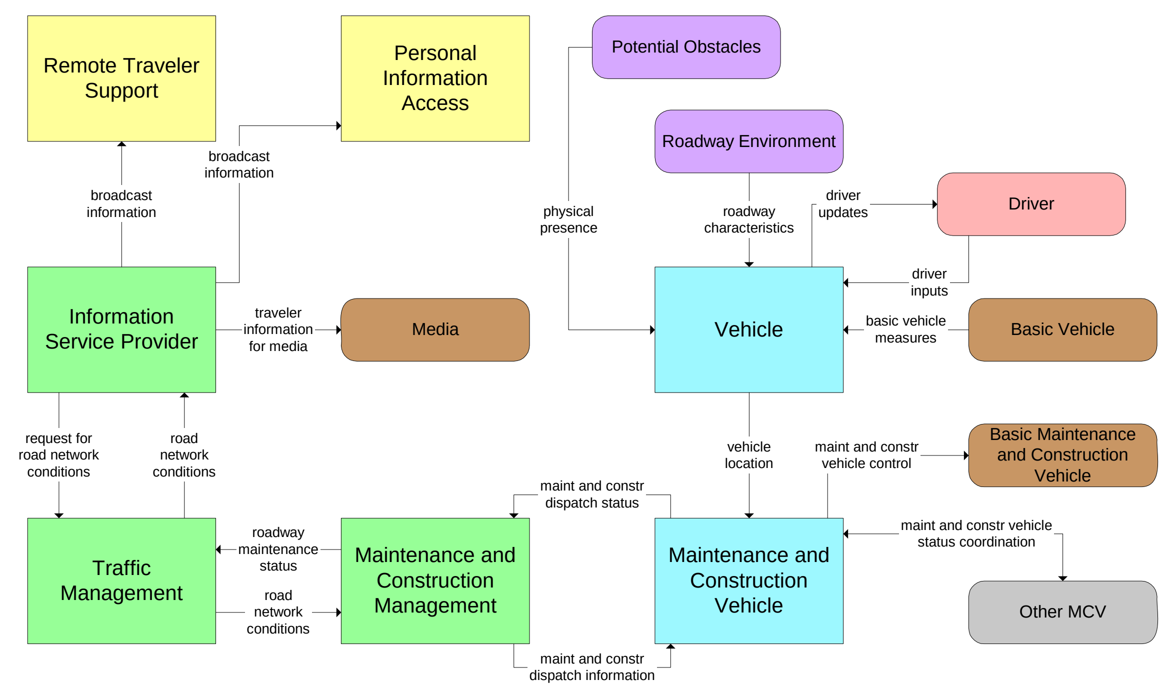


Figure 9-22: Winter Road Opening Architecture Schematic

Table 9-42: Winter Road Opening, Key Stakeholders

Element	Role	Stakeholder
Basic Maintenance and Construction Vehicle	Performs maintenance functions (e.g. plowing) in maintenance vehicle	NPS Park Maintenance Vehicles
Basic Vehicle	On-board equipment that provides information regarding current vehicle status	NPS Park Maintenance Vehicles
Driver	Operates winter maintenance vehicle	NPS Park Maintenance Staff
Information Service Provider	Provides information on the current status of winter roadway opening operations	NPS Park Unit
Maintenance and Construction Management	Oversees winter roadway opening operations	NPS Park Unit
Maintenance and Construction Vehicle	Plow, grader or other maintenance vehicle used in winter roadway opening operations	NPS Park Maintenance Vehicles
Media	Provides information to general public on current status of winter roadway operations	Newspapers, radio, television stations
Other MCV	Represents other maintenance vehicles assisting in winter roadway opening operations	NPS Park Maintenance Vehicles
Personal Information Access	Provides information to visitors on their own device (personal digital assistant, cell phone, etc.)	Visitors
Potential Obstacles	Represents non-permanent obstacles on roadway that may affect winter roadway operations	N/A
Remote Traveler Support	Provides information to visitors at fixed locations (hotels, airports, etc.)	Kiosk/terminal owners
Roadway Environment	The roads which are being plowed	NPS Park Unit
Traffic Management	Interprets status on roadways to provide information on open/closed status of park roads	NPS Park Unit
Vehicle	Represents vehicle functions in maintenance vehicle	NPS Park Maintenance Vehicles

Table 9-43: Winter Road Opening, Information Flows

Information Flow	Description
basic vehicle measures	Information provided to on-board ITS equipment indicating current vehicle status
broadcast information	General broadcast information about the winter road closures and openings
driver inputs	Driver commands to the vehicle
driver	Information displayed by the vehicle to the driver
maint and constr dispatch information	Information used to dispatch maintenance and construction vehicles, equipment, and crews. This information includes routing information, traffic information, road restrictions, incident information, environmental information, decision support information, maintenance schedule data, dispatch instructions, personnel assignments, and corrective actions.
maint and constr dispatch status	Current maintenance and construction status including work data, operator status, crew status, and equipment status.
maint and constr vehicle control	Control data sent from on-board ITS systems to control maintenance and construction vehicle equipment, including control of materials dispersion rate and other control functions that will vary with vehicle type and application.
maint and constr vehicle status coordination	Maintenance and construction vehicle status information that is shared between vehicles. This includes environmental conditions and the operational status of the vehicles.
physical presence	Detection of an obstacle by a vehicle. Obstacle could include animals, other vehicles, pedestrians, rocks in roadway, etc.
request for road network conditions	Request for traffic, weather, incident and other road information
road network conditions	Current and forecasted traffic, weather, incident and other road information
roadway characteristics	Detectable or measurable road characteristics such as friction coefficient and general surface conditions, road geometry and markings, etc. these characteristics are monitored or measured by ITS sensors and used to support advanced vehicle safety and control and road maintenance capabilities.
roadway maintenance status	Summary of maintenance fleet operations affecting the road network. This includes the status of winter maintenance (snow plow schedule and current status).
traveler information for media	General traveler information that has been provided to the media
vehicle location	Location of vehicle which is exchanged between vehicle subsystems

Scenario

Visitor. Troy and Kristina were planning a trip to a National Park in early April, because they were interested in observing wildlife during early spring. However, they knew from friends' past experience that one could never know when the roads would be open for driving for good, or whether a sudden snowstorm would delay their plans. In recent years, the park had been providing weekly updates on their web site. Now, having implemented this winter road opening theme, the park provides daily updates on the status of operations. In addition, the park seems to be able to clear the roadways more quickly after unexpected storms. This knowledge gave Troy and Kristina more confidence as they planned their trip that they could drive into the park when they wanted.

Park Management. Park management would benefit from this theme because they would be able to provide real-time information to their visitors, and they would be able to remove snow in a safer and more efficient manner. This system would improve efficiency by coordinating maintenance vehicle location, tracking road clearance progress, and providing information to the public. This system would improve safety by tracking the vehicle position on the roadway and identifying possible obstacles. This would allow plow drivers more visibility and save them from off the road accidents.

Technology Implementations

Implementation of this theme would require several distinct components.

Track Vehicle Position on Roadway

Snow removal operations currently rely on drivers' visual perception of roadway conditions and challenges. In mountainous park roads, it may often not be clear where the edge of the roadway is. Consequently, drivers will exercise greater caution to protect themselves, the plows and the park land. There have been different technologies that have successfully improved drivers' perception of the roadway. Special magnetic roadway striping or magnetic studs embedded in the pavement can be used to indicate lateral lane position. In-vehicle equipment is then required to read vehicle position relative to the magnets, and provide this information to the driver on a heads-up display. An alternative technology is to use enhanced global positioning systems to provide a microscopic measurement of vehicle location on the roadway. This technology has also been used.

Identify Obstacles (Vision Enhancement)

Sometimes whiteout conditions or deep snow can cover obstacles that are in a snowplow's path and make them invisible, yet dangerous to the plow driver. Radar can be used in snowplows for detection of this type of obstacle. After detection, the snowplow operator would need to be informed. This could be done by providing the snow plow operator with a heads-up display, by having a "radar detector" of sorts that would beep when the radar detects an obstacle, or by hooking the radar detector to the radio so that a voice would inform the driver.

Coordinate Maintenance Vehicle Location and Track Road Clearance Progress

An automated vehicle location (AVL) system would be used to track the snowplows in the fleet. If the AVL system was coordinated with a map, it could track vehicle location, as well as where the plows had already been, where they were headed to, and their estimated time to plow an area. By knowing where the vehicles had been and were headed to, coordination between maintenance vehicles could be done. This would allow for more efficient snowplow removal. The National Park Service would serve as the traffic/plow management center, although it is hoped that the majority of this theme would be automated.

Dissemination of Winter Road Opening Information to Visitors

Visitors would receive information regarding winter road opening, road clearance progress, and estimated time to clearance. These reports could be provided to the public via remote traveler support such as kiosks or the Internet, park rangers, personal information access devices such as a cell phone or PDA, and the local media. If the park has had experience with sudden snowstorms closing down park roadways after the park is open to vehicles, the park may wish to use highway advisory radio, changeable message signs, or static signs with rotating drums that can be activated remotely.

Issues

Technological Issues

- Lateral guidance systems will require investment in in-vehicle systems and/or related roadway enhancements. These technologies have been successfully tested in some small-scale environments, but the technology has not yet been widely implemented.

- The dynamic real-time nature of information provided by this system may require upgrades and enhancements of the park's normal information outlets (for example, web page enhancements to provide dynamically updated maps).

Institutional Issues

- There is a need to achieve buy-in from plow drivers about vehicle instrumentation, since there may be some concern about what the purpose of the instrumentation is.

- By providing visitors with the whereabouts of snowplows, they may try to follow them.

9.3.4. NPS/Gateway Community Smart Card

Description

This theme would allow visitors to have a smart card that would enable them to engage in a variety of park or park-area activities. The card would be linked with a financial institution to permit the visitor to use the card to pay for park admission, lodging in the park or in the gateway community, and concessionaire-provided services. The card could be accepted by merchants in the gateway community to promote a closer relationship with the park, and providing the visitor with a more seamless park visit experience. The card could be developed for an individual park unit, but would have greater utility if it were implemented on a system wide basis, perhaps in conjunction with the NPS annual pass.

Architecture Concept

Figure 9-23 provides an ITS architecture framework for the NPS/Gateway Community Smart Card theme. The key system elements are shown in Table 9-44. Because the smart card has the potential to be a national card, the NPS park unit would represent the most likely champion for this theme. Smart card activities by individual NPS park units could be coordinated through NPS headquarters. However, gateway community chambers of commerce, gateway community merchants, and the financial institutions would need to have an integral role in this theme as well. The information flows to support this theme are summarized in Table 9-45.

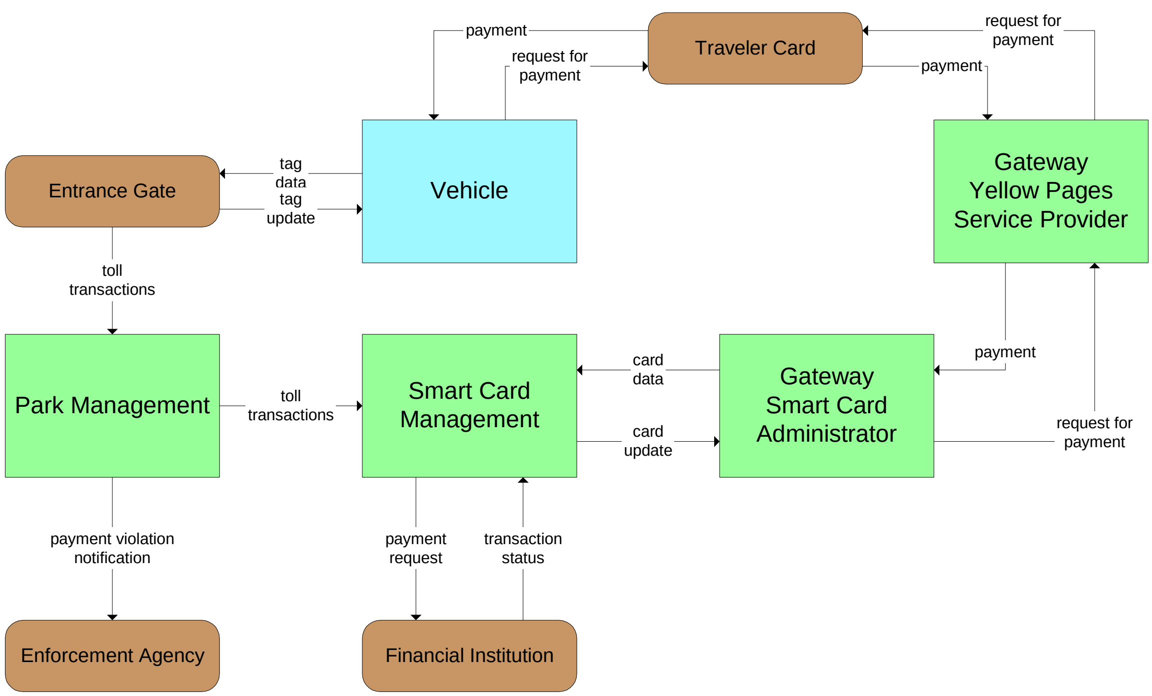


Figure 9-23: NPS/Gateway Community Smart Card Architecture Schematic

Table 9-44: NPS/Gateway Community Smart Card, Key Stakeholders

Element	Role	Stakeholder
Enforcement Agency	Ensures compliance with entrance fees	NPS Park Police
Entrance Gate	Automatically charges entry for vehicles with smart cards	NPS Park Unit
Financial Institution	Provides funds for merchants, park	Financial institutions
Gateway Smart Card Administrator	Clearinghouse pooling local merchants interested in smart card	Gateway Community Chamber of Commerce
Gateway Yellow Pages Service Provider	Area businesses providing services of value to visitors	Gateway Community Merchants
Park Management	Manages entrance into park site	NPS Park Unit
Smart Card Management	Coordinates smart card activities across all park units	NPS
Traveler Card	Smart card holding value for area merchants and permitting automatic entry into park	NPS owns cards; visitors maintain possession
Vehicle	Seeks entry into park with electronic charging of entrance fee on smart card	Visitor with smart card

Scenarios

Visitors. Rajeeb and Sher-lu were planning a trip to see the “American West.” This trip would include multiple parks, local activities, and lodging in gateway communities. Being very budget-conscious people, they wanted to be able to track how much they spent on their trip and they wanted to have an easy way to pay for everything instead of carrying credit cards and cash (for those places that do not except credit cards).

Sher-lu, just having graduated from college, thought it would be neat if there were something like a college identification card that could be used to purchase meals, books, and things from vending machines. When she did more research into it, she found out that the National Park Service had just deployed a Smart Card that was similar to what she was looking for. Sher-lu and Rajeeb were able to go on their trip and have a great time while also monitoring their spending and having an easy time of it!

Park Management. The implementation of this program would allow the NPS to collect data reflecting economical impact of the parks and visitors on gateway communities (names would not be linked with information). It would also allow for a more enjoyable visitor experience

Table 9-45: NPS/Gateway Community Smart Card, Information Flows

Information Flow	Description
card data	Unique card ID and related personal information
card update	Update data held in card which can be read by another device
payment	Payment of some kind (e.g., toll, parking, fare) by traveler which, in most cases, can be related to a credit account.
payment request	Request for payment from financial institution.
payment violation notification	Notification to enforcement agency of an entrance fee payment violation
request for payment	Request to deduct cost of service from user’s payment account
tag data	Unique tag ID and related vehicle information.
tag update	Update data held in tag which can be read by another device
toll transactions	Detailed list of transactions from a toll station.
transaction status	Response to transaction request. Normally dealing with a request for payment.

instead of having visitors scrambling to find cash. It would also allow for statistics to be collected on what parks people are visiting when they go to multiple parks.

Technology Implementations

This particular theme is not oriented toward transportation problems as much as it is toward enhancing tourism, as it can be used to facilitate discounts for park visitors, and provide package deals with gateway community merchants. For parks charging admission at a manned ranger station, this theme could decrease visitors’ wait time at entrance stations if those with smart cards could go through a different line and therefore be processed more quickly.

Collect Entrance Fees

Instead of purchasing a National Parks Pass, those interested in participating in this program would purchase a Smart Card that would allow them into all of the parks just like a park pass, but would also allow them to use the Smart Card as a way to purchase things.

The equipment needed at the entrance station would include readers, such as those deployed for toll collection on bridges and toll roads (e.g. FasTrak in California) and for entrance gate management at Yellowstone National Park. These readers would collect entrance fees for parks that are exceptions to the National Park Pass or to identify that someone is a park pass holder for all other park units. Two closed circuit cameras would also be needed for each bypass lane to record license plates of cars that go through this lane without the proper transponder.

Partner with Gateway Merchants

The park unit should partner with merchants in the gateway communities to get them to accept the Smart Card as payment. Potential merchants would be gas stations, restaurants, lodging, and other local attractions. There could even be the potential to offer visitors who use the Smart Card a discount to these places. This may increase the number of Smart Card users, increase the number of visitors to that particular store, and increase the savings for tourists.

The merchants would also need to purchase and set up the machines to charge these cards (e.g. Aggie card at Texas A&M University) unless credit card machines could be used.

Partner with In-park Concessionaires

The park unit should also partner with concessionaires inside the park to get them to accept the Smart Card as payment. Potential merchants would be restaurants, lodging, gift shops, and activities in the park (e.g. ski rentals, horseback riding, boat rides, etc).

Partner with Financial Institutions

The National Park Service would need to partner with financial institutions to provide visitors with options for using the card. Options could include putting money on the card and being able to purchase until you spend the set amount of money, having the Smart Card linked to your credit card or checking account so that as money is spent it is automatically withdrawn, using it like a credit card where you would get a bill every month, or putting a set amount of money on the card and when it gets below a limit, your credit card or checking account are automatically charged and the card is reset at the specific amount you requested.

Issues

Technological Issues

- Some parks do not have multiple lanes at their entrance gates, which may remove much of the benefit of installing this system to reduce entrance gate congestion.
- Getting all of the stores equipped with the proper technology may be costly and difficult.
- The existing national park pass would need significant modification to function as either an in-vehicle transponder or a debit/credit card at a local merchant.

Institutional Issues

- There may be some privacy issues with attempting to retrieve statistics from the cards that are used.

- Each park unit may have its own vision for how a smart card would be used; however, a national vision and standard must be developed to ensure maximum benefit and efficiency of smart cards implemented at any particular park.

- Careful thought needs to be given to the effect of smart card-related discounts on park unit goals. For example, would gas discounts make sense for a park that is seeking to reduce vehicle traffic?

- The park will own the cards, but the visitors will use them. Therefore, will people need to pay an additional charge for the smart card, or just that of the normal National Park Pass? In California, transponder users are not charged a deposit if they secure the transponder with a credit card and have fewer than three transponders on their account. For transponder accounts paid for using cash or checking accounts, a deposit is required. In New York drivers are not charged for a transponder, while in Massachusetts they are.

9.3.5. Virtual Ranger

Description

NPS has had an interest in promoting education and interpretation related to its sites. Brochures, self-guided tours, signage, audiocassettes and a variety of other means have been used successfully toward this end. These means are intended to supplement the interpretation that may be provided by a park ranger or volunteer; however, many visitors may not have enough interaction with staff to learn what they want to know about park sites and resources. This ITS theme would develop a computer interface to supplement handheld (e.g. PDA) or in-vehicle technologies to provide customized interpretation. Geo-location capabilities could allow the virtual ranger to "know" where the visitor is and provide appropriate information on the natural, historical, cultural and other resources they are seeing. It could provide menus to allow the visitor to access the information about which they are most interested. The use of an electronic media means that the breadth and depth of information content is limited only by technology. This could provide a powerful supplement to other forms of interpretation and would provide greater capabilities for customized interpretation, especially for non-English speaking visitors.

Architecture Concept

Figure 9-24 provides an ITS architecture framework for the virtual ranger theme. The key system elements are shown in Table 9-46. Because this theme is a direct link to the park and its history, the park should take the lead on developing the interpretation that should be provided by the virtual ranger. However, a private sector partner and a GPS partner would need to have an integral role in this theme as well to ensure that the virtual ranger can fit existing technological

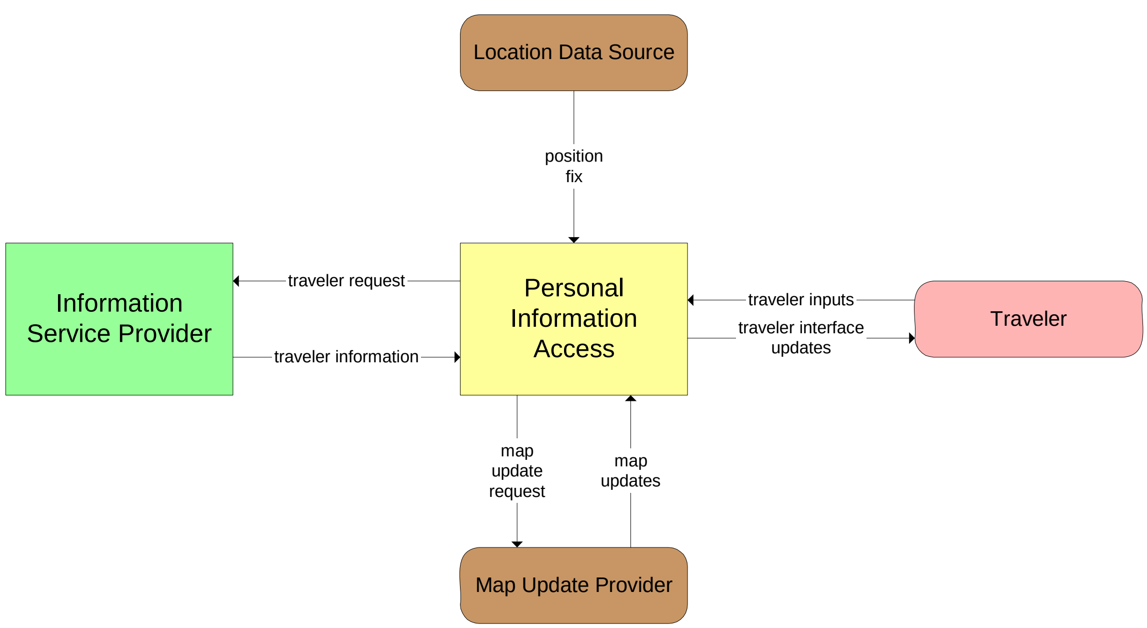


Figure 9-24: Virtual Ranger Architecture Schematic

Table 9-46: Virtual Ranger, Key Stakeholders

Element	Role	Stakeholder
Information Service Provider	Provides Park-specific interpretation	NPS Park Police
Location Data Source	Provides geographic reference base	GPS provider
Map Update Provider	Provides digitized updates of maps	Private-sector provider
Personal Information Access	Provides customized interpretation based on visitor needs and desires	Visitors
Traveler	Visitor exploring Park sites unaccompanied by a ranger or tour	Visitors

Table 9-47: Virtual Ranger, Information Flows

Information Flow	Description
map update request	Request for a map update, including map layer updates
map updates	Map update, including new real-time map or map layer(s) update
position fix	Information that provides a visitor's geographical position
traveler information	Visitor information including customized interpretation
traveler inputs	Request by visitor for specific types of interpretation
traveler interface updates	Visual or audio information (e.g., maps, interpretation) to the visitor
traveler request	Request by a visitor for information

platforms. The information flows to support this theme are summarized in Table 9-46.

Scenario

Visitor. Yvonne was traveling to a California National Park, but was worried that she wouldn't be able to gain any historical information about the park because it is difficult to find tours with rangers that speak German. When she arrived at the park and used broken English to ask for the brochures and maps in German, she also found out that she could rent a PDA that could be set for German and would give her the historical information for the particular spot in the park where she was located. At the visitor center, she plugged the PDA into a dataport that downloaded current information into the unit. This allowed her to have an understanding of both the historical interpretation aspects to the park, and also interpretation regarding native plant and wildlife with which she was unfamiliar. She was very excited and had a great visitor experience.

Park Management. Although parks employ hundreds of volunteers in the summer to help with interpretive programs, there are still not enough rangers or volunteers to give personal tours. This is especially true given the broad variety of interpretation interests and the increasing percentage of non-English speaking visitors. Several California parks were able to work with a consortium of PDA manufacturers to develop a software interface that would provide customized interpretation for park visitors based on their location, language and interests. With this basic architecture in place, each park was free to develop interpretation at its own pace according to its own visitors' requirements. After initially incorporating material from the park newspaper, the park map and in-park signage, the park saw the potential for this technology to get more information out about the park and to help enhance the visitors' experience. They added more detailed information on historical background associated with several spots that could only be found in selected publications at their visitor center. They developed a far more detailed catalog on archeological and cultural sites in the park, which would be of interest to some visitors. The park was excited about the potential of the technology to offer even more information with minimal additional cost as the technology continues to mature. The technological system was also able to remember many more facts than a person too!

Technology Implementations

Collect Interpretive Information

The National Park Staff would be in charge of making a list of all park reference points and providing all relevant interpretation (historical, cultural, natural, etc.). This information would need to be put into a database that could be accessed using visitor location, a menu system, or some other feature. The information would also need to be written in a factual, yet interesting way. The interpretation would need to be developed in a way that respects the limitations of current PDA technology but is scalable to allow for additional functionality in the future (for example, customized video and audio feed).

Collect a Geographic Reference Base

The GPS provider would be in charge of correlating the list of park reference points made by park staff with a geographic reference base that would allow the technology used by the visitor to automatically discern the present location and provide appropriate location-specific information.

Choose User Interface and Use Agreements

A private sector partner would need to give the park service recommendations on which technology should be used for interpretation (e.g. PDA that can be read, a headset to listen to, etc), on how the menu should be set-up so that visitors can get the specific information they are interested in, and how the technologies should be distributed (e.g. should people bring their own and have information downloaded, should people rent them, or should they be lent out at no cost?).

Issues

Technological Issues

- Technology will need to be chosen that does not require a communications infrastructure that may not be available in a National Park Setting.

Institutional Issues

- The park will need to work closely with technology companies to understand the current capabilities and limitations of technologies that may be used as a virtual ranger, and how the capabilities are expected to evolve in the future. It is recommended that a group of parks interested in this concept work together with the technology companies, or that this be approached from a national level.

- It is unclear whether this would detract from the visitor experience. This depends upon the expectations that a visitor has going in. Some parks, such as historical sites and battlefields, would probably be more amenable to this than others.

10. IMPLEMENTATION OF ITS

This chapter outlines the next steps recommended for national parks in California that wish to implement ITS projects. To facilitate implementation, each section within this chapter includes a checklist which the park can use to ensure that all key points have been addressed. The checklists covering the entire implementation process are summarized in Figure 10-1.

Checklist for Implementing ITS Projects in California National Parks

- ☐ Develop relationship with local RTPA/MPO
- ☐ Conduct a transportation needs assessment
- ☐ Identify ITS themes for Park
- ☐ Identify ITS projects from ITS themes

Figure 10-1: Checklist for Implementing ITS Projects.

10.1. Develop Relationship with Local RTPA/MPO

The first step for a California national park interested in implementing ITS projects is to develop a relationship with transportation agencies that can assist in project planning, development, design and funding. Two critical agencies are the regional transportation planning agencies (sometimes called metropolitan planning organizations depending upon the level of urbanization) and Caltrans.

Most transportation funding within the state of California is directed through the state's regional transportation planning agencies (RTPAs) and metropolitan planning organizations (MPOs). These agencies are responsible for transportation planning and programming of transportation improvements, are familiar with the broad array of potential funding sources, and may be a useful conduit for developing partnerships between the park and other agencies. The park should seek to become better acquainted with RTPA/MPO staff and how to get involved in their decision-making processes regarding transportation planning and scheduling of future projects. This partnership will be especially valuable for ITS projects, since RTPAs and MPOs are responsible for maintaining the regional ITS architectures within which an ITS project needs to fit. A map of the RTPA/MPO boundaries within California is shown in Figure 7-6 (on page 107).

The park also should seek to enhance its relationship with the local Caltrans district, which can provide information on other sources of state and Federal funding. Figure 10-2 provides a short checklist to ensure that this step has been completed and a map of Caltrans districts is shown in Figure 10-3.

Develop relationship with local RTPA/MPO

☐ The local RTPA/MPO is: ______________________________

See Figure 7-6

☐ A good contact person there is: ________________________

☐ The park is in Caltrans District(s) ______________________

See Figure 10-3

☐ A good contact person there is: ________________________

Figure 10-2: Checklist for Developing Relationship with RTPA/MPO.

10.2. Conduct a Transportation Needs Assessment

ITS is most successful when it is viewed as a tool to help address particular transportation problems. This study followed that approach by focusing on two of California's nearly two dozen national parks – Golden Gate National Recreation Area (GGNRA) and Sequoia and Kings Canyon National Parks (SEKI) – and assessing the transportation needs at each park. While the resulting ITS theme recommendations should be appropriate for these two parks, they may not be transferable to other parks. Therefore, other parks should seek to have a reasonable understanding of their park's transportation needs before implementing ITS projects. The following steps would be valuable in helping identify those needs.

Figure 10-3: Map of Caltrans District Boundaries.

- Review recent general management plans and other park planning documents completed within the last twenty years.
- Review applicable local transportation plans. The RTPA/MPO is the best starting point to identify relevant transportation plans.
- Meet with county RTPA or MPO representatives, Caltrans district staff, state and county law enforcement, emergency response personnel and others to discuss how the park affects transportation outside the park and vice-versa.

- Meet with concessionaires, local tourism officials, and park partner organizations to identify how transportation can best serve the visitor experience.

- Survey visitors regarding their perception of transportation challenges and the appropriateness of various solutions to meet those challenges. To conserve time and resources, the park should take advantage of all surveys which have been conducted to date, including the National Park Service's Visitor Services Project (VSP) surveys.

These steps are summarized in a checklist in Figure 10-4.

10.3. Identify ITS Themes for Park

Last chapter presented several ITS themes which were developed primarily in response to the transportation needs identified at GGNRA and SEKI, along with other themes that may have applicability to other parks. However, these themes represent a fraction of the potential ITS can offer in a park setting and may not be fully transferable to other parks within California. Therefore, before implementing an ITS project, the park needs to ensure that the project fits in within an overall strategy of what ITS should accomplish. The following steps are recommended for identifying suitable ITS themes, and are summarized in the checklist in Figure 10-5 (see page 227).

- <u>Develop a transportation vision statement for the park</u>. This may have already been done through a general management plan or another park document. It should reflect that the transportation system may be a part of the overall visitor experience but that it should not detract from that experience.

- <u>Develop a vision for intelligent transportation systems in the park</u>. It is important that a vision for ITS fall within the overall transportation vision for the park. This vision should consider both how ITS can enhance the visitor experience, as well as how it can improve the management of the park from an operational and resource protection perspective. This vision should be developed in consultation with the region's RTPAs and MPOs along with the local Caltrans district to identify opportunities for collaboration.

- <u>Refine the ITS vision into ITS objectives</u>. The ITS vision should be reformulated into objective statements about what ITS should seek to accomplish in the park in order to meet the park's transportation needs. There will likely be overall objectives regarding the aesthetic character of ITS field elements, as well as more specific objectives related to different aspects of the transportation system (e.g. parking, transit). These objectives should be specific and measurable, to ensure that the performance of the ITS solution may be quantitatively evaluated.

- <u>Develop ITS themes from ITS objectives</u>. ITS themes are a useful starting point for putting ITS into a park, because they can present at a fairly simplistic level what ITS should accomplish without getting weighed down in more detailed technology decisions.

Conduct a transportation needs assessment

- [ ] Park Planning Documents
  - The last park GMP was conducted in ____________________________
  - [ ] Review the transportation needs identified in that GMP
  - Other transportation studies conducted in the last ten years include:
  - [ ] ____
  - [ ] ____
  - [ ] ____
- [ ] Local Planning Documents
  - [ ] Regional ITS Strategic Deployment Plan
    See Figure 7-5 to identify the appropriate plan
  - [ ] Local Regional Transportation Plan
  - Other transportation documents recommended by RTPA/MPO
  - [ ] ____
  - [ ] ____
  - [ ] ____
  - Gateway Community/City Transportation Plans
  - [ ] ____
  - [ ] ____
- [ ] Meet with local transportation officials
  - [ ] RTPA/MPO staff ____
  - [ ] Caltrans District staff ____
  - [ ] California Highway Patrol ______________________________________
  - [ ] Local law enforcement ____
  - [ ] Local emergency response ______________________________________
  - [ ] Local Air Quality Management District ___________________________
- [ ] Meet with other affected partners
  - [ ] Local tourism agency ____
  - [ ] Local chambers of commerce ____________________________________
  - [ ] Park concessionaires ____
  - [ ] Park partner support organizations ______________________________
- [ ] Survey park visitors
  - [ ] Review most recent visitor services project (VSP) survey
  - [ ] Review other recent surveys
  - [ ] Identify critical survey questions
  - [ ] Conduct park survey (VSP, park staff, or contractor)

Figure 10-4: Checklist for Conducting a Transportation Needs Assessment.

Identify ITS Themes for Park

- ☐ Develop a transportation vision for the park
  - ☐ Develop draft vision statement
  - ☐ Solicit comments from key park stakeholders
    - ☐ Park interpretation staff
    - ☐ Park maintenance staff
    - ☐ Park visitors
    - ☐ Park partner organizations
    - ☐ Gateway community government officials
    - ☐ County government officials
    - ☐ Other stakeholder ______________________________
    - ☐ Other stakeholder ______________________________
  - ☐ Revise vision statement
- ☐ Develop an ITS vision for the park
  - ☐ Craft draft ITS vision from overall transportation vision
  - ☐ Solicit comments from key ITS stakeholders
    - ☐ RTPA/MPO staff
    - ☐ Caltrans district staff
  - ☐ Revise ITS vision statement
- ☐ Refine the ITS vision into ITS objectives
  - ☐ Review draft ITS objectives
    See Table 8-1
  - ☐ Add objectives as needed to meet park needs
    Aim for specific, measurable objectives
  - ☐ Remove non-critical objectives
- ☐ Develop ITS themes to match ITS objectives
  - ☐ Review existing themes to see which ones address park transportation problems
    See Table 10-1
  - ☐ Review existing themes to see which ones address park ITS objectives
    See Table 10-2
  - ☐ Remove themes that are not appropriate for park goals
  - ☐ Identify pieces of ITS Architecture to make new themes
    - ☐ Review market packages from ITS National Architecture
      See http://itsarch.iteris.com/itsarch/
    - ☐ Identify market packages which would help to address park needs
    - ☐ Review equipment packages associated with each market package to identify relevant pieces
    - ☐ Combine selected equipment packages to form self-contained ITS themes
    - ☐ Review information flows for completeness
    - ☐ Develop diagrams of ITS themes
    - ☐ Develop description of ITS theme
      - Identify primary functions
      - Develop order of functions
      - Identify key stakeholders

Figure 10-5: Checklist for Identifying ITS Themes for Parks.

One way of developing ITS themes is to compare the problems at a specific park with those that were identified at GGNRA and SEKI to see if the problems are comparable, and if the themes are transferable. Table 10-1 summarizes the problems that were identified for each park, and the recommended themes. This would provide a good starting point, although the themes should be examined in detail to ensure that all key stakeholders are included, and all park-specific problems are addressed.

Since GGNRA and SEKI represent only two of California's national parks, their transportation problems may not be inclusive of all transportation problems confronting the state's national parks. However, the same theme may address numerous transportation problems, including some that are not challenges for either GGNRA or SEKI. Therefore, another approach to identify whether some of the themes might be applicable to a park's unique challenges is to start with the ITS objectives and see which themes address which objectives. Table 10-2 provides this traceability by listing all of the ITS objectives developed in this report along with the themes which may realize those objectives.

Finally, the themes in this report do not encompass all of the potential ITS solutions that could benefit a park. If the themes provided in this report are not sufficient, the National ITS Architecture can be used as a way to develop new themes. When using the National ITS Architecture, it is advised that the park work with an agency or contractor who is familiar with it. In brief, the following steps would be required:

1. Review the market packages from the National ITS Architecture. These may be accessed from the National ITS Architecture web site (http://itsarch.iteris.com/itsarch/) by selecting the "Market Packages" button.

2. Identify market packages that can match park needs. The market package description and diagram should be used to interpret whether the market package may help to address park transportation challenges.

3. Select equipment packages from each market package. Each market package consists of a set of equipment packages, each of which is associated with a specific subsystem. The market packages represent a fairly expansive view of what ITS can do in a given area, but this can be made more realistic by selecting only those equipment packages that make the most sense from the park's perspective. The equipment packages for each market package can be viewed by selecting a given market package and scrolling down on the web page to select the appropriate hyperlinks. The hyperlinks for each equipment package provide more detail on the information flows associated with each one.

4. Combine equipment packages to form self-contained ITS themes. Equipment packages from a variety of market packages may be combined to make an integrated ITS theme. To identify opportunities for combining these equipment packages, the park should consider sequentially or chronologically how the theme would collect, analyze and disseminate information or data.

Table 10-1: ITS Themes to Address Park Transportation Problems

Problem	Theme	Page
Campground Information and Reservations	Campground Reservations and Information (SEKI)	185
Degradation of Air Quality	Emissions Monitoring (SEKI)	189
Emergency Response	Major Emergency Response (GGNRA)	149
Inadequate Access	Parking Intercept (GGNRA) Pre-trip Traveler Information (GGNRA) Transit Trip Planner (GGNRA)	131 137 144
Lack of Planning Data	Data Collection and Storage (GGNRA) Parking Management and Information (GGNRA) Roadway Congestion Forecasting (GGNRA)	121 126 115
Limited Parking	Parking Intercept (GGNRA) Parking Management and Information (GGNRA) Parking Management and Information (SEKI) Pre-trip Traveler Information (GGNRA) Roadway Congestion Forecasting (GGNRA) Transit Service and Transit Traveler Information (SEKI)	131 126 157 137 115 162
Queues at Entrance Stations	Electronic Entrance Fee Collection (SEKI)	173
Road Infrastructure	Oversize Vehicle Detection (SEKI)	193
Roadway Congestion	Oversize Vehicle Detection (SEKI) Parking Intercept (GGNRA) Parking Management and Information (GGNRA) Parking Management and Information (SEKI) Pre-trip Traveler Information (GGNRA) Road Construction Information and Coordination (SEKI) Road Monitoring and Incident Management (SEKI) Roadway Congestion Forecasting (GGNRA) Transit Service and Transit Traveler Information (SEKI) Transit Trip Planner (GGNRA)	193 131 126 157 137 181 177 115 162 144
Safety Challenges due to Incidents	Road Monitoring and Incident Management (SEKI)	177
Transit Coordination and Information	Parking Intercept (GGNRA) Pre-trip Traveler Information (GGNRA) Transit Trip Planner (GGNRA)	131 137 144
Transit Service	Transit Service and Transit Traveler Information (SEKI)	162
Traveler Information	Parking Intercept (GGNRA) Parking Management and Information (GGNRA) Pre-trip Traveler Information (GGNRA) Roadway Congestion Forecasting (GGNRA) Transit Trip Planner (GGNRA)	131 126 137 115 144
Weather Forecasts and Road Conditions	Weather and Road Condition Information (SEKI)	168
Work Zone/Event Coordination	Pre-trip Traveler Information (GGNRA) Road Construction Information and Coordination (SEKI) Roadway Congestion Forecasting (GGNRA)	137 181 115

Table 10-2: Objectives Achieved by ITS Themes

Goal / Objective	Themes
Goal 1: Enhance the visitor experience	
Objective 1.1: Provide real-time, accurate, convenient and relevant information to visitors to help them make travel decisions	
Objective 1.1.1: Develop predictive information that will help visitors plan their trips better	GGNRA 1, GGNRA 3, GGNRA 5, SEKI 7
Objective 1.1.2: Provide appropriate information at major transportation decision points	GGNRA 4, SEKI 1, SEKI 2, SEKI 3, SEKI 6
Objective 1.1.3: Provide information to help visitors avoid congested locations and times	GGNRA 1, GGNRA 4, GGNRA 5, SEKI 1
Objective 1.1.4: Provide weather, road condition, and chain requirement information	GGNRA 5, SEKI 3, OTHER 3
Objective 1.1.5: Provide construction and work zone information	GGNRA 5, SEKI 6
Objective 1.1.6: Provide information on parking availability	GGNRA 3, GGNRA 4, GGNRA 5, SEKI 1
Objective 1.1.7: Provide information at various park sites about transit arrivals and schedules	GGNRA 4, GGNRA 5, GGNRA 6, SEKI 2
Objective 1.1.8: Provide air quality information	SEKI 8
Objective 1.2: Improve visitor safety	
Objective 1.2.1: Improve the safety of vehicles at or approaching congested entrance stations	SEKI 4
Objective 1.2.2: Improve the safety of vehicle travel by visitors on park roadways	SEKI 5, SEKI 9
Objective 1.2.3: Improve the safety of vehicle travel through work zones in the park	SEKI 6
Objective 1.2.4: Improve the safety of bicyclists and pedestrians approaching popular destinations	GGNRA 3, SEKI 1
Objective 1.3: Enhance visitor access to the variety of natural, cultural, recreational and educational opportunities available at the park and surrounding areas	
Objective 1.3.1: Improve access options for visitors without automobile access	GGNRA 6, SEKI 2
Objective 1.3.2: Provide transit service that enables visitors to see attractions that may not have been possible because of unavailability of parking	GGNRA 6, SEKI 2
Objective 1.4: Improve visitor convenience	
Objective 1.4.1: Reduce the delay to visitors waiting in long lines at entrance stations	SEKI 4
Objective 1.4.2: Decrease the difficulty in finding available campsites	SEKI 7, OTHER 1
Objective 1.4.3: Allow visitors to make reservations for experiencing certain park activities	OTHER 1
Objective 1.4.4: Provide customized and enhanced interpretation through in-vehicle or handheld systems	OTHER 5

Table 10-2: Objectives Achieved by ITS Themes (cont.)

Goal / Objective	**Themes**
Goal 2: Assist in resource protection	
Objective 2.1: Encourage use of alternative modes of transportation to, from or within the park	
Objective 2.1.1: Increase usage of transit, pedestrian and bicycle modes for park access	GGNRA 4, GGNRA 6, OTHER 2
Objective 2.1.2: Increase usage of alternative transportation systems within park	GGNRA 6, SEKI 2
Objective 2.1.3: Promote information about non-automobile alternatives	GGNRA 4, GGNRA 5, GGNRA 6, SEKI 2
Objective 2.2: Monitor and reduce vehicle emissions	
Objective 2.2.1: Reduce emissions of idling vehicles in parking areas	SEKI 1
Objective 2.2.2: Reduce emissions of idling vehicles at entrance gates	SEKI 4
Objective 2.2.3: Improve the monitoring of air quality in the park	SEKI 8
Objective 2.3: Protect the road infrastructure as a park resource	
Objective 2.3.1: Re-direct oversize vehicle traffic to reduce roadway impacts	SEKI 9
Objective 2.3.2: Reduce time required for snow removal and other roadway maintenance	OTHER 3
Goal 3: Improve management of the park's transportation system	
Objective 3.1: Manage congestion within the park	
Objective 3.1.1: Predict occurrence and duration of congestion based on historical and real-time information	GGNRA 1, GGNRA 3
Objective 3.1.2: Monitor transportation operations and congested areas	GGNRA 1, GGNRA 4, SEKI 5
Objective 3.1.3: Reduce congestion on park roadways	SEKI 2, SEKI 9, OTHER 2
Objective 3.2: Manage incidents to reduce their impact on the park's transportation system and promote visitor safety	
Objective 3.2.1: Improve the response time to incidents along park roadways	SEKI 5
Objective 3.2.2: Provide for prompt and efficient evacuation of visitors during major emergencies	GGNRA 7
Objective 3.3: Manage construction and work zone activities and special events to minimize visitor inconvenience	
Objective 3.3.1: Enhance interagency coordination and communication regarding work zones and special events	SEKI 6, OTHER 3
Objective 3.3.2: Reduce the vehicle delay through work zones within the park	SEKI 6
Objective 3.3.3: Use archived data to help to promote improved planning for the impacts of special events on the local transportation system	GGNRA 1, GGNRA 6

Table 10-2: Objectives Achieved by ITS Themes (cont.)

Goal / Objective	**Themes**
Objective 3.4: Manage parking facilities within the park	
Objective 3.4.1: Reduce congestion in and around parking areas	GGNRA 3, GGNRA 4, SEKI 1, SEKI 2, OTHER 2
Objective 3.4.2: Reduce parking outside of designated parking areas	GGNRA 3, SEKI 1, SEKI 2
Objective 3.4.3: Improve management of existing parking facilities to optimize parking usage	GGNRA 3, GGNRA 4, SEKI 1
Objective 3.5: Manage transit systems providing access to park sites	
Objective 3.5.1: Improve efficiency and level of service of transit operations within the park	SEKI 2
Objective 3.5.2: Enhance the monitoring and coordination of various transit operations serving the park	GGNRA 6
Objective 3.6: Manage data to promote better transportation planning in the park	
Objective 3.6.1: Enhance the reliability, accuracy, and timeliness of visitation statistics	GGNRA 2
Objective 3.6.2: Collect additional statistics to help in transportation planning (e.g. distinguish between travelers and visitors, determine linked trips and trip patterns, count non-motorized travel)	GGNRA 2
Objective 3.7: Manage the transportation impact of the park's visitation on surrounding communities	
Objective 3.7.1: Manage adverse traffic impacts on local communities while preserving the economic benefits of tourist activity	GGNRA 3
Objective 3.7.2: Promote sharing of information regarding tourist activities between the park and local communities	GGNRA 5, OTHER 4

5. Review information flows for completeness. The information flow descriptions for each equipment package should be reviewed to insure that they meet the park's requirements while not providing unnecessary functionality. The architecture may be customized by adding new information flows or by changing the subsystems between which a certain information flow travels. However, the park should seek to adhere as closely to the National ITS Architecture as possible before pursuing customization.

6. Diagram the ITS theme. The subsystems, terminators and information flows can be connected in a simple box-and-arrow diagram. This provides a better visual understanding of what the ITS theme intends to do.

7. Describe the ITS theme. Once the diagram is developed, the ITS theme may be effectively described. Key elements in the description include listing and ordering the primary functions associated with the ITS theme, and identifying the primary stakeholders represented by every subsystem and terminator shown in the diagram,

ITS themes are a useful starting point for putting ITS into a park, because they can present at a fairly simplistic level what ITS should accomplish without getting weighed down in detailed technology decisions.

10.4. Develop ITS Projects from ITS Themes

The next step toward ITS implementation is to develop specific ITS projects from the recommended ITS themes. While ITS themes were designed to be technology-neutral, field implementations of these themes cannot be. Therefore, park staff need to work with other stakeholders – including their local RTPA or MPO and their local Caltrans district office – to develop project recommendations from each theme.

In order to promote consistency with the National ITS Architecture, the following steps are recommended for developing projects. These steps are shown in the checklist in Figure 10-6.

- Develop ITS projects from ITS themes. To develop project ideas, each theme should be examined to identify how ITS elements could be phased in over time. Once this has been done for each theme, the component elements should be compared across themes to see if there are any synergies that may be achieved. For example, collection of real-time traffic data could be a vital input for a parking management theme and a roadway congestion monitoring theme, so it may be a useful component to break out as a separate project.

- Identify a project champion. When multiple stakeholders are involved in the project, it will be necessary to have a project champion – an individual within an agency who takes leadership for ensuring that the project gets deployed. The park will be the "logical" champion for many projects, but in some cases a park partner, a local Caltrans district or another stakeholder may be more appropriate.

- Develop project architecture. By developing a project architecture at this stage, this ensures that opportunities for integration and data sharing are considered early on. The architecture should first consider how the regional architecture incorporates the park and its transportation needs before adding new components to reflect the project's needs.

- Develop concept of operations for each project. The park should develop an understanding of how the project would work: where would it be deployed, what information would it generate, who would use it, and similar questions.

- Develop requirements for each project. Based on the concept of operations, the park should develop a list of functional requirements for the project. This will be critical in understanding what technologies may be most appropriate for the project, in identifying appropriate contractors and vendors, and ensuring vendor/contractor compliance with stakeholder needs. In order to ensure that the system is fully defined, it would be helpful to have a third-party guide the park and other stakeholders

Develop ITS Projects from ITS Themes

- ☐ Develop ITS projects from ITS themes
  - ☐ Identify potential project phasing
  - ☐ Compare themes to identify common elements for larger, integrated ITS
  - ☐ Develop discrete projects from themes
  - ☐ Prioritize projects
- ☐ Identify project champions
  - ☐ Identify park champion for each project
  - ☐ Identify involved stakeholders for each project
  - ☐ Identify contact person with each stakeholder
- ☐ Develop project architecture
  - ☐ Review and combine theme diagrams
  - ☐ Define all subsystems and terminators for each project
  - ☐ Define all information flows
  - ☐ Compare project to regional architecture and amend as necessary
    - *Coordinate with RTPA/MPO*
- ☐ Develop concept of operations
  - ☐ Identify roles and responsibilities of stakeholders
  - ☐ Identify location and environment of operations
  - ☐ Summarize information inputs and outputs
  - ☐ Identify system users and their expectations/needs
  - ☐ Quantify performance requirements (e.g. speed, reliability, capacity, life cycle, etc.)
  - ☐ Identify measures of effectiveness
- ☐ Develop project requirements
  - ☐ Set-up system walkthrough
  - ☐ Review draft requirements
  - ☐ Finalize requirements
- ☐ Obtain stakeholder buy-in
  - ☐ Develop agreements or memoranda of understanding with all stakeholders
    - *Information-sharing*
    - *Interoperability*
    - *Ownership*
    - *Operations and Maintenance*

Figure 10-6: Checklist for Developing ITS Projects from ITS Themes.

through requirements development. An initial "walkthrough" session, where stakeholders can agree on how the system should function, can help the third party to develop draft requirements. These requirements can be reviewed for completeness by the park, the champion and involved stakeholders.

- Obtain stakeholder buy-in for projects. Most ITS projects will require cooperation at least between different units of park staff, if not cooperation between park staff and other stakeholders. A list of stakeholders for each project should be developed. Agreements may need to be developed regarding interoperability, information sharing, operations and maintenance, cost sharing and other issues.

11. SUMMARY AND FUTURE RESEARCH

This report has investigated how intelligent transportation systems can meet the needs of national parks in California, by focusing on two specific parks and using those parks to help identify needs and opportunities in California's other parks. This chapter summarizes the content of this final technical report, and identifies promising directions for future research in this area.

11.1. Summary of Phase 1

Caltrans Division of Research and Innovation (DRI) provided funding to research the potential for intelligent transportation systems (ITS) to address transportation challenges in California's national parks. To better focus the research effort, two parks were chosen to provide some representation of parks statewide; these parks were Golden Gate National Recreation Area and Sequoia and Kings Canyon National Parks.

A variety of methods were used at both parks to identify transportation challenges and potential solutions. General management plans and other park documentation were reviewed; meetings with and surveys of key park stakeholders were conducted; and visitor surveys were also conducted. Based on these transportation challenges, objectives were developed for what ITS could accomplish in each park. These objectives were translated into ITS themes that represent parts of the National ITS Architecture that may be used to support ITS projects.

The themes may represent an effective entry point for parks considering implementing ITS projects at parks. Therefore, a series of checklists was presented that would enable parks to take use themes as a foundation to implement ITS projects in their parks.

11.2. Next Steps of Research Project

Caltrans DRI has approved additional funding for a second phase of this research project. The second phase is intended to build on the planning and needs assessment described in this report and lead toward demonstration and evaluation of ITS applications in park settings. The deliverables associated with this second phase are described in the following sections.

11.2.1. Park Outreach Video

The research conducted for this report has provided insight into how ITS may be able to address park challenges. However, this knowledge is currently focused primarily around the two demonstration parks. To promote broader understanding of the potential applicability of ITS to address transportation needs in and near a national park, the second phase will produce a park outreach video. The video will be scripted at 10-15 minutes in length, and will be aimed toward a broad audience including park staff, local transportation officials, politicians and decision-makers, and the general public. The video will seek to highlight the unique resources that national parks protect, along with the transportation challenges currently experienced at national parks. It will introduce how ITS may be used to solve some of the park's challenges, with a focus on the two demonstration parks in this report. The video will close with recommendations for how parks and local officials can proceed with incorporating ITS into the local transportation system to address transportation challenges, while preserving or enhancing the quality of the visitor experience.

The video content and script will be developed by WTI in conjunction with Caltrans video production staff, with content review provided by a technical advisory committee comprised of staff from Caltrans Division of Research and Innovation staff, regional and local NPS, FHWA Federal Lands Highway Program, the Volpe National Transportation Systems Center, and the local RTPA/MPO. It is currently planned that a draft video will be developed by spring 2004.

11.2.2. Measures of Effectiveness for ITS in National Parks

In order to obtain funding for ITS (or other initiatives), it is generally necessary that the anticipated benefits of these projects be known, so the alternative uses of scarce resources can be compared and it can be known whether the project has been a “success.” A variety of measures of effectiveness have been developed for ITS in general, e.g. reduced travel times, reduced crash frequency, increased throughput, and others. It is not clear, however, that these measures would be appropriate for use in evaluating ITS projects in national parks, and if they are not, what measures would be appropriate. Consequently, the second phase will also seek to develop a series of measures that may be used to evaluate ITS projects. These measures will be developed with an eye toward the early-winner projects (described later), but will hopefully have broader applicability to ITS projects and themes that were not identified through phase 1 of this research effort.

11.2.3. Integration and Architecture Support

As was discussed in the last chapter, each ITS project that is deployed is supposed to conform with a region’s ITS architecture, which in turn is to be consistent with the National ITS Architecture. With rare exceptions, however, regional ITS architectures in California have not explicitly considered the transportation needs of national parks within their respective regions. Consequently, it is not clear how an ITS project designed to assist a national park may integrate with a region’s architecture. Therefore, this part of the second phase will use a case study approach to examine how successfully park-focused ITS projects can be successfully integrated into their respective regional architectures.

11.2.4. Early-Winner Projects

The primary emphasis of phase 2 will be the development, design, implementation and evaluation of early-winner projects in Golden Gate National Recreation Area and Sequoia and Kings Canyon National Parks. One candidate project will be selected for each park, based on consultation with Caltrans Division of Research and Innovation staff, Caltrans district staff, local RTPA staff, and NPS regional and local staff. The selected project will have a high probability of yielding significant benefits in the short-term, in order to generate greater support for future ITS initiatives among project stakeholders.

For each selected project, a systems engineering approach will be used to ensure that the ultimate design best reflects the true stakeholder needs. As part of the systems engineering approach, a vision will be developed for each project, describing what the ITS project should do for each park. After this, a concept of operations will be developed, which includes an identification of project stakeholders, a description of the deployment's scope and scale, a review of practices and procedures necessary to support the concept, a description of applicable performance requirements, an overview of the anticipated utilization of the system, measures of system effectiveness, an estimate of the project's life cycle, and a description of the environmental conditions surrounding deployment. The concept of operations will help to develop appropriate functional requirements for each project.

Based on the requirements analysis, there will be an analysis of funding availability for each project. This analysis will identify which project stakeholders may be able to contribute toward project funding, both for initial capital costs as well as ongoing operations and maintenance. The availability of funding, between this project and other sources, will help to determine how much of each project can be implemented immediately. The systems engineering approach used in this project is especially appropriate for cases where full funding is not immediately available, since it makes phasing options more apparent. Based on the phasing that can be completed within existing funding, the project requirements will be used to develop a request-for-proposal (RFP) to procure equipment for each park's project. Prior to issuing the RFP, the research team will solicit input from Caltrans and other stakeholders as to appropriate selection criteria. The RFP will be issued and evaluated according to the agreed-upon selection criteria. Once vendors are selected, the equipment will be procured and installed.

Provided that the projects can be implemented this year, phase 2 will also include some preliminary evaluation activities for the early-winner projects. An evaluation plan will be developed that will identify measures of effectiveness for each project, and how data will be collected to support these measures. The evaluation plan will require data collection both before and after system implementation. The pre-implementation data would need to be collected during 2004. Results of this interim evaluation will then be created.

11.3. Future Research

The research completed on this project to date has suggested numerous promising areas for future research related to transportation in national parks. Some of these ideas are discussed in the sections below.

- Information Needs at Other National Parks. This study focused on two parks within California, but visitors at other parks would likely have different information needs based on demographics, visitation patterns, and other factors. This would provide useful information on additional parks, in addition to the changing receptivity of visitors to various technologies and transportation alternatives over time.

- Integration of Tourism and Transportation Information. The increased demand for information on transportation and tourism highlights some potential synergies between these areas. Currently, 511 has been set apart at a national level as a telephone number for travel information. At some locations (Yellowstone National Park, for example), the possibility of integrating tourism information into the travel information number is being explored. This may be explored for parks within

California as well, especially in some of the high-visitation urban parks (e.g. GGNRA and Santa Monica Mountains National Recreation Area).

- Information Dissemination at National Parks. National parks provide some unique challenges for providing traveler information, including the lack of infrastructure supporting automated real-time information, aesthetic concerns, and the percentage of non-English speaking visitors at many park sites. This combination of factors provides a need to consider non-conventional approaches for how to effectively disseminate information to visitors without increasing the time burden on park staff and volunteers. This research could focus on the methods and locations of information dissemination, and the requirements for information updating.

- Economic Impacts of Parks on Gateway Communities. There is a relationship between park visitation and economic activity at gateway communities adjacent to parks. However, there has been concern at some parks that increased reliance on transit for visitor transportation will reduce commercial activity in gateway communities. Some studies have sought to assess the economic impacts of specific national parks, but few have focused on national park units within California, and few have tried to examine the specific impact of park transportation strategies.

- Evaluation of ITS Strategies in National Parks. While some evaluation of ITS projects in national parks is provided in the second phase of this existing research project, there is comparably little ITS evaluation activity compared to ITS projects deployed for urban transportation networks. Further research into ITS measures of effectiveness, the effectiveness of various applications, and the transferability of these applications to other parks would help to direct future investment in ITS applications in or near national parks.

- ITS Infrastructure in Reduced Utility Environments. Power and communications availability in each demonstration park limit the feasibility of various ITS solutions. Further research into how ITS technologies could be designed in order to make more efficient use of available power and communications resources could yield significant benefits for ITS applications in national parks, as well as rural areas in general. This research could be university-based, but would likely need to be developed in consultation with vendors.

- Context-Sensitive ITS Design. ITS in a national park setting should ideally have a different look from systems in urban areas while providing comparable functionality in order to preserve the aesthetics of the park visit experience. Further research into construction materials and techniques, siting alternatives, human factors issues (for how visitors receive information) and other areas could lead to the development of guidelines for how ITS elements could fit successfully in a park context.

- Information Collection. All of the ITS themes described in this report involve collecting and distributing data or information. A database for the collection of National Park information should be created to store, archive, and automatically disseminate this information – including parking, lodging, wait times, transit usage, emissions levels, 511 information – on a real-time basis.

APPENDIX A: ATTENDEES AT GGNRA STAKEHOLDER MEETINGS

November 15, 2001

Name	Agency	Address	Phone	E-Mail
Susan Harrington	Caltrans, New Tech	1227 O St., Sacramento 95814	916/654-7482	susan_harrington@dot.ca.gov
Ginni Dilworth	Texas A&M	2261 TAMU	979/845-5349	gdilworth@rpts.tamu.edu
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
Chris Strong	WTI/MSU	P.O.Box 173910, Bozeman, MT 59717	406/994-7351	chriss@coe.montana.edu
Scott Williams	Caltrans, New Tech	1227 O St., Sacramento	916/654-9851	scott_williams@dot.ca.gov
Kevin Keck	SF MUNI	1145 Market St.	415/554-3239	kevin_keck@ci.sf.ca.us
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

November 16, 2001

Name	Agency	Address	Phone	E-Mail
Susan Harrington	Caltrans, New Tech	1227 O St., Sacramento 95814	916/654-7482	susan_harrington@dot.ca.gov
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
Alex Zwissler	Fort Mason Foundation	Landmark Building A, San Francisco 94123	415/441-3400	zwissler@fortmason.org
Ginni Dilworth	Texas A&M	2261 TAMU	979/845-5349	gdilworth@rpts.tamu.edu

APPENDIX B: OUTREACH SURVEY TO GGNRA STAKEHOLDERS

- What is your organization's role with respect to the transportation system in and around GGNRA?

- What is your organization's role with respect to tourism in and around GGNRA?

- Are there any new initiatives your organization is involved in that directly involve the Park?

- What do you see as some of the major transportation or tourism concerns in and around GGNRA? Example areas include: visitor experience, traveler safety, emergency response and management, traveler information, fleet management, transit and public mobility, infrastructure operations and maintenance, traffic congestion and parking, commercial vehicle operations, institutional issues, etc.

- What do you see as some of the major tourism concerns in and around GGNRA?

- What level of familiarity do you have with intelligent transportation systems (ITS)?

- What types of ITS applications do you think would have applicability to the Park's transportation or tourism challenges?

- We will be conducting three rounds of visitor surveys at the Park for this study. Are there particular areas of inquiry for which we should try to collect data?

- Please provide any other comments that you think would be helpful for this project.

APPENDIX C: ATTENDEES AT SEKI STAKEHOLDER MEETING

November 14, 2001

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
Jody McCullough	FHWA-Central Fed Lands	555 Zang, Denver	303/716-2272	jodymccullough@fhwa.dot.gov
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

APPENDIX D: OUTREACH SURVEY TO SEKI STAKEHOLDERS

- What is your organization's role with respect to the transportation system in and around Sequoia/Kings Canyon?

- What is your organization's role with respect to tourism in and around Sequoia/Kings Canyon?

- Are there any new initiatives your organization is involved in that directly involve the Park?

- What do you see as some of the major transportation or tourism concerns in and around Sequoia/Kings Canyon National Park? Example areas include: visitor experience, traveler safety, emergency response and management, traveler information, fleet management, transit and public mobility, infrastructure operations and maintenance, traffic congestion and parking, commercial vehicle operations, institutional issues, etc.

- What do you see as some of the major tourism concerns in and around Sequoia/Kings Canyon National Park?

- What level of familiarity do you have with intelligent transportation systems (ITS)?

- What types of ITS applications do you think would have applicability to the Park's transportation or tourism challenges?

- We will be conducting three rounds of visitor surveys at the Park for this study. Are there particular areas of inquiry for which we should try to collect data?

- Please provide any other comments that you think would be helpful for this project.

APPENDIX E: GGNRA VISITOR SURVEY FORM

Golden Gate National Recreation Area Transportation and Technology Study 2002

California Department of Transportation
Department of Recreation, Park & Tourism Sciences, Texas A&M University
Texas Transportation Institute
Western Transportation Institute

Mobility Analysis

Texas Transportation Institute
3135 TAMU
College Station, TX 77843-3135

Dear Visitor:

Thank you for taking the time to participate in this important study. Our goal is to learn about the experiences, opinions and needs of visitors to national parks in regard to transportation and technology. This will enable park managers, such as those as Golden Gate National Recreation Area, to better manage the park and serve you, the visitor.

The questionnaire is only being given to approximately 1200 visitors, so your participation is very important! It should take about 15-20 minutes for you to complete the survey. When your visit is over, please complete the survey, fold it in half with the postage-paid stamp and return address on the outside, staple or tape the open end, and drop it in any U.S. mailbox.

Please note that by returning this questionnaire, you are voluntarily agreeing to participate in this study. All of your answers in this questionnaire will be treated as strictly confidential. This survey has been reviewed and approved by the Institutional Review Board – Human Subjects in Research, Texas A&M University. For research-related problems or questions regarding subjects' rights, you may contact the Institutional Review Board through Dr. Michael W. Buckley, Director of Support Services, Office of Vice President for Research at (979) 458-4067.

If you have questions about this survey, please contact Scott Shafer (sshafer@rpts.tamu.edu) or Ginni Dilworth (gdilwort@rpts.tamu.edu), Department of Recreation, Park & Tourism Sciences at Texas A&M University. The phone number is (979) 845-5349.

NPS permit #: GOGA-2002-SCI-0001

Section I: Your visit to Golden Gate National Recreation Area (GGNRA)

The questions in this section of the survey are designed to help us understand some of the aspects of your most recent visit to Golden Gate National Recreation Area.

1. Which park in Golden Gate Recreation Area were you visiting when you received this questionnaire?

   Muir Woods ____
   Stinson Beach ____

Questionnaires were distributed at several locations in Golden Gate National Recreation Area. Please respond to the following questions <u>for the park at which you received the questionnaire</u>.

2. Would you consider yourself a tourist on a trip to this area? (please circle one) YES NO
   (if YES, continue with 3. If NO, go to question 5)

3. Approximately how many days were you in the San Francisco Bay area? _____

4. Please check the type of transportation you used and tell us why you used it.
   ____ Private automobile ______________________________
   ____ Rental automobile ______________________________
   ____ Private RV ______________________________
   ____ Rental RV ______________________________
   ____ Bicycle ______________________________
   ____ Public transportation ______________________________
   ____ Other ______________________________

5. What, if any, other parks/tourist sites did you visit while you were visiting the area?
   ____ Muir Woods
   ____ Stinson Beach
   ____ Marin Headlands
   ____ Point Reyes
   ____ Golden Gate Bridge/Overlooks
   ____ Golden Gate Park
   ____ Sausalito
   ____ Mt. Tamalpais State Park
   ____ Tennessee Valley
   ____ Fort Baker
   ____ Presidio
   ____ Cliff House
   ____ Mill Valley
   ____ Tiburon
   ____ Other (please specify) ______________________________

6. Did you use any other type of transportation than that indicated in question #4 to move between sites listed in question #5?

7. What activities did you participate in during your trip to the park?
   ____ Visit beach
   ____ View wildlife
   ____ Horseback riding
   ____ Ranger-led walks/talks
   ____ Hiking
   ____ Bicycling
   ____ Walk nature trails
   ____ Picnic
   ____ Go for a drive
   ____ Other (please specify: ______________________________)

A local resident is someone who lives in the area and travels to the park from home for a day visit. <u>If you are a local resident, please go to question 8</u>.

8. If you **are not a local resident**, did you stay overnight in the area? (please circle one)
   YES (continue with question 7)   **NO** (go to question 8)

9. Where did you stay overnight while visiting the park?
   ____ With family/friends
   ____ Hotel (name of town hotel is in: ______________________________________)
   ____ Campground (name of town campground is in: ___________________________)
   ____ Stayed in own home/condo
   ____ Other (please specify: ____)

10. Please rate how congested (with traffic) each of following areas was during your visit. Please check only one response for each area.

Areas	**Uncongested 1**	**Somewhat Uncongested 2**	**Neither 3**	**Somewhat Congested 4**	**Congested 5**	**I Don't know 6**
Roads leading To park	**1**	**2**	**3**	**4**	**5**	**6**
Parking lots	**1**	**2**	**3**	**4**	**5**	**6**
Trails	**1**	**2**	**3**	**4**	**5**	**6**

11. a) Please use the scale below to rate (from 1 to 5) how crowded you felt by people during this visit. Please circle **only one**.

Not at all Crowded		Crowded		Extremely Crowded
1	2	3	4	5

b) If you rated the above question by circling 3, 4, or 5, where in the park were you when you felt crowded? Please be as specific as possible.

____

12. Please indicate the importance of the following to your park visit.

	Unimportant 1	Somewhat Unimportant 2	Neither 3	Somewhat Important 4	Important 5
Safe roads	1	2	3	4	5
Safe parking areas	1	2	3	4	5
Level of congestion on roads leading to park	1	2	3	4	5
Level of congestion on trails in park	1	2	3	4	5
Ability to use own vehicle	1	2	3	4	5

13. Please indicate your level of satisfaction with the mode of transportation that you used to travel to the park. (please circle only one)

Unsatisfied 1	Somewhat Unsatisfied 2	Neither 3	Somewhat Satisfied 4	Satisfied 5

Section II: PARK USE EXPERIENCE

The amount of experience that people have with parks varies greatly. The following questions will be used to help us understand your past experience with national parks.

14. Approximately how much time did you spend in this park? ____ Days ____ Hours

15. Was this your first visit to this park? **YES** (go to question 18) **NO** (go to question 16)

16. Approximately how many times have you visited this park (including this visit) in the last 12 months? _______ times

17. In approximately what year did you make your first visit to this park? _________

18. Do you plan to visit this park again in the next 12 months? (please circle one) YES NO

19. Please estimate how many national park units you have visited in the past 5 years (not including this park) _______ park units

20. Please list the most recent parks (other than GGNRA sites) that you have visited.

Section III: PLANNING FOR THIS TRIP

In this part of the survey we would like you to tell us how you planned your trip to this park.

21. We would like to know what types of information you want when planning a trip. We would also like to know when you obtain each type of information. Please tell us at what point in your trip (before arriving at the park and/or in the park) you obtained each of the following types of information (if at all).

Please indicate (with an X) each type of information you obtained
(Please check all that apply)

	Before arriving at The park	**In the park**	**Did not obtain at all**
General park information (hours of operation and entrance fees)			
Activities at park			
Hotel/lodging information			
Campground information			
Travel time to park			
Transportation options to get to the park			
Alternate auto routes			
Road conditions			
Public transportation in park			
Parking availability			
Weather			
Other things to do in the area			

22. Next we would like to know what sources of information you used for your trip.

Please indicate (with an X) each item that you used …
(Please check all that apply)

I used the following …	**Before arriving at the park**	**In the park**	**Did not obtain**
Tour Book / visitor guides			
Internet – park web site			
Internet – other web site			
Friends/relatives			
Previous visits			
Visitor / Tourist information centers			
Commercial television			
Local access television			
Commercial radio			
Informational radio (e.g. highway advisory)			
Electronic Road Signs			
Chambers of Commerce			
Terminal Kiosks (airport, train or stations) with brochures, maps, etc.)			
Hotel information kiosks - computer terminal			
Phone inquiry to park			
Cell phone (to access current data)			
Personal Digital Assistant (PDA)			
Current Internet travel information			
Newspaper/magazine articles			
Talk to people in local communities			
Travel agent			

23. If you stayed overnight in the area or at the park, how did you make your lodging or camping reservations?

____ Called establishment directly
____ Stopped in
____ AAA
____ Visitor center
____ Used reservation service
____ Used the Internet
____ Travel agent
____ Other (please specify: ________________________)

Section IV: ATTITUDES

Now we would like to know how you feel about certain aspects of a park.

24. Please indicate how **appropriate** you believe the following are for use in national parks.

Please circle only one response for each item

I believe each of the following is …	**Inappropriate 1**	**Somewhat Inappropriate 2**	**Neither 3**	**Somewhat Appropriate 4**	**Appropriate 5**
Tour Book / visitor guides available in the park	1	2	3	4	5
Internet terminals in the park	1	2	3	4	5
Getting information from friends and relatives	1	2	3	4	5
Talking to Ranger at the park	1	2	3	4	5
Calling Ranger before visiting park	1	2	3	4	5
Commercial television used to provide park information	1	2	3	4	5
National Park Service video providing travel information	1	2	3	4	5
Commercial radio stations used to provide travel information	1	2	3	4	5
Informational radio (e.g. highway advisory radio)	1	2	3	4	5
National Park Service radio station with travel information	1	2	3	4	5
Electronic signs with travel information in the parking lots	1	2	3	4	5
Electronic signs with travel information on the park roads	1	2	3	4	5
Visitor center information kiosks – traditional (brochures, maps, etc.)	1	2	3	4	5
National Park Service automated telephone information line	1	2	3	4	5
Personal Digital Assistant (PDA) to access travel information	1	2	3	4	5
Use Travel Agent to obtain travel information about park	1	2	3	4	5
Mandatory shuttle service in park (you must park car outside park and ride shuttle into park)	1	2	3	4	5
Optional shuttle service in park (can either park car outside park and take shuttle or can drive into park in your car)	1	2	3	4	5
Taking a public bus into the park	1	2	3	4	5
Parking your car at the entrance and riding your bike into the park	1	2	3	4	5

25. Please indicate the extent to which you believe each of the following is an important part of the park's purpose.

Preservation of natural resources
____ not at all important ____ somewhat important ____ important ____very important ____ extremely important

Recreational use
____ not at all important ____ somewhat important ____ important ____very important ____ extremely important

Section V: TECHNOLOGY

This section asks you to tell us about the technology that you use in general and when planning a visit to a park.

26. Do you **own** any of the following? (check all that apply)
____ Computer ____ PDA (Personal Digital Assistant)
____ Cell phone ____ GPS (Geographic Positioning System)

27. Please tell us why you **don't own** each item that you did not check in question 26.

Please check only one for each item

	Too expensive	Don't know how to use	Don't think it is useful / don't need	Other (please specify
Computer				
Cell Phone				
PDA				
GPS				

28. Do you have access to the Internet (check all that apply)
____ at home ____ at work/school ____ other (please specify: ________________)

29. Do you use any of the following to make plan trips? (please circle YES or NO for each item)

			Please tell us why you do or do not use each item
GPS	YES	NO	
Current Internet Information	YES	NO	
Computer trip planners (e.g. MapQuest)	YES	NO	
Informational TV (e.g. weather channel)	YES	NO	
Commercial TV	YES	NO	
Information radio (e.g. Highway advisory)	YES	NO	
Commercial Radio	YES	NO	
PDA (Personal Digital Assistant)	YES	NO	
Cell phone to call for current information	YES	NO	

Section VI: OBTAINING TRAVEL INFORMATION

In this section we would like you to tell how useful you believe various information sources are, and how likely you are to use them.

30. Please tell us how **likely** it is that you would use each of the following before arriving at the park and while you are in Golden Gate National Recreation Area.

How **likely** is it that you would use each of the following . … (please rate each item on a scale of 1 to 5, with 1 meaning not at all likely and 5 meaning very likely)	**Before arriving** in this park not at all likely…..…….very likely 1 2 3 4 5	**While in** this park not at all likely…………likely very 1 2 3 4 5
Tour Book / visitor guides	1 2 3 4 5	1 2 3 4 5
Internet – park web site	1 2 3 4 5	1 2 3 4 5
Internet – other web site	1 2 3 4 5	1 2 3 4 5
Friends/relatives	1 2 3 4 5	1 2 3 4 5
Previous visits	1 2 3 4 5	1 2 3 4 5
Visitor / Tourist information centers	1 2 3 4 5	1 2 3 4 5
Commercial television	1 2 3 4 5	1 2 3 4 5
Local access television	1 2 3 4 5	1 2 3 4 5
Commercial radio	1 2 3 4 5	1 2 3 4 5
Informational radio (e.g. highway advisory)	1 2 3 4 5	1 2 3 4 5
Electronic Road Signs	1 2 3 4 5	1 2 3 4 5
Chambers of Commerce	1 2 3 4 5	1 2 3 4 5
Terminal Kiosks (airport, train or bus stations) with brochures, maps, etc.)	1 2 3 4 5	1 2 3 4 5
Terminal Kiosks (airport, train or bus stations) – electronic/computer	1 2 3 4 5	1 2 3 4 5
Hotel information kiosks with brochures, maps, etc.	1 2 3 4 5	1 2 3 4 5
Hotel information kiosks – electronic/ computer	1 2 3 4 5	1 2 3 4 5
Phone inquiry to park	1 2 3 4 5	1 2 3 4 5
Cell phone (to access current data)	1 2 3 4 5	1 2 3 4 5
Personal Digital Assistant (PDA)	1 2 3 4 5	1 2 3 4 5
Current Internet travel information	1 2 3 4 5	1 2 3 4 5
Newspaper/magazine articles	1 2 3 4 5	1 2 3 4 5
Talk to people in local communities	1 2 3 4 5	1 2 3 4 5
Travel agent	1 2 3 4 5	1 2 3 4 5
In park shuttle – no fee	1 2 3 4 5	1 2 3 4 5
In park shuttle – fee	1 2 3 4 5	1 2 3 4 5
Public bus to park - fee	1 2 3 4 5	1 2 3 4 5
Park and ride	1 2 3 4 5	1 2 3 4 5
Park and bike	1 2 3 4 5	1 2 3 4 5

Section VII: TRANSPORTATION

This section asks about the types of transportation you use, and the reasons that you do or do not use various types of transportation.

31. How often do you use public transportation?

____ daily ____ at least once per week
____ at least once per month ____ at least once per year
____ never

32. Have you ever used public transportation at a national park? YES NO

If yes, please specify the park(s) ____

If no, please tell us why not ____

Section VIII: GENERAL INFORMATION

33. Please indicate your gender: ____ male ____ female

34. In what year were you born? ______

35. What race do you consider yourself? (please check all that apply)

____ Black or African American ____ Asian
____ Hispanic or Latino ____ American Indian or Native Alaskan
____ White/Caucasian ____ Native Hawaiian or Pacific Islander
____ Other (Please specify: ___________________)

36. Please tell us the primary language you speak at home __________________________

37. What is the highest level of education that you have completed so far? (please check one)

____ Less than 12 years ____ Some college
____ High school graduate ____ College graduate
____ Technical / Vocational school ____ Graduate or professional degree

38. Which of these categories includes your annual household income?

____ Under $20,000 ____ $60,000 - $79,999
____ $20,000 - $39,999 ____ $80,000 - $99,999
____ $40,000 - $59,999 ____ $100,000 or more

39. Which of the following categories applies to you? (please check all that apply)

____ Employed full-time ____ Retired ____ Unemployed ____ Student
____ Employed part-time ____ Homemaker ____ Self-employed

Thank you for taking the time to complete this survey. If you feel that we have left anything out please use the space below to write additional comments. **Please fold the survey in half, with the return address showing, tape the open end and mail it back to us at your earliest convenience.**

APPENDIX F: SEKI VISITOR SURVEY FORM

Sequoia and Kings Canyon National Parks
Transportation and Technology Study
2002

California Department of Transportation
Department of Recreation, Park & Tourism Sciences, Texas A&M University
Texas Transportation Institute
Western Transportation Institute

Mobility Analysis
Texas Transportation Institute
3135 TAMU
College Station, TX 77843-3135

Dear Visitor:

Thank you for taking the time to participate in this important study. Our goal is to learn about the experiences, opinions and needs of visitors to national parks in regard to transportation and technology. This will enable park managers, such as those as Sequoia and Kings Canyon National Parks, to better manage the park and serve you, the visitor.

The questionnaire is only being given to approximately 1200 visitors, so your participation is very important! It should take about 15-20 minutes for you to complete the survey. When your visit is over, please complete the survey, fold it in half with the postage-paid stamp and return address on the outside, staple or tape the open end, and drop it in any U.S. mailbox.

Please note that by returning this questionnaire, you are voluntarily agreeing to participate in this study. All of your answers in this questionnaire will be treated as strictly confidential. This survey has been reviewed and approved by the Institutional Review Board – Human Subjects in Research, Texas A&M University. For research-related problems or questions regarding subjects' rights, you may contact the Institutional Review Board through Dr. Michael W. Buckley, Director of Support Services, Office of Vice President for Research at (979) 458-4067.

If you have questions about this survey, please call Scott Shafer (sshafer@rpts.tamu.edu) or Ginni Dilworth (gdilwort@rpts.tamu.edu), Department of Recreation, Park & Tourism Sciences at Texas A&M University. The phone number is (979) 845-5349.

NPS permit #: SEKI-2002-SCI-0003

Section I: YOUR VISIT TO SEQUOIA AND KINGS CANYON NATIONAL PARKS
(In this survey we will often refer to Sequoia & Kings Canyon National Parks as "this park")

The questions in this section of the survey are designed to help us understand some of the aspects of your most recent visit to Sequoia and Kings Canyon National Parks.

1. To begin, we would like to know what other tourist sites/parks, if any, you visited as part of this trip. We would also like to know what other tourist sites/parks you visited the same day that you visited Sequoia and Kings Canyon. (please check all that apply)

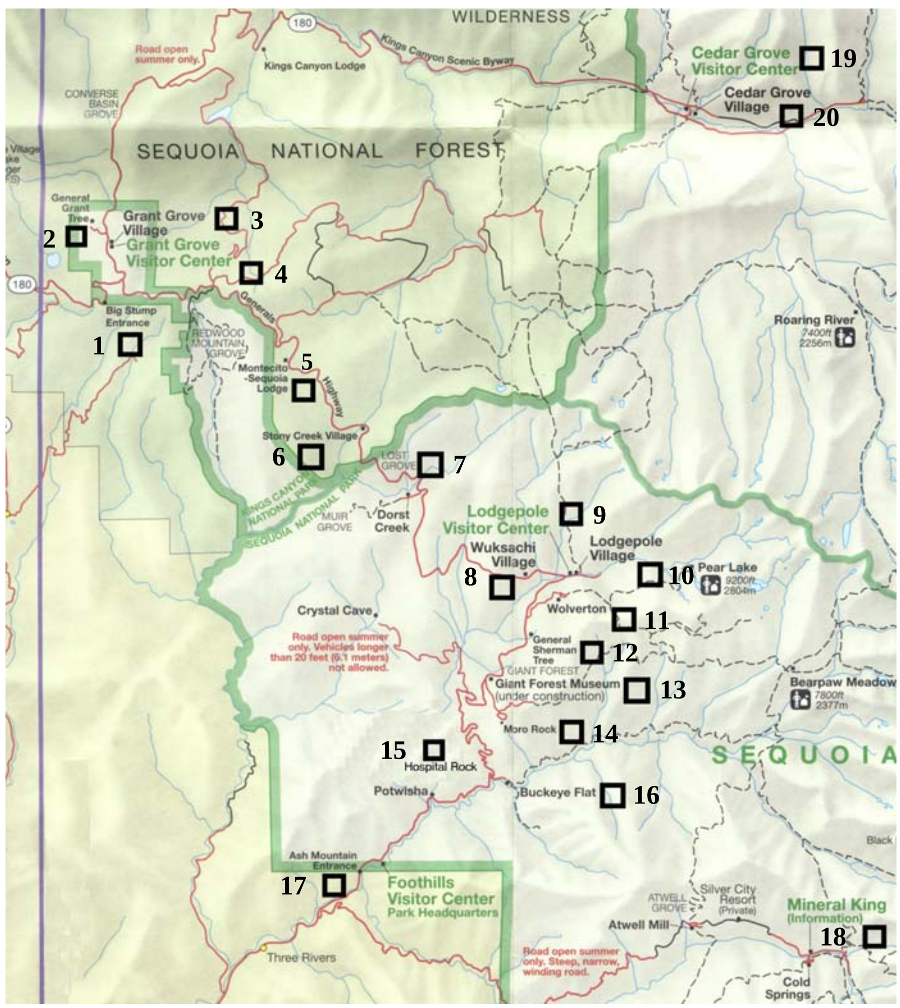
	Other sites visited during this trip	Other sites visited the same day as Sequoia & Kings Canyon
Yosemite National Park	_____	_____
Death Valley National Park	_____	_____
Other	_____	_____

(if other, please specify: ____)

2. We would like to get an idea of the route you took through the park and the places that you stopped inside the park. We would like you to do each of the following:

a. Using the map to the right, **please draw arrows showing the route you took** through the park.

b. Using the map to the right, **please mark an "X" in the boxes next to the places that you stopped while in the park** (use the list below as a reference).



1. Big Stump Entrance
2. General Grant Tree
3. Grant Grove Village
4. Grant Grove Visitor Center
5. Montecito-Sequoia Lodge
6. Stony Creek Village
7. Lost Grove
8. Wuksachi Village
9. Lodgepole Visitor Center
10. Lodgepole Village
11. Wolverton
12. General Sherman Tree
13. Giant Forest Museum
14. Moro Rock
15. Hospital Rock
16. Buckeye Flat
17. Foothills Visitor Center
18. Mineral King
19. Cedar Grove Visitor Center
20. Cedar Grove Village

3. Approximately how many days did you spend away from home on this trip? _______

4. How long did you stay at Sequoia and Kings Canyon National Parks? ______ days ______ hours

5. What activities did you participate in during your trip to Sequoia and Kings Canyon National Parks? (please check all that apply)

____ Backcountry camping	____ Camping in developed campground	____ Picnic
____ Ranger-led walks/talks	____ Horseback riding	____ Fishing
____ Sightseeing/scenic drive	____ View wildlife	____ Hiking
____ Cross-country skiing	____ Bicycling	____ Climbing

____ Other (please specify: ____)

A local resident is someone who lives in the area and travels to the park from home for a day visit. If you **are a local resident**, go to question 9.

6. If you **are not a local resident**, did you stay overnight in the area?

   YES (continue with question 7)   **NO** (go to question 9)

7. Did you stay inside the park? If yes, please check all that apply. If no, go to question 8.
   a) Campground
      ___ Grant Grove (Azalea, Crystal Springs, Sunset)
      ___ Grant Forest / Lodgepole Area (Dorst, Lodgepole)
      ___ Foothills Area (Buckeye Flat, Potwisha, South Fork)
      ___ Mineral King Area (Atwell Mill, Cold Springs)
      ___ Cedar Grove (Sheep Creek, Sentinel, Canyon View, Moraine)
      ___ Bearpaw High Sierra Camp
   b) Park lodging
      ___ Wuksachi Lodge   ___ Grant Grove Village   ___John Muir Lodge
      ___ Cedar Grove Lodge   ___ Silver City Resort (Mineral King Area)

8. Did you stay **outside the park** (while visiting this park)? If yes, please check type of accommodations from list below.
   a) ____ Hotel (Name of town hotel is in: ______________________________)
   b) ____ Campground (Name of town campground is in: ____________________)
   c) ____ B&B (Name of town B&B is in: ______________________________)
   d) ____ With family/friends
   e) ____ Own home or condo
   f) ____ Other (please specify: ____)

9. Please check the primary type of transportation you used and tell us why you used it. (please check only one)
   ____ Private automobile ____
   ____ Rental automobile ____
   ____ Private RV ____
   ____ Rental RV ____
   ____ Bicycle ____
   ____ Public transportation ____
   ____ Other ____

10. Please indicate your level of satisfaction with the type of transportation that you checked in question 9. (please circle only one)

Unsatisfied 1	Somewhat Unsatisfied 2	Neither 3	Somewhat Satisfied 4	Satisfied 5

11. Please rate how congested (with traffic) each of following areas was during your visit. Please circle only one response for each area.

Areas	**Uncongested 1**	**Somewhat Uncongested 2**	**Neither 3**	**Somewhat Congested 4**	**Congested 5**	**I don't care / not applicable 6**
Roads leading to this park	1	2	3	4	5	6
Roads inside this park	1	2	3	4	5	6
Parking lots	1	2	3	4	5	6
Trails	1	2	3	4	5	6

12. Please use the scale below to rate how crowded you felt during this visit. Please circle **only one**.

Not at all crowded		Crowded		Extremely Crowded
1	2	3	4	5

13. If you rated the above question (#12) by circling 3, 4, or 5, where in Sequoia and Kings Canyon National Parks were you thinking of? Please be as specific as possible.

____

____

14. Please indicate the importance of the following to your park visit. (please circle one response for each item)

	Unimportant 1	Somewhat Unimportant 2	Neither 3	Somewhat Important 4	Important 5
Safe roads	1	2	3	4	5
Safe parking areas	1	2	3	4	5
Level of congestion on roads leading to park	1	2	3	4	5
Level of congestion on trails in park	1	2	3	4	5
Ability to use own vehicle	1	2	3	4	5

Section II: PARK USE EXPERIENCE

The amount of experience that people have with parks varies greatly. The following questions will be used to help us understand your past experience with national parks.

15. Was this your first visit to this park? **YES** (go to question 18) **NO** (go to question 16)

16. Approximately how many times have you visited this park (including this visit) in the last 12 months? ______ times

17. In approximately what year did you make your first visit to this park? ________

18. Do you plan to visit this park again in the next 12 months? YES NO

19. Please estimate how many national park units you have visited in the past 5 years (not including this park). ______

20. Please list the most recent parks (other than this park) that you have visited.

Section III: PLANNING FOR THIS TRIP

In this part of the survey we would like you to tell us how you planned your trip to Sequoia and Kings Canyon National Parks.

21. We would like to know what types of information you want when planning a trip. We would also like to know when you obtain each type of information. Please tell us at what point in your trip (before leaving home, on the way to the park, while at the park), if at all, you obtained each of the following types of information.

Please indicate (with an X) each type of information you obtained (Please check all that apply)

I obtained information about:	**Before arriving** in the park	**In the park**	Did not obtain / Not applicable
General park information (hours of operation and entrance fees)			
Activities at park			
Hotel/lodging information			
Campground information			
Travel time to park			
Transportation options to get to the park			
Alternate auto routes			
Road conditions			
Public transportation in the park			
Parking availability			
Weather			
Other things to do in the area			

22. Next we would like to know how you obtained information when planning your trip. Please indicate when you used each of the following sources to obtain information for your trip, if at all.

Please indicate (with an X) each item that you used …
(Please check all that apply)

I used the following:	**Before arriving** in the park	while **in the park**	Did not use / not applicable
Tour Book / visitor guides			
Internet – park web site			
Internet – other web site			
Friends/relatives			
Previous visits			
Visitor / Tourist information centers			
Commercial television			
Local access television			
Commercial radio			
Informational radio (e.g. highway advisory)			
Electronic Road Signs			
Chambers of Commerce			
Terminal Kiosks (airport, train or bus stations) with brochures, maps, etc.			
Hotel information kiosks - electronic/computer			
Phone inquiry to park			
Cell phone (to access current data)			
Personal Digital Assistant (PDA)			
Current Internet travel information			
Newspaper/magazine articles			
Talk to people in local communities			
Travel agent			

23. If you stayed overnight in the area or at the park, how did you make your lodging or camping reservations?

____ Called establishment directly ____ Used reservation service
____ Stopped in ____ Used the Internet
____ AAA ____ Travel agent
____ Visitor center ____ Other (please specify: ________________________)

Section IV: ATTITUDES

Now we would like to know how you feel about certain aspects of a park.

24. Please indicate how **appropriate** you believe the following are for use **in national parks**.

Please circle one response for each item

I believe each of the following is …	Inappropriate 1	Somewhat Inappropriate 2	Neither 3	Somewhat Appropriate 4	Appropriate 5
Tour Book / visitor guides available in the park	1	2	3	4	5
Internet terminals in the park	1	2	3	4	5
Getting information from friends and relatives	1	2	3	4	5
Personal Digital Assistant (PDA) to access travel information	1	2	3	4	5
Calling Ranger before visiting park	1	2	3	4	5
Commercial television used to provide park information	1	2	3	4	5
National Park Service video providing travel information	1	2	3	4	5
Commercial radio stations used to provide travel information	1	2	3	4	5
Informational radio (e.g. highway advisory radio)	1	2	3	4	5
National Park Service radio station with travel information	1	2	3	4	5
Public/municipal bus between area surrounding park and park					
Electronic signs with travel information in the parking lots	1	2	3	4	5
Electronic signs with travel information on the park roads	1	2	3	4	5
Visitor center information kiosks with brochures, maps, etc.	1	2	3	4	5
National Park Service automated telephone information line	1	2	3	4	5
Talking to Ranger at the park	1	2	3	4	5
Mandatory shuttle service in park – you must park outside park and ride shuttle into park	1	2	3	4	5
Optional shuttle service in park (can either park car outside park and take shuttle or drive into park in your car)	1	2	3	4	5
Parking you car at entrance and riding your bike into the park	1	2	3	4	5

25. Please indicate the extent to which you believe each of the following is an important part of Sequoia and Kings Canyon National Parks' purpose.

Preservation of natural resources
____ not at all important ____ somewhat important ____ important ____ very important ____ extremely important

Recreational use
____ not at all important ____ somewhat important ____ important ____ very important ____ extremely important

Section V: TECHNOLOGY

This section asks you to tell us about the technology that you use in general and when planning a visit to a park.

26. Do you own any of the following? (check all that apply)
_____ Computer _____ PDA (Personal Digital Assistant)
_____ Cell phone _____ GPS (Geographic Positioning System)

27. Please tell us why you don't own each item that you did not check in question 26.

Please check only one for each item

	Too expensive	Don't know how to use	Don't think it is useful / don't need	Other (please specify
Computer				
Cell Phone				
Personal Digital Assistant (PDA)				
GPS				

28. Do you have access to the Internet (check all that apply)
____ at home ____ at work/school ____ Other (please specify:________________)

29. Please tell us if you use any of the following when planning a trip (please circle YES or NO for each item).

			Please tell us why you either do or do not use each item
GPS	YES	NO	
Current Internet Information	YES	NO	
Computer trip planners (e.g. MapQuest)	YES	NO	
Informational TV (e.g. Weather Channel)	YES	NO	
Commercial TV	YES	NO	
Information radio (e.g. Highway Advisory)	YES	NO	
Commercial radio	YES	NO	
Personal Digital Assistant (PDA)	YES	NO	
Cell phone to call for current information	YES	NO	

Section VI: OBTAINING INFORMATION

30. Please tell us how **likely** it is that you would use each of the following before arriving at the park, and while you are in Sequoia and Kings Canyon National Parks.

Please circle one response for each item "before park" and "in park"

How **likely** is it that you would use each of the following . … (please rate each item on a scale of 1 to 5, with 1 meaning not at all likely and 5 meaning very likely)	**Before arriving** in this park not at all likely…………very likely 1 2 3 4 5	Does not apply	**While in** this park not at all likely…………very likely 1 2 3 4 5	Does not apply
Tour Book / visitor guides	1 2 3 4 5	N/A	1 2 3 4 5	N/A
Internet – park web site	1 2 3 4 5	N/A	1 2 3 4 5	N/A
Internet – other web site	1 2 3 4 5	N/A	1 2 3 4 5	N/A
Friends/relatives	1 2 3 4 5	N/A	1 2 3 4 5	N/A
Previous visits	1 2 3 4 5	N/A	1 2 3 4 5	N/A
Visitor / Tourist information centers	1 2 3 4 5	N/A	1 2 3 4 5	N/A
Commercial television	1 2 3 4 5	N/A	1 2 3 4 5	N/A
Local access television	1 2 3 4 5	N/A	1 2 3 4 5	N/A
Commercial radio	1 2 3 4 5	N/A	1 2 3 4 5	N/A
Informational radio (e.g. highway advisory)	1 2 3 4 5	N/A	1 2 3 4 5	N/A
Electronic Road Signs	1 2 3 4 5	N/A	1 2 3 4 5	N/A
Chambers of Commerce	1 2 3 4 5	N/A	1 2 3 4 5	N/A
Terminal Kiosks (airport, train or bus stations) with brochures, maps, etc.	1 2 3 4 5	N/A	1 2 3 4 5	N/A
Terminal Kiosks (airport, train or bus stations) with internet terminals	1 2 3 4 5	N/A	1 2 3 4 5	N/A
Hotel information kiosks with brochures, maps, etc.	1 2 3 4 5	N/A	1 2 3 4 5	N/A
Hotel information kiosks with internet terminals	1 2 3 4 5	N/A	1 2 3 4 5	N/A
Phone inquiry to park	1 2 3 4 5	N/A	1 2 3 4 5	N/A
Cell phone (to access current data)	1 2 3 4 5	N/A	1 2 3 4 5	N/A
Personal Digital Assistant (PDA)	1 2 3 4 5	N/A	1 2 3 4 5	N/A
Current Internet travel information	1 2 3 4 5	N/A	1 2 3 4 5	N/A
Newspaper/magazine articles	1 2 3 4 5	N/A	1 2 3 4 5	N/A
Talk to people in local communities	1 2 3 4 5	N/A	1 2 3 4 5	N/A
Travel agent	1 2 3 4 5	N/A	1 2 3 4 5	N/A
In park shuttle – no fee	1 2 3 4 5	N/A	1 2 3 4 5	N/A
In park shuttle – fee	1 2 3 4 5	N/A	1 2 3 4 5	N/A
Public bus to park - fee	1 2 3 4 5	N/A	1 2 3 4 5	N/A
Park and ride	1 2 3 4 5	N/A	1 2 3 4 5	N/A
Park and bike	1 2 3 4 5	N/A	1 2 3 4 5	N/A

Section VII: TRANSPORTATION
This section asks about the types of transportation you use, and the reasons that you do or do not use various types of transportation.

31. How often do you use public transportation on a day-to-day basis? (please check only one)
    ____ daily ____ at least once per week
    ____ at least once per month ____ at least once per year
    ____ never

32. Have you ever used public transportation at a national park? YES NO

    If yes, please specify the park(s) ____

    If no, please tell us why not ____

Section VIII: GENERAL INFORMATION
33. Please indicate your gender: _____ Male _____ Female

34. In what year were you born? ______

35. What race do you consider yourself? (please check all that apply)

    ____ Black or African American ____ Asian
    ____ Hispanic or Latino ____ American Indian or Native Alaskan
    ____ White/Caucasian ____ Native Hawaiian or Pacific Islander
    ____ Other (Please specify: ___________________)

36. Please tell us the primary language you speak at home ___________________________

37. What is the highest level of education that you have completed so far? (please check one)

    ____ Less than 12 years ____ Some college
    ____ High school graduate ____ College graduate
    ____ Technical / Vocational school ____ Graduate or professional degree

38. Which of these categories includes your annual household income?

    ____ Under $20,000 ____ $60,000 - $79,999
    ____ $20,000 - $39,999 ____ $80,000 - $99,999
    ____ $40,000 - $59,999 ____ $100,000 or more

39. Which of the following categories applies to you? (please check all that apply)

    ____ Employed full-time ____ Retired ____ Unemployed ____ Student
    ____ Homemaker ____ Employed part-time ____ Self-employed

Thank you for taking the time to complete this survey. If you feel that we have left anything out please use the space below to write additional comments. **Please fold survey in half, with the return address showing, tape or staple the open end and mail it back to us at your earliest convenience.**

APPENDIX G: VISITOR SURVEY RESULTS AT GGNRA

GOGA Section I: Your Visit to Golden Gate National Recreation Area

1. Which park in Golden Gate Recreation Area were you visiting when you received this questionnaire?

	Count	Percent
Muir Woods	168	81.6
Stinson Beach	38	18.4
	N =	206
	*** =**	0

2. Would you consider yourself a tourist on a trip to this area? (please circle one) YES NO

	Count	Percent
Yes	153	75.4
No	50	24.6
	N =	203
	*** =**	3

3. Approximately how many days where you in the San Francisco Bay area? ______

	Count	Percent
1 to 3 days	49	33.1
4 to 5 days	61	41.2
5 to 7 days	26	17.6
7 or more days	12	8.1
	N =	148
	*** =**	58
	Mean	4.66
	StDev	3.48

4. Please check the type of transportation you used and tell us why you used it.

	Count	Percent
Private automobile	91	44.2
Rental automobile	84	40.8
Private RV	2	1.0
Rental RV	1	0.5
Bicycle	0	0.0
Public transportation	5	2.4
Other*	23	11.2
	N =	206
	*** =**	0

* *Of the Other, Tour bus is 10.2% (n =21)*

Additionally, respondents were asked to explain why they used the type of transportation that they used. The most frequent responses are summarized below:

Why used private automobile:

	Count	Percent
Close to home	23	26.4
Convenience	19	21.8
With friends/relatives	12	13.8
Driving vacation	10	11.5
Kids and stuff	6	6.9
Cost effective	6	6.9
What I use	6	6.9
No public transit	5	5.7
	N =	87
	*** =**	119

Why used rental automobile:

	Count	Percent
Convenience	27	33.3
Flew in	25	31.0
Independent	2	2.4
No choice	2	2.4
	N =	81
	*** =**	125

5. What, if any, other parks/tourist sites did you visit while you were visiting the area?

	Count	Percent
Muir Woods	85	41.3
Stinson Beach	47	22.8
Marin Headlands	31	15.0
Point Reyes	25	12.1
Golden Gate Bridge	125	60.7
Golden Gate Park	72	35.0
Sausalito	89	43.2
Mt. Tamalpais	26	12.6
Tennessee Valley	7	3.4
Fort Baker	7	3.4
Presidio	43	20.9
Cliff House	33	16.0
Mill Valley	24	11.7
Tiburon	25	12.1
Napa	13	6.3
Alcatraz	9	4.4
Fisherman's Wharf	8	3.9
	N =	206
	*** =**	0

6. Did you use any other type of transportation than that indicated in question #4 to move between sites listed in #5?

	Count	Percent
Car	75	44.1
Tour Bus	19	11.2
Rental Car	67	39.4
Public Bus	3	1.8
Other	1	0.6
Taxi	1	0.6
RV/Van	4	2.4
	N =	170
	*** =**	36

7. What activities did you participate in during to your trip to the park?

	Count	Percent
Visit Beach	76	37.1
View wildlife	69	33.7
Horseback riding	2	1.0
Ranger-led walks/talks	25	12.2
Hiking	80	39.0
Bicycling	4	2.0
Walk nature trails	148	72.5
Picnic	37	18.0
Go for drive	87	42.9
Other	8	3.9
	N =	205
	*** =**	1

8. If you are not a local resident, did you stay overnight in the area?

	Count	Percent
Yes	112	78.3
No	31	21.7
	N =	143
	*** =**	63

9. Where did you stay overnight while visiting the park?

	Count	Percent
Family/Friends	12	10.2
Hotel*	95	80.5
Campground**	5	4.2
Home/Condo	1	0.9
Other***	5	4.2
	N =	118
	* =	88

* *76.5% stayed in San Francisco, 4.0% stayed in Sausalito*
** *1.7% stayed in Bodega Bay*
*** *3.6% stayed in a bed and breakfast*

10. Please rate how congested (with traffic) each of the following areas was during your visit. Please cheek only one response for each area.

Roads leading to Park

	Count	Percentage
(1) Uncongested	101	51.8
(2) Somewhat Uncongested	33	16.9
(3) Neither	19	9.7
(4) Somewhat congested	30	15.4
(5) Congested	12	6.2
	N =	195
	*** =**	11
	Mean	2.07
	St Dev	1.34

Parking Lots

	Count	Percentage
(1) Uncongested	51	26.3
(2) Somewhat Uncongested	22	11.3
(3) Neither	6	3.1
(4) Somewhat congested	42	21.6
(5) Congested	73	37.6
	N =	194
	*** =**	12
	Mean	3.33
	St Dev	1.67

Trails

	Count	Percentage
(1) Uncongested	66	36.7
(2) Somewhat Uncongested	36	20.0
(3) Neither	36	20.0
(4) Somewhat congested	33	18.3
(5) Congested	9	5.0
	N =	180
	*** =**	26
	Mean	2.35
	St Dev	1.28

11. a) Please use the scale below to rate (from 1 to 5) how crowded you felt by people during the visit.

	Count	Percent
(1) Uncrowded	69	34.3
(2) Somewhat Uncrowded	79	39.3
(3) Neither	36	17.9
(4) Somewhat crowded	13	6.5
(5) Crowded	4	2.0
	N =	201
	*** =**	5
	Mean	2.02
	St Dev	0.98

b) If you rated the above question by circling 3, 4, 5, where in the park were you when you felt crowded? (Respondents could list more than one location.)

	Count	Percent
Nature trails	25	47.2
Parking lots	25	47.2
Restrooms/Gift shops/Entrance	11	20.8
Other	8	15.1
	N =	53
	*** =**	153

12. Please indicated the importance of the following to you park visit.

	N	*	(1) Unimportant		(2) Somewhat Unimportant		(3) Neither		(4) Somewhat Important		(5) Important		Mean	StDev.
			Count	%	Count	%	Count	%	Count	%	Count	%		
Safe Roads	197	9	3	1.5	3	1.5	5	2.5	48	24.4	138	70.1	4.60	0.75
Safe Parking Areas	197	9	2	1.0	3	1.5	12	6.1	50	25.4	130	66.0	4.54	0.77
Level of congestion on roads leading to park	196	10	2	1.0	5	2.6	19	9.7	101	51.5	69	35.2	4.17	0.78
Level of Congestion on trails in park	198	8	6	3.0	10	5.1	18	9.1	75	37.9	89	44.9	4.17	1.00
Ability to use own vehicle	199	7	23	11.6	7	3.5	30	15.1	43	21.6	96	48.2	3.91	1.35

13. Please indicate your level of satisfaction with the mode of transportation that you used to travel to the park.

	Count	Percent
(1) Unsatisfied	1	0.5
(2) Somewhat Unsatisfied	5	2.5
(3) Neither	4	2.0
(4) Somewhat Satisfied	20	9.8
(5) Satisfied	174	85.3
	N =	204
	*** =**	2
	Mean	4.77
	StDev.	0.65

GOGA Section II: Park Use Experience

14. Approximately how much time did you spend in this park?

Days

N =	20
*** =**	186
Mean	1.30
StDev.	0.57

Hours

N =	131
*** =**	75
Mean	2.95
StDev.	1.55

15. Was this your first visit to the park?

	Count	Percent
Yes	101	49.5
No	103	50.5
	N =	204
	*** =**	2

16. Approximately how many times have you visited the park in the last 12 months? _______ times

N =	103
*** =**	103
Mean	2.92
StDev	6.14

Repeat visitors have visited the park an average of two times over the previous twelve months.

17. In approximately what year did you make you visit to this park?

	Count	Percent
2000s	12	11.8
1990s	34	33.3
1980s	19	18.6
1970s	21	20.6
1960s	12	11.8
Prior to 1960	4	3.9
	N =	102
	*** =**	104

18. Do you plan to visit this park again in the next 12 months?

	Count	Percent
Yes	50	24.3
No	121	58.7
Didn’t Answer	35	17.0
	N =	206
	*** =**	0

19. Please estimate how many national park units you have visited in the past five years (not including this park)

N =	198
*** =**	8
Mean	6.34
StDev.	7.41

20. Please list the most recent parks (other than GGNRA sites) you have visited

	Count	Percent
Yosemite	49	28.0
Grand Canyon	39	22.3
Yellowstone	32	18.3
Zion	15	8.6
Sequoia and Kings Canyon	14	8.0
Grand Teton	13	7.4
Bryce Canyon	11	6.3
Rocky Mountain	11	6.3
Great Smoky Mountains	10	5.7
Acadia	8	4.6
Arches	7	4.0
Glacier	7	4.0
Mount Rushmore	6	3.4
Badlands	5	2.9
Joshua Tree	5	2.9
Lassen	5	2.9
Mount Rainier	5	2.9
Painted Desert	5	2.9
Redwood	5	2.9
Shenandoah	5	2.9
Other Parks**	4	2.3
	N =	175
	*** =**	31

** Other parks visited included the Washington Mall, Canyonlands, Death Valley Everglades, and Gettysburg (each has 2.3%).

GOGA Section III: Planning For This Trip

21. We would like to know what types of information you want when planning a trip. We would also like to know when you obtain each type of information. Please tell use at what point in your trip (before arriving at the park and/or in the park) you obtain each of the following types of information (if at all).

	N =	* =	Before Arriving in the Park		While in the Park		Did Not Obtain/Not Applicable	
			Count	Percent	Count	Percent	Count	Percent
General Park Information	206	0	92	44.7	68	33.0	53	25.7
Activities at park	206	0	51	24.8	99	48.1	60	29.1
Hotel/Lodging Information	206	0	67	32.5	3	1.5	136	66.0
Campground Information	206	0	19	9.2	6	2.9	181	87.9
Travel Time to Park	205	1	103	50.2	6	2.9	96	46.8
Transportation Options to get to the Park	206	0	62	30.1	2	1.0	142	68.9
Take Auto-routes	206	0	56	27.2	4	1.9	146	70.9
Road Conditions	206	0	33	16.0	11	5.3	164	79.6
Public Transportation in Park	206	0	20	9.7	13	6.3	175	85.0
Parking Availability	206	0	26	12.6	68	33.0	113	54.9
Weather	206	0	101	49.0	28	13.6	79	38.3
Other Things to do in the Area	205	1	82	40.0	18	8.8	106	51.7

22. Sources of information. Respondents were asked to tell us what sources of information they used when planning their trip, and at which point in the planning process they used the information source.

Travel Information Type	N =	* =	Before Arriving in the Park		While in the Park		Did Not Obtain/Not Applicable	
			Count	Percent	Count	Percent	Count	Percent
Tour Book/Visitor Guides	204	2	117	57.4	32	15.7	66	32.4
Internet – park web site	203	3	54	26.6	1	0.5	149	73.4
Internet – other web site	205	1	74	36.1	0	0.0	131	63.9
Friends/relative	203	3	95	46.8	1	0.5	107	52.7
Previous Visits	204	2	94	46.1	4	2.0	107	52.5
Visitor/Tourist Information Centers	203	3	53	26.1	47	23.2	110	54.2
Commercial Television	202	4	3	1.5	0	0.0	199	98.5
Local Access Television	202	4	6	3.0	0	0.0	196	97.0
Commercial Radio	201	5	2	1.0	0	0.0	199	99.0
Highway Advisory Radio	202	4	4	2.0	1	0.5	197	97.5
Electronic Road Signs	201	5	9	4.5	0	0.0	192	95.5
Chambers of Commerce	202	4	13	6.4	1	0.5	188	93.1
Terminal Kiosks -- airport, train or bus station	202	4	16	7.9	2	1.0	184	91.1
Hotel Information Kiosks – computer terminal	202	4	40	19.8	1	0.5	162	80.2
Phone Inquiry to Park	202	4	15	7.4	0	0.0	187	92.6
Cell phone (to access current data)	202	4	9	4.5	1	0.5	192	95.0
Personal Digital Assistant (PDA)	202	4	2	1.0	0	0.0	200	99.0
Current Internet Travel Information	202	4	35	17.3	1	0.5	166	82.2
Newspaper/magazine Articles	202	4	34	16.8	1	0.5	167	82.7
Talk to People in Local Communities	202	4	44	21.8	7	3.5	151	74.8
Travel Agent	202	4	4	2.0	1	0.5	197	97.5

23. If you stayed overnight in the area or at the park, how did you make you lodging or camping reservations?

	Count	Percent
Called the establishment directly	28	26.7
Stopped in at an establishment	5	4.8
AAA	8	7.6
Visitor center	0	0.0
Used the reservation service	12	11.4
Used the Internet	42	40.0
Travel agent	16	15.2
Other	6	5.7
	N =	105
	*** =**	101

GOGA Section IV: Attitudes

24. Please indicate how **appropriate** you believe the following are for use in national parks.

	N =	* =	(1) Inappropriate		(2) Somewhat Inappropriate		(3) Neither		(4) Somewhat Appropriate		(5) Appropriate		Mean	StDev
			Count	%	Count	%	Count	%	Count	%	Count	%		
Tour Book / visitor guides available in the park	203	3	1	0.5	5	2.5	4	2.0	22	10.8	171	84.2	4.76	0.66
Internet terminals in the park	197	9	70	35.5	18	9.1	53	26.9	29	14.7	27	13.7	2.62	1.44
Getting information from friends and relatives	199	7	0	0.0	5	2.5	27	13.6	57	28.6	110	55.3	4.37	0.81
Talking to Ranger at the park	196	10	3	1.5	2	1.0	14	7.1	41	20.9	136	69.4	4.56	0.80
Calling Ranger before visiting park	194	12	13	6.7	20	10.3	58	29.9	52	26.8	51	26.3	3.56	1.18
Commercial television used to provide park information	192	14	15	7.8	20	10.4	66	34.4	57	29.7	34	17.7	3.39	1.13
National Park Service video providing travel information	196	10	8	4.1	13	6.6	44	22.4	73	37.2	58	29.6	3.82	1.06
Commercial radio stations used to provide travel information	194	12	13	6.7	15	7.7	55	28.4	65	33.5	46	23.7	3.60	1.13
Informational radio (e.g. highway advisory radio)	195	11	10	5.1	13	6.7	50	25.6	54	27.7	68	34.9	3.81	1.14
National Park Service radio station with travel information	195	11	7	3.6	12	6.2	33	16.9	56	28.7	87	44.6	4.05	1.09
Electronic signs with travel information in the parking lots	197	9	26	13.2	26	13.2	45	22.8	53	26.9	47	23.9	3.35	1.33
Electronic signs with travel information on the park roads	195	11	28	14.4	29	14.9	32	16.4	56	28.7	50	25.6	3.36	1.38
Visitor center information kiosks – traditional (brochures, maps, etc.)	201	5	1	0.5	1	0.5	8	4.0	51	25.4	140	69.7	4.63	0.64
National Park Service automated telephone information line	196	10	6	3.1	4	2.0	31	15.8	52	26.5	103	52.6	4.23	1.00
Personal Digital Assistant (PDA) to access travel information	190	16	29	15.3	15	7.9	84	44.2	36	18.9	26	13.7	3.08	1.19
Use Travel Agent to obtain travel information about park	68	6	3	4.4	4	5.9	22	32.4	17	25.0	22	32.4	3.75	1.11
Mandatory shuttle service in park (you must park car outside park and ride shuttle into park)	196	10	33	16.8	19	9.7	37	18.9	61	31.1	46	23.5	3.35	1.38
Optional shuttle service in park (can either park car outside park and take shuttle or can drive into park in your car)	197	9	15	7.6	3	1.5	36	18.3	65	33.0	78	39.6	3.95	1.15
Taking a public bus into the park	197	9	9	4.6	7	3.6	42	21.3	47	23.9	92	46.7	4.05	1.11
Parking your car at the entrance and riding your bike into the park	197	9	48	24.4	15	7.6	58	29.4	31	15.7	45	22.8	3.05	1.46

25. Please indicate the extent to which you believe each of the following is an important part of the park's purpose.

Preservation of natural resources

	Count	Percent
(1) Not at all Important	1	0.5
(2) Somewhat Important	3	1.5
(3) Important	10	4.9
(4) Very Important	27	13.2
(5) Extremely Important	164	80.0
	N =	205
	*** =**	1
	Mean	4.71
	StDev.	0.67

Recreational Use

	Count	Percent
(1) Not at all Important	7	3.4
(2) Somewhat Important	20	9.9
(3) Important	68	33.5
(4) Very Important	66	32.5
(5) Extremely Important	42	20.7
	N =	203
	*** =**	3
	Mean	3.57
	StDev.	1.03

GOGA Section V: Technology

26. Do you own any of the following ? (cheek all that apply)

	Count	Percent
Computer	191	93.2
Cell phone	174	84.9
PDA	42	20.5
GPS unit	24	11.7
	N =	205
	*** =**	1

27. Please tell us why you don't own each item that you did not check in question 26.

Computer

	Count	Percent
Too Expensive	3	23.1
Don't know how to use	2	15.4
Don't think it is useful/ don't need	4	30.8
Other	4	30.8
	N =	13
	*** =**	193

Cell Phone

	Count	Percent
Too Expensive	5	16.1
Don't know how to use	0	0.0
Don't think it is useful/ don't need	21	67.7
Other	5	16.1
	N =	31
	*** =**	176

PDA

	Count	Percent
Too Expensive	19	11.8
Don't know how to use	24	14.9
Don't think it is useful/ don't need	109	67.7
Other	9	5.6
	N =	161
	*** =**	45

GPS

	Count	Percent
Too Expensive	35	19.7
Don't know how to use	19	10.7
Don't think it is useful/ don't need	110	61.8
Other	14	7.9
	N =	178
	*** =**	28

28. Do you have access to the Internet (cheek all that apply)…

	Count	Percent
At home	179	87.3
At work/school	157	76.6
Other way to access the Internet*	19	9.3
	N =	205
	*** =**	1

* 58% of other access the web at the library

29. Do you use any of the following to make plan trips? (please circle yes or no for each item). Please tell us why you do or do not use each item.

	YES	Percent
GPS (N = 199)	14	7.0
Current Internet information (N = 202)	172	85.1
Computer trip planners (N = 202)	140	69.3
Informational TV (N = 205)	125	61.0
Commercial TV (N = 201)	53	26.4
Information radio (N = 203)	72	35.5
Commercial radio (N = 202)	53	26.2
PDA (N = 201)	11	5.5
Cell phone (N = 203)	94	46.3

Reasons given for using GPS included available in rental car (14.3%), use for hiking (14.3%), use when sailing (14.3%), and use when flying plane (7.1%). Reasons given for not using GPS (n = 185) included do not have/want/need (38.9%), use maps (3.8%), expense (2.7%), do not know how to use (2.2%), and want to find on own/drive randomly (1.6%).

Reasons given for using Current Internet Information (n = 172) to plan included information (9.9%), ease of use (9.3%), ability to get current information (8.7%), convenient/available (8.1%), useful/helpful (7.6%), fast (2.3%). The most common reason given for not using Current Internet Information (n = 30) was do not own/have/need (30.0%).

Reasons for using Computer Trip Planners (n = 140) to plan included convenience (17.9%), to obtain directions (15.7%), accuracy (3.6%), and to check distances (2.1%). The reasons given by those who do not use Computer Trip Planners (n = 62) included do not have/own/need (24.2%), use maps (6.5%), not accurate (6.5%), and use AAA (2.1%)

Reasons for using Informational TV (n = 125) included check weather and related clothing needs (20.0%), convenient/easy/current (12.0%), and general planning information (8.0%). Reasons given by those who do not use this media form (n = 80) included do not like/own TV (17.5%), not useful/not convenient (6.3%), read newspaper (3.8%)

Reasons given for using Commercial TV (n = 53) included weather information (9.4%), travel channel (9.4%), and to get ideas (7.5%). Reasons given for not using this media outlet (n = 148) included no need/not useful (17.6%), do not watch (4.1%) do not watch much (3.8%), and not convenient (3.4%).

Reasons given for using Information Radio (n = 72) included traffic (25.0%), weather (12.5%), and convenience (6.9%). Reasons given for not using Information Radio (n = 131) included do not like/use/need (11.5%), do not know how/do not know about (3.8%), and do not know local channels (3.1%).

Reasons given for using Commercial Radio (n = 53) included current traffic (11.3%), ideas/information (11.3%), if available (7.5%), and weather (3.8%). Reasons given for not using Commercial Radio (n = 149) included do not listen/need (11.4%), does not provide information (7.4%), not efficient (4.0%), do not know about/do not think about (3.4%), and only listen for music (2.7%).

Reasons correspondents used PDA for planning includes the following: handy (9.0%), husband's new toy (9.0%), and it links to my computer (9.0%). Reasons given for not using a PDA (n = 190) included do not own/need/have (29.5%), does not have network capability (5.3%), do not know what it is/do not know how to use (3.2%), and toy/gadget (2.1%).

Finally, the reasons given for using a Cell Phone (n = 94) to plan included convenient/handy (19.1%), call ahead for hotel (5.3%), in case I get lost (5.3%), if needed (4.3%), current updates (4.3%), and emergencies (4.3%). Reasons given for not using a Cell Phone (n = 109) included do not own/need/use on trip (22.9%), and expense (3.7%).

GOGA Section VI: Obtaining Travel Information

30. Please tell how likely it is that you would use each of the following before arriving at the park and while you are in Golden Gate National Recreational Area.

Before Arriving in the Park:	N =	* =	(1) Not at All Likely		(2) Somewhat Not Likely		(3) Neither		(4) Somewhat Likely		(5) Very Likely		N/A		Mean	StDev
			Count	%	Count	%	Count	%	Count	%	Count	%	Count	%		
Tour Book / visitor guides	202	4	12	5.9	11	5.4	18	8.9	23	11.4	136	67.3	2	1.0	4.30	1.20
Internet – park web site	202	4	21	10.4	6	3.0	32	15.8	41	20.3	99	49.0	3	1.5	3.96	1.32
Internet – other web site	201	5	29	14.4	12	6.0	30	14.9	40	19.9	86	42.8	4	2.0	3.72	1.45
Friends/relative	202	4	15	7.4	6	3.0	35	17.3	44	21.8	99	49.0	3	1.5	4.04	1.22
Previous visits	195	11	10	5.1	2	1.0	13	6.7	32	16.4	119	61.0	19	9.7	4.41	1.07
Visitor/tourist information centers	199	7	27	13.6	19	9.5	29	14.6	37	18.6	83	41.7	4	2.0	3.67	1.45
Commercial television	201	5	106	52.7	29	14.4	34	16.9	11	5.5	12	6.0	9	4.5	1.93	1.23
Local access television	201	5	111	55.2	30	14.9	26	12.9	18	9.0	11	5.5	5	2.5	1.92	1.25
Commercial radio	199	7	109	54.8	28	14.1	31	15.6	11	5.5	14	7.0	6	3.0	1.93	1.27
Informational radio (e.g. highway advisory)	199	7	85	42.7	26	13.1	43	21.6	20	10.1	22	11.1	3	1.5	2.33	1.41
Electronic Road Signs	198	8	56	28.3	18	9.1	45	22.7	33	16.7	40	20.2	6	3.0	2.91	1.51
Chambers of Commerce	197	9	93	47.2	28	14.2	36	18.3	19	9.6	16	8.1	5	2.5	2.15	1.34
Terminal Kiosks (airport, train or bus stations) with brochures, maps, etc.)	199	7	57	28.6	23	11.6	38	19.1	31	15.6	47	23.6	3	1.5	2.94	1.55
Terminal Kiosks (airport, train or bus stations) – electronic/;computer	198	8	85	42.9	25	12.6	37	18.7	18	9.1	27	13.6	6	3.0	2.36	1.47
Hotel information kiosks with brochures, maps, etc.	202	4	41	20.3	11	5.4	39	19.3	47	23.3	63	31.2	1	0.5	3.40	1.49
Hotel information kiosks – electronic/computer	199	7	81	40.7	24	12.1	32	16.1	27	13.6	32	16.1	3	1.5	2.52	1.53
Phone inquiry to park	200	6	52	26.0	23	11.5	50	25.0	25	12.5	48	24.0	2	1.0	2.97	1.51
Cell phone (to access current data	199	7	76	38.2	23	11.6	40	20.1	24	12.1	32	16.1	4	2.0	2.55	1.51
Personal Digital Assistant (PDA)	198	8	145	73.2	13	6.6	13	6.6	1	0.5	6	3.0	20	10.1	1.37	0.91
Current Internet travel information	198	8	48	24.2	14	7.1	37	18.7	38	19.2	57	28.8	4	2.0	3.22	1.55
Newspapers/magazine articles	199	7	31	15.6	13	6.5	44	22.1	57	28.6	51	25.6	3	1.5	3.43	1.36
Talk to people in local communities	201	5	48	23.9	20	10.0	42	20.9	36	17.9	49	24.4	6	3.0	3.09	1.51
Travel agent	198	8	97	49.0	25	12.6	33	16.7	17	8.6	17	8.6	9	4.5	2.11	1.36
In park shuttle – no fee	193	13	38	19.7	9	4.7	18	9.3	30	15.5	67	34.7	31	16.1	3.49	1.62
In park shuttle – fee	190	16	59	31.1	17	8.9	34	17.9	22	11.6	29	15.3	29	15.3	2.66	1.53
Public bus to park – fee	198	8	85	42.9	16	8.1	37	18.7	20	10.1	25	12.6	15	7.6	2.37	1.49
Park and ride	198	8	54	27.3	16	8.1	43	21.7	30	15.2	39	19.7	16	8.1	2.91	1.52
Park and Bike	199	7	96	48.2	20	10.1	31	15.6	12	6.0	23	11.6	17	8.5	2.15	1.44

While in Park:	N =	* =	(1) Not at All Likely		(2) Somewhat Not Likely		(3) Neither		(4) Somewhat Likely		(5) Very Likely		N/A		Mean	StDev
			Count	%	Count	%	Count	%	Count	%	Count	%	Count	%		
Tour Book / visitor guides	188	18	20	10.6	12	6.4	17	9.0	28	14.9	104	55.3	7	3.7	4.02	1.39
Internet – park web site	184	22	115	62.5	24	13.0	13	7.1	5	2.7	14	7.6	13	7.1	1.71	1.24
Internet – other web site	184	22	122	66.3	22	12.0	12	6.5	4	2.2	10	5.4	14	7.6	1.58	1.11
Friends/relative	184	22	81	44.0	19	10.3	24	13.0	14	7.6	32	17.4	14	7.6	2.39	1.58
Previous visits	176	30	30	17.0	7	4.0	18	10.2	24	13.6	72	40.9	25	14.2	3.67	1.57
Visitor/tourist information centers	183	23	10	5.5	4	2.2	15	8.2	44	24.0	106	57.9	4	2.2	4.30	1.09
Commercial television	183	23	133	72.7	12	6.6	4	2.2	3	1.6	5	2.7	26	14.2	1.31	0.88
Local access television	184	22	125	67.9	20	10.9	6	3.3	4	2.2	4	2.2	25	13.6	1.38	0.88
Commercial radio	181	25	123	68.0	16	8.8	10	5.5	4	2.2	7	3.9	21	11.6	1.48	1.03
Informational radio (e.g. highway advisory)	184	22	99	53.8	12	6.5	25	13.6	15	8.2	16	8.7	17	9.2	2.02	1.41
Electronic Road Signs	184	22	57	31.0	14	7.6	35	19.0	30	16.3	34	18.5	14	7.6	2.82	1.54
Chambers of Commerce	182	24	110	60.4	21	11.5	13	7.1	8	4.4	7	3.8	23	12.6	1.62	1.11
Terminal Kiosks (airport, train or bus stations) with brochures, maps, etc.)	182	24	86	47.3	8	4.4	21	11.5	17	9.3	23	12.6	27	14.8	2.25	1.56
Terminal Kiosks (airport, train or bus stations) – electronic/;computer	184	22	105	57.1	11	6.0	15	8.2	10	5.4	11	6.0	32	17.4	1.76	1.29
Hotel information kiosks with brochures, maps, etc.	185	21	88	47.6	10	5.4	19	10.3	21	11.4	16	8.6	31	16.8	2.14	1.47
Hotel information kiosks – electronic/computer	180	26	104	57.8	11	6.1	18	10.0	8	4.4	9	5.0	30	16.7	1.71	1.22
Phone inquiry to park	180	26	92	51.1	16	8.9	17	9.4	11	6.1	16	8.9	28	15.6	1.97	1.40
Cell phone (to access current data	184	22	91	49.5	20	10.9	14	7.6	24	13.0	19	10.3	16	8.7	2.17	1.48
Personal Digital Assistant (PDA)	182	24	134	73.6	14	7.7	6	3.3	0	0.0	3	1.6	25	13.7	1.24	0.70
Current Internet travel information	182	24	107	58.8	13	7.1	18	9.9	9	4.9	13	7.1	22	12.1	1.80	1.31
Newspapers/magazine articles	181	25	86	47.5	21	11.6	20	11.0	21	11.6	15	8.3	18	9.9	2.13	1.41
Talk to people in local communities	182	24	70	38.5	14	7.7	21	11.5	28	15.4	30	16.5	19	10.4	2.60	1.60
Travel agent	181	25	127	70.2	13	7.2	5	2.8	3	1.7	2	1.1	31	17.1	1.27	0.74
In park shuttle – no fee	186	20	27	14.5	4	2.2	23	12.4	36	19.4	84	45.2	12	6.5	3.84	1.45
In park shuttle -- fee	185	21	52	28.1	15	8.1	34	18.4	35	18.9	36	19.5	13	7.0	2.93	1.53
Public bus to park – fee	184	22	79	42.9	17	9.2	24	13.0	13	7.1	25	13.6	26	14.1	2.29	1.53
Park and ride	183	23	55	30.1	11	6.0	33	18.0	28	15.3	40	21.9	16	8.7	2.92	1.59
Park and Bike	184	22	91	49.5	13	7.1	28	15.2	16	8.7	20	10.9	16	8.7	2.17	1.46

GOGA Section VII: Transportation

31. How often do you use public transportation?

	Count	Percent
Daily	15	7.4
At least one per week	12	5.9
At least once per month	29	14.4
At least once per year	89	44.1
Never	57	28.2
	N =	202
	*** =**	4

32. Have you ever used public transportation at a national park? YES NO

	Count	Percent
Yes*	76	37.8
No**	125	62.2
	N =	201
	*** =**	5

* 37.8% of respondents have used public transportation in a national park. The parks that they used public transportation in included Yosemite (51.3%), Grand Canyon (28.9%), Zion (9.2%), and Denali (3.9%). Note: visitors could list more than one park.

** The reasons given by those who have not used public transportation in a national park included not available (23.4%), had a car (10.2%), no need (7.8%), own car more convenient (5.5%), and have never seen it (4.7%).

GOGA Section VIII: General Information

33. Please indicate your gender.

	Count	Percent
Male	96	47.1
Female	108	52.9
	N =	204
	*** =**	2

34. In what year were you born? (Ages were calculated from this as shown.)

	Count	Percent
Under 19	0	0.0
19 – 34	37	18.4
35 – 50	91	45.3
51 - 65	62	30.8
66+	11	5.5
	N =	201
	*** =**	5
	Mean	46
	StDev.	12.2

35. What race do you consider yourself? (please check all that apply)

	Count	Percent
Black / African American	2	1.0
Hispanic / Latino	3	1.5
White/Caucasian	195	95.1
Asian	3	1.5
American Indian/Native Alaskan	1	0.5
Native Hawaiian/Pacific Islander	0	0.0
Other	2	1.0
	N =	205
	*** =**	1

36. Please tell us the primary language you speak at home.

	Count	Percent
English	198	97.5
German	2	1.0
Russian	2	1.0
Dutch	1	0.5
	N =	203
	*** =**	3

37. What is the highest level of education that you have completed so far? (please check one)

	Count	Percent
Less than 12 years	0	0.0
High School Graduate	8	3.9
Technical / Vocational School	5	2.5
Some College	35	17.2
College Graduate	78	38.4
Graduate or Professional Degree	77	37.9
	N =	203
	*** =**	3

38. Which of these categories includes your annual household income?

	Count	Percent
Under $20,000	7	3.6
$20,000 - $39,999	17	8.9
$40,000 - $59,999	28	14.7
$60,000 - $79,999	30	15.7
$80,000 - $99,999	28	14.7
$100,000 or more	81	42.4
	N =	191
	*** =**	15

39. Which of the following categories applies to you? (please check all that apply)

	Count	Percent
Employed full-time	118	57.6
Employed part-time	23	11.2
Self-employed	36	17.6
Homemaker	31	15.1
Retired	22	10.7
Unemployed	2	1.0
Student	7	3.4
	N =	205
	*** =**	1

GOGA Respondent Comments

March

- The GGNRA is a tremendous, ??, great park. We hiked from near the top of Mt. Tamalpais through Mt. Tamalpais State Park to Stinson Beach. We shuttled our vans to Stinson Beach before we began hiking. We ate lunch and played on the beach at Stinson Beach.
- Clean and well placed / indicated rest rooms. Fair, non-exploitative prices in eating places and gift shops.
- The search for new easy to distribute information about national parks is a necessary task, and the NPS should embrace this duty with an open mind to technology. Failure to do so can risk sending the agency into a situation where they refuse to use the tools to combat a trend of higher and higher visitation, and the probable accompanying resource damage. However, it is essential to preserve the personal aspects of the NPS … the rangers and their service that have become the bread and butter of the agency. Despite any and all new transportation and/or technology introduced, the foundation of information distribution must stay with the park ranger!

May

- The park was very busy, but to be expected on Memorial Day Weekend
- Nice park – thanks
- Muir Woods is a beautiful park. It has been well maintained. My only frustration is not being able to park during my visit.
- I've loved every park I've visited and can't wait to see more. I volunteered on the Big Bend National Park trail crew through the Student Conservation Association. I think programs like this need to be expanded and their existence communicated to more people – kids especially.
- I don't use public transportation on holidays as I have kids with me and strollers and diaper bags and it is too much to haul in and out of shuttles and buses.
- Need free transportation to parks such as Muir Woods. We drove only because tickets would have cost us $80.00. We rented a car for $43. I would gladly pay $43 if you took me to the park. Additionally, the trails need to be identified more properly. The routes were very confusing. Finally, where are all the trashcans?! This encourages littering. Parking situation is horrific. I was at Muir on a weekday. It must be worst on weekends.
- I would have been able to use a little map upon entering the park regarding the trails and distances (like you get at a golf course). It is truly a beautiful park in its natural beauty. Thank you!
- Using technology to access info about park is great. Having technology in the park contradicts the "natural environment" unless it is only for info about Muir Woods – interactive educational stuff. Using some sort of park & ride during peak season makes sense. It's a fairly dangerous road for those not familiar with area. Limit size of buses, they're part of the problem. No electric signs in park, again, this is nature at its best, not Disneyland. Today, May 25, was a beautiful, sunny day – perfect for Muir Woods. I was glad to see people there, it wasn't

too crowded and parking was easy (Lot full sign but a place opened up for us ☺), it seemed in perfect balance. I hope we can keep it this way.

- Access seems to be an issue. If access needs to be limited to protect resources, environmentally and shuttles or other means of access is required, I would be willing to use whatever is helpful; needed. Information – although I have a computer and use it to plan and schedule trips and gain info – printed materials I believe are vital. Younger folks would enjoy computer terminals – for information, if readily accessible.

July

- It's nice to get away from any kind of electronics when in national parks
- RE: Muir Woods – if shuttle system was run like that at the Hearst Castle – with large parking area away from the actual site and frequent, well-managed bus transportation that included taped information on the recreation area – designed to have the minimum impact on the park site itself – and it was required to park personal vehicles off site at this center that offered the needed amenities (food, restrooms, souvenir ships, film and video "theaters" with park history and information) it would benefit both tourists and park preservation.
- It would be hard to have shuttles when you're transporting kids and stuff too far. Although, I would not want to "pave" paradise.
- I volunteer at the visitor center in Sausalito. Many tourists come by ferry boat from San Francisco. They are very disappointed – the only transportation to Muir Woods is by taxi. A roundtrip, with ½ hour to walk through, is $60. Muir Woods is only 12 miles from Sausalito. Because of mountain roads it takes about ½ hour. Once there parking, at least in summer, does not meet the demand. Cars lined up to wait for a space. My daughter and I drove over last week to act like tourists, Muir Woods is very beautiful and the walk is raised to protect the environment and make it handicapped accessible.
- RE: Recreational Use for Park purpose… If rec. use means walking on nature trails/ranger talks – very important. If Rec. use means horseback riding/motorcycle riding, etc. – then not at all important.
- A park shuttle would be very helpful in this park. I would use it.

APPENDIX H: VISITOR SURVEY RESULTS AT SEKI

SEKI Section I: Your Visit to Sequoia and Kings Canyon National Parks

1. To begin, we would like to know what other tour sites/parks, if any, you visited as park of this trip. We would also like to know what other tour sites/parks you visited the same day that you visited Sequoia and Kings Canyon.

Park / tourist site	Visited during this trip		Visited same day as SEKI	
	Count	Percent	Count	Percent
Yosemite National Park	118	26.0	21	4.6
Death Valley National Park	31	6.8	3	0.7
Other:	116	25.6	7	1.5
Southwestern National Parks	39	8.6	N =	454
Central California sites	20	4.4	* =	0
California – General	17	3.7		
Rockies and Southwestern parks	12	2.6		
West Coast	9	2.0		
	N =	454		
	* =	0		

2. We would like to get an idea of route you took through the park and the places that you stopped inside the park. We would like you to do each of the following:
   a. [On corresponding map in survey], please draw arrow showing the route you took through the park

Entry Point	Exit Point	Count	Percent
South (Ash Mountain)	North (Big Stump)	112	31.2
South (Ash Mountain)	South (Ash Mountain)	67	18.7
North (Big Stump)	North (Big Stump)	107	29.8
North (Big Stump)	South (Ash Mountain)	68	18.9
North & South*	North & South*	5	1.4
		N =	359
		***** =	95

* Entered and exited at both the north and south ends (this usually occurred when the Generals Highway was closed due to snow

b. [On corresponding map in survey], please mark an “X” in the boxes next to the places that you stopped while in the park (use the list below as a reference).

The following chart indicates the percentage of respondents who stopped at various sites within the park (see corresponding map in survey).

	Count	Percent
Big Stump Entrance	150	33.9
General Grant Tree	264	59.6
Grant Grove Village	231	52.1
Grant Grove Visitor Center	240	54.2
Montecito-Sequoia Lodge	66	14.9
Stony Creek Village	51	11.5
Lost Grove	76	17.2
Wuksachi Village	127	28.7
Lodgepole Visitor Center	183	41.3
Lodgepole Village	166	37.5
Crystal Cave**	36	17.6
Wolverton	39	8.8
General Sherman Tree	307	69.3
Giant Forest Museum	220	49.7
Moro Rock	196	44.2
Hospital Rock	77	17.4
Buckeye Flat	30	6.8
Foothills Visitor Center	185	41.8
Mineral King	11	2.5
Cedar Grove Visitor Ctr.	59	13.3
Cedar Grove Village	84	19.0
	N =	443
	*** =**	11

** – Crystal Cave was only included explicitly in July survey (N = 205)

3. Approximately how many days did you spend away from home on this trip?

N =	442
*** =**	12
Mean	10.48
StDev.	22.11

4. How long did you stay at Sequoia and Kings Canyon National Parks?

Stay at least one day:	
N =	339
*** =**	115
Mean	2.80
StDev.	2.20

Stayed less than one day:	
N =	105
*** =**	349
Mean	6.06
StDev.	3.08

5. What activities did you participate in during your trip to Sequoia and Kings Canyon National Parks? (please check all that apply)

	Count	Percent
Backcountry camping	15	3.3
Ranger-led walks/talks	66	14.6
Sightseeing/scenic drive	385	85.4
Cross-country skiing	1	0.2
Front country camping	114	25.3
Climbing	48	10.6
Horseback riding	14	3.1
View wildlife	239	53.0
Bicycling	16	3.5
Picnic	162	35.9
Fishing	28	6.2
Hiking	270	59.9
Other	67	14.9
Explore caves	13	2.9
Swimming	9	2.0
Photography	6	1.3
See snow	6	1.3
	N =	451
	*** =**	3

6. If you are not a local resident, did you stay overnight in the area?
YES (continue to question 7) NO (go to question 9)

	Count	Percent
Yes*	325	82.9
No	67	17.1
	N =	392
	*** =**	62

7. Did you stay inside the park? If yes, please cheek all that apply. If not go to question 8.
a) Campgrounds

	Count	Percent
Giant Forest	51	28.8
Grant Grove	40	22.6
Cedar Grove	16	9.0
Foothills	11	6.2
Mineral King	2	1.1
Bearpaw High Sierra	1	0.6
	N =	177
	*** =**	277

b) Park lodging

	Count	Percent
Wuksachi Lodge	44	24.9
John Muir Lodge	22	12.4
Grant Grove Village	19	10.7
Cedar Grove Lodge	8	4.5
Silver City Resort	3	1.7
	N =	177
	*** =**	277

8. Did you stay outside the park (while visiting this park)? If yes, please check type of accommodations from list below.

	Count	Percent
Hotels	128	68.1
Three Rivers	56	29.8
Visalia	23	12.2
Fresno	14	7.4
Tulare	6	3.2
National Forest Lodges	5	2.7
No answer	8	4.3
Other Cities	24	12.8
Campgrounds	38	20.2
National Forest	19	10.1
Three Rivers	5	2.7
Lemon Cove	4	2.1
Visalia	3	1.6
Kingsburg	2	1.1
No answer	2	1.1
Other Cities	5	2.7
B&B	4	2.1
Lemon Cove	2	1.1
Other Cities	2	1.1
With family/friends	9	4.8
Own home	1	0.5
Other Cities	3	1.6
	N =	188
	*** =**	266

9. Please cheek the primary type of transportation you used and tell use why you used it. (please check only one).

	Count	Percent
Private automobile	310	68.9
Rental automobile	87	19.4
Private RV	46	10.2
Rental RV	9	2.0
Bicycle	2	0.4
Public transportation	0	0.0
Other	3	0.7
	N =	450
	*** =**	4

* Some people selected multiple modes (for example, an RV towing a car)

Why they used the type of transportation that they used. The most frequent responses are summarized below:

Why used private automobile?

	Count	Percent
Convenience	56	18.1
What I use	31	10.0
Flexible/ Easy	26	8.4
Cost effective	26	8.4
Gear	21	6.8
Tow car/RV	18	5.8
Park of longer trip	18	5.8
No other transportation	13	4.2
Day trip/close to home	13	4.2
Fits everyone	9	2.9
	N =	310
	*** =**	144

Why used rental automobile?

	Count	Percent
Flew in	44	50.6
Convenience	8	9.2
Lengthy trip	4	4.6
Least expensive	4	4.6
More room	4	4.6
	N =	87
	*** =**	367

Why used own RV?

	Count	Percent
Lodging	6	13.0
Feels like home	4	8.7
Comfort	2	4.3
Convenience	2	4.3
Independence/freedom	1	2.2
	N =	46
	*** =**	408

Why used rental RV?

	Count	Percent
Convenience	4	44.4
	N =	9
	*** =**	445

10. Please indicate your level of satisfaction with the type of transportation that you cheeked in question 9. (please circle only one)

	Count	Percent
(1) Unsatisfied	2	0.4
(2) Somewhat Unsatisfied	7	1.6
(3) Neither	2	0.4
(4) Somewhat Satisfied	48	10.7
(5) Satisfied	388	86.8
	N =	447
	*** =**	7
	Mean	4.82
	StDev.	0.55

11. Please rate how congested (with traffic) each of following areas was during your visit. Please circle only one response for each area.

Roads leading to this park

	Count	Percent
(1) Uncongested	283	63.0
(2) Somewhat Uncongested	81	18.0
(3) Neither	36	8.0
(4) Somewhat Congested	32	7.1
(5) Congested	14	3.1
I don't care/ not applicable	3	0.7
	N =	449
	*** =**	5
	Mean	1.68
	StDev.	1.09

Roads inside this park

	Count	Percent
(1) Uncongested	242	54.4
(2) Somewhat Uncongested	97	21.8
(3) Neither	51	11.5
(4) Somewhat Congested	43	9.7
(5) Congested	8	1.8
I don't care/ not applicable	4	0.9
	N =	445
	*** =**	9
	Mean	1.82
	StDev.	1.09

Parking lots

	Count	Percent
(1) Uncongested	175	39.3
(2) Somewhat Uncongested	102	22.9
(3) Neither	36	8.1
(4) Somewhat Congested	77	17.3
(5) Congested	43	9.7
I don't care/ not applicable	12	2.7
	N =	445
	*** =**	9
	Mean	2.33
	StDev.	1.41

Trails

	Count	Percent
(1) Uncongested	246	58.2
(2) Somewhat Uncongested	63	14.9
(3) Neither	38	9.0
(4) Somewhat Congested	24	5.7
(5) Congested	1	0.2
I don't care/ not applicable	51	12.1
	N =	423
	*** =**	31
	Mean	1.58
	StDev.	0.93

12. Please use the scale below to rate how crowded you felt during this visit. Please circle only one.

	Count	Percent
(1) Not Crowded	248	55.6
(2) Somewhat Crowded	142	31.8
(3) Crowded	45	10.1
(4) Really Crowded	10	2.2
(5) Extremely Crowded	1	0.2
	N =	446
	*** =**	8
	Mean	1.60
	StDev.	0.78

13. If you rated the above question (#12) by circling 3, 4, or 5, where in the park were you when you felt crowded? Please be as specific as possible.

Those who reported feeling crowded (by responding between 3 and 5 to question 12) cited the following locations as the places where they experienced the crowding:

	Count	Percent
Sherman Tree	16	27.1
Moro Rock	11	18.6
Parking lots	9	15.3
Grant Grove	7	11.9
Entrances	6	10.2
Grant Grove Village	6	10.2
Azalea Campground	4	6.8
Museum	3	5.1
Giant Forest	3	5.1
	N =	59
	*** =**	395

14. Please indicate the importance of the following to your park visit. (please circle one response for each item)

Safe roads

	Count	Percent
(1) Uncongested	2	0.4
(2) Somewhat Uncongested	5	1.1
(3) Neither	10	2.2
(4) Somewhat Congested	80	17.8
(5) Congested	352	78.4
	N =	449
	*** =**	5
	Mean	4.73
	StDev.	0.60

Safe parking areas

	Count	Percent
(1) Uncongested	4	0.9
(2) Somewhat Uncongested	9	2.0
(3) Neither	35	7.8
(4) Somewhat Congested	98	21.9
(5) Congested	301	67.3
	N =	447
	*** =**	7
	Mean	4.53
	StDev.	0.80

Level of congestion of roads leading to park

	Count	Percent
(1) Uncongested	5	1.1
(2) Somewhat Uncongested	11	2.4
(3) Neither	59	13.1
(4) Somewhat Congested	192	42.7
(5) Congested	183	40.7
	N =	450
	*** =**	4
	Mean	4.19
	StDev.	0.84

Level of congestion on trails in park

	Count	Percent
(1) Uncongested	24	5.5
(2) Somewhat Uncongested	11	2.5
(3) Neither	60	13.9
(4) Somewhat Congested	158	36.5
(5) Congested	180	41.6
	N =	433
	*** =**	21
	Mean	4.06
	StDev.	1.07

Ability to use own vehicle

	Count	Percent
(1) Unimportant	14	3.1
(2) Somewhat important	22	4.9
(3) Neither	34	7.6
(4) Somewhat important	86	19.2
(5) Important	293	65.3
	N =	449
	*** =**	5
	Mean	4.39
	StDev.	1.03

SEKI Section II: Park Use Experience

15. Was this your first visit to the park? YES (got to question 18) NO (go to question 16)

	Count	Percent
Yes	250	55.2
No	203	44.8
	N =	453
	*** =**	1

16. Approximately how many times have you visited this park (including this visit) in the last 12 months? _____________ times.

N =	201
*** =**	253
Mean	2.17
StDev.	3.81

17. In approximately what year did you make your first visit to this park? ______

	Count	Percent
Since 2000	18	9.1
In the 1990s	50	25.3
In the 1980s	31	15.7
In the 1970s	34	17.2
In the 1960s	39	19.7
Prior to the 1960s	26	13.1
	N =	198
	*** =**	256
	Mean	1978
	StDev.	16

18. Do you plan to visit this park again in the next 12 months? YES NO

	Count	Percent
Yes	114	25.3
No	336	74.7
	N =	450
	*** =**	4

(31.3% of respondents indicated that they might visit again during that time. This was not a valid response, so these were included in the "No" category.)

19. Please estimate how many national park units you have visited in the past 5 years (not including this park).

N =	452
*** =**	2
Mean	7.4
StDev.	12.0

20. The parks frequented most often by respondents during the past five years were:

	Count	Percent
Yosemite	189	48.7
Grand Canyon	110	28.4
Yellowstone	74	19.1
Zion	72	18.6
Bryce Canyon	55	14.2
Death Valley	48	12.4
Joshua Tree	37	9.5
Arches	35	9.0
Glacier	31	8.0
Grand Teton	25	6.4
Crater Lake	20	5.2
Rocky Mountain	20	5.2
Great Smoky Mountains	19	4.9
Lassen	19	4.9
Redwood	18	4.6
Acadia	17	4.4
Canyonlands	17	4.4
	N =	388
	*** =**	66

SEKI Section III: Planning For This Trip

In this park of the survey we would like you to tell us how you planned your trip to sequoia and Kings Canyon National Parks.

21. We would like to know what types of information you want when planning a trip. We would also like to know when you obtain each type of information. Please tell us at what point in your trip (before leaving home, on the way to the park, while at the park), if at all, you obtained each of the following types of information.

	N =	* =	Before arriving in the park		While in the park		Did not obtain/not applicable	
			Count	Percent	Count	Percent	Count	Percent
General Park information	452	2	272	60.2	154	34.1	60	13.3
Activities at park	452	2	192	42.5	226	50.0	90	19.9
Hotel/lodging information	452	2	200	44.2	41	9.1	220	48.7
Campground information	452	2	149	33.0	77	17.0	250	55.3
Travel time to park	451	3	293	65.0	19	4.2	143	31.7
Transportation options to get to park	452	2	129	28.5	10	2.2	315	69.7
Alternate auto routes	452	2	239	52.9	37	8.2	187	41.4
Road conditions	452	2	136	30.1	106	23.6	230	50.9
Public transportation in park	452	2	42	9.3	50	11.1	366	81.0
Parking availability	452	2	44	9.7	132	29.2	282	62.4
Weather	452	2	250	55.3	106	23.5	121	26.8
Other things to do in the area	452	2	160	35.4	97	21.5	222	49.1

22. Sources of information. Respondents were asked to tell us what sources of information they used when planning their trip, and at which point in the planning process they used the information source. NOTE: Respondents were asked to check all that apply; therefore, percentages may not add up to 100.

Travel Information Type	N =	* =	Before Arriving in the Park		While in the Park		Did Not Obtain/Not Applicable	
			Count	Percent	Count	Percent	Count	Percent
Tour Book/Visitor Guides	451	3	253	56.1	137	30.4	119	26.4
Internet – park web site	451	3	267	59.2	3	0.7	183	40.6
Internet – other web site	451	3	185	41.0	3	0.7	265	58.8
Friends/relative	451	3	205	45.5	9	2.0	242	53.7
Previous Visits	451	3	164	36.4	20	4.4	280	62.1
Visitor/Tourist Information Centers	451	3	73	16.2	257	57.0	141	31.3
Commercial Television	451	3	8	1.8	0	0.0	443	98.2
Local Access Television	451	3	0	0.0	0	0.0	451	100.0
Commercial Radio	451	3	2	0.4	0	0.0	449	99.6
Highway Advisory Radio	451	3	13	2.9	21	4.7	418	92.7
Electronic Road Signs	451	3	14	3.1	36	8.0	405	89.8
Chambers of Commerce	451	3	16	3.5	2	0.4	434	96.2
Terminal Kiosks -- airport, train or bus station	451	3	12	2.7	7	1.6	433	96.0
Hotel Information Kiosks – computer terminal	451	3	38	8.4	8	1.8	405	89.8
Phone Inquiry to Park	451	3	107	23.7	5	1.1	341	75.6
Cell phone (to access current data)	451	3	22	4.9	12	2.7	421	93.3
Personal Digital Assistant (PDA)	451	3	3	0.7	4	0.9	445	98.7
Current Internet Travel Information	451	3	111	24.6	2	0.4	339	75.2
Newspaper/magazine Articles	451	3	94	20.8	15	3.3	348	77.2
Talk to People in Local Communities	451	3	74	16.4	26	5.8	356	78.9
Travel Agent	451	3	12	2.7	2	0.4	437	96.9

23. If you stayed overnight in the area or at the park, how did you make you lodging or camping reservations?

	Count	Percent
Establishment directly	120	35.7
Stopped by establishment	108	32.1
AAA	16	4.8
Visitor center	8	2.4
Reservation service	50	14.9
Internet	73	21.7
Travel Agent	2	0.6
Other	14	4.2
	N =	336
	*** =**	118

SEKI Section IV: Attitudes

Now we would like to know how you feel about certain aspects of a park.

24. Please indicate how appropriate you believe the following are for use in national parks.

	N =	* =	(1) Inappropriate		(2) Somewhat Inappropriate		(3) Neither		(4) Somewhat Appropriate		(5) Appropriate		Mean	StDev
			Count	%	Count	%	Count	%	Count	%	Count	%		
Tour Book/ visitor guides available in the park	447	7	1	0.2	1	0.2	11	2.5	40	8.9	394	88.1	4.85	0.47
Internet terminals in the park	423	31	96	22.7	52	12.3	136	32.2	72	17.0	67	15.8	2.91	1.35
Getting information from friends and relatives	437	17	8	1.8	6	1.4	69	15.8	128	29.3	226	51.7	4.28	0.91
Talking to Ranger at the park	438	16	2	0.5	9	2.1	17	3.9	61	13.9	349	79.7	4.70	0.68
Calling Ranger before visiting park	427	27	39	9.1	33	7.7	136	31.9	92	21.5	127	29.7	3.55	1.24
Commercial television used to provide park information	423	31	57	13.5	53	12.5	137	32.4	113	26.7	63	14.9	3.17	1.23
National Park Service video providing travel information	425	29	19	4.5	31	7.3	109	25.6	144	33.9	122	28.7	3.75	1.09
Commercial radio stations used to provide travel information	424	30	41	9.5	45	10.6	151	35.6	111	26.2	76	17.9	3.32	1.17
Informational radio (e.g. highway advisory radio)	424	30	24	5.7	18	4.2	106	25.0	135	31.8	141	33.3	3.83	1.11
National Park Service radio station with travel information	426	28	12	2.8	17	4.0	96	22.5	130	30.5	171	40.1	4.01	1.02
Electronic signs with ravel information in the parking lots	422	32	85	20.1	51	12.1	89	21.1	120	28.4	77	18.2	3.13	1.39
Electronic signs with travel information on the park roads	423	31	94	22.2	42	9.9	75	17.7	117	27.7	95	22.5	3.18	1.46
Visitor center information kiosks with brochures, maps, etc.	439	15	2	0.5	9	2.1	13	3.0	61	13.9	354	80.6	4.72	0.66
National Park Service automated telephone information line	424	30	19	4.5	19	4.5	81	19.1	116	27.4	189	44.6	4.03	1.11
Personal Digital Assistant (PDA) to access travel information	408	46	67	16.4	35	8.6	204	50.0	63	15.4	39	9.6	2.93	1.13
Mandatory shuttle service in park – you must park outside park and ride shuttle into park	429	25	163	38.0	72	16.8	72	16.8	72	16.8	50	11.7	2.47	1.43
Optional shuttle service in park (can either park car outside park and take shuttle or drive into park in your car)	430	24	22	5.1	28	6.5	64	14.9	114	26.5	202	47.0	4.04	1.16
Public/municipal bus between area surrounding park and park	421	33	40	9.5	33	7.8	137	32.5	94	22.3	117	27.8	3.51	1.24
Parking your car at entrance and riding your bike into the park	428	26	154	36.0	38	8.9	112	26.2	50	11.7	74	17.3	2.65	1.49

25. Please indicate the extent to which you believe each of the following is an important part of Sequoia and Kings Canyon National Parks' purpose.

Preservation of Natural Resources

	Count	Percent
(1) Not at all Important	2	0.4
(2) Somewhat Important	4	0.9
(3) Important	25	5.5
(4) Very Important	75	16.6
(5) Extremely Important	345	76.5
	N =	451
	*** =**	3
	Mean	4.68
	StDev.	0.66

Recreational Use

	Count	Percent
(1) Not at all Important	6	1.3
(2) Somewhat Important	40	8.9
(3) Important	152	33.9
(4) Very Important	144	32.1
(5) Extremely Important	107	23.8
	N =	449
	*** =**	5
	Mean	3.68
	StDev.	0.98

SEKI Section V: Technology

This section ask you to tell us about the technology that you use in general and when planning a visit to a park.

26. Do you own any of the following (check all that apply)

	Count	Percent
Computer	414	92.0
Cell phone	358	79.6
PDA	75	16.7
GPS unit (N = 445)	78	17.5
	N =	450
	*** =**	4

27. Please tell us why you don't own each item that you did not check in question 26.

Computer

	Count	Percent
Too Expensive	8	20.5
Don't know how to use	5	12.8
Don't think it is useful/ don't need	21	53.8
Other	5	12.8
	N =	39
	*** =**	415

Cell Phone

	Count	Percent
Too Expensive	29	32.2
Don't know how to use	1	1.1
Don't think it is useful/ don't need	47	52.2
Other	13	14.4
	N =	90
	*** =**	364

PDA

	Count	Percent
Too Expensive	33	9.0
Don't know how to use	53	14.4
Don't think it is useful/ don't need	253	68.9
Other	28	7.6
	N =	367
	*** =**	87

GPS

	Count	Percent
Too Expensive	72	19.5
Don't know how to use	42	11.4
Don't think it is useful/ don't need	224	60.5
Other	32	8.6
	N =	370
	*** =**	84

28. Do you have access to the Internet (cheek all that apply)

	N =	* =	Count	Percent
At home	450	4	383	85.1
At work/school	449	5	266	59.2
Other way to access the Internet*	450	4	40	8.9

* 58% of Other access the web at the library

29. Please tell us if you use any of the following when planning a trip (please circle YES or NO for each item).

	N =	* =	Count	Percent
GPS	422	32	31	7.3
Current Internet Information	439	15	355	80.9
Computer trip planners	440	14	257	58.4
Information TV	439	15	209	47.6
Commercial TV	435	19	76	17.5
Information radio	437	17	152	34.8
Commercial radio	435	19	68	15.6
PDA	436	18	20	4.6
Cell Phone	434	20	164	37.8

Reasons provided by respondents for using GPS (n = 31) included backpacking safety (12.9%) and helpful (9.7%). Reasons given for not using GPS (n = 391) included do not want/like/need (15.9%), do not know what it is/do not know how to use (4.3%), use map (4.1%), and expensive (3.1%).

Reasons given for using Current Internet Information (n = 355) included ease of use (17.7%) information source (13.0%), current/up-to-date (8.2%), available/convenient (7.0%), useful/helpful (6.8%), fast (6.0%), and weather and road information (2.8%). Reasons given for not using Current Internet Information (n = 84) included do not own/have/need (28.6%), not aware of do not know how (9.5%), and familiar with site (6.0%).

Reasons given for using a Computer Trip Planner (n = 257) included ease of use (14.4%), directions and compare routes (13.2%), convenient and useful (12.8%), and travel time (4.7%). Reasons given for not using a Computer Trip Planner (n = 183) included do not need/do not use (24.0%), use maps (9.3%), familiar with site (7.1%), do not know how (6.0%), and use AAA (5.5%).

Reasons given for using Informational TV (n = 209) included weather and related clothing (27.3%), convenience (12.0%), current information (4.9%), and good planning information (2.9%). Reasons given for not using Informational TV (n = 230) included do not need / do not use (17.8%), do not have/like/own (15.2%), check web/use Internet instead (5.7%), poor quality information (2.6%), and familiar with site (2.2%).

Reasons given for using Commercial TV (n = 76) included to get ideas (21.0%), convenient / useful (10.5%), and weather reports (6.6%). Reasons given for not using Commercial TV (n = 359) included do not watch/own (18.7%), not useful/not helpful/not for planning (12.0%), do not watch often (4.2%), commercials are fake [respondents did not understand question] (3.5%), and use Internet instead (2.5%).

Reasons given for using Information Radio (n = 152) included road and weather conditions (31.0%), convenient/up-to-date (14.5%), and if happen to hear it (2.6%). Reasons given for not using Information Radio (n = 285) included do not need/do not use (17.5%), poor reception (5.3%), do not know how (3.2%), do not know channel (2.8%), and always have music on (2.1%).

Reasons given for using Commercial Radio (n = 68) included road and traffic information (14.7%), weather (11.8%), if by chance (8.8%), general information (7.3%), and ease of use (5.9%). Reasons given for not using Commercial Radio (n = 367) included do not need/do not use for planning (13.4%), do not like (8.2%), inefficient (3.3%), and listen to music only (2.7%).

Reasons given for using a PDA (n = 20) included data storage and retrieval (25.0%), and convenience (20.0%). Reasons given for not using a PDA (n = 416) included do not have/own/need (38.7%), do not know what it is (3.6%), no Internet link (2.4%), and for business only (2.4%).

Finally, reasons given for using a Cell Phone (n = 164) included convenient/handy/useful (22.6%), emergency use (14.6%), check weather (4.2%), and to check lodging (3.7%). Reasons given for not using a Cell Phone (n = 270) included do not need/use/have (29.3%), expensive (6.7%), no signal in park (6.3%), call before leaving home (4.1%), and not for planning (3.3%).

SEKI Section VI: Obtaining Travel Information

30. Please tell how likely it is that you would use each of the following before arriving at the park and while you are in Sequoia and Kings Canyon National Parks.

Before Arriving in the Park:	N =	* =	(1) Not at All Likely		(2) Somewhat Not Likely		(3) Neither		(4) Somewhat Likely		(5) Very Likely		N/A		Mean	StDev
			Count	%	Count	%	Count	%	Count	%	Count	%	Count	%		
Tour Book / visitor guides	434	20	23	5.3	25	5.8	38	8.8	61	14.1	281	64.7	6	1.4	4.29	1.18
Internet – park web site	426	28	48	11.3	12	2.8	35	8.2	60	14.1	251	58.9	20	4.7	4.12	1.37
Internet – other web site	429	25	81	18.9	22	5.1	45	10.5	64	14.9	193	45.0	24	5.6	3.66	1.58
Friends/relative	434	20	40	9.2	26	6.0	78	18.0	92	21.2	184	42.4	14	3.2	3.84	1.31
Previous visits	421	33	23	5.5	10	2.4	15	3.6	51	12.1	247	58.7	75	17.8	4.41	1.14
Visitor/tourist information centers	425	29	102	24.0	22	5.2	42	9.9	48	11.3	186	43.8	25	5.9	3.49	1.68
Commercial television	425	29	237	55.8	58	13.6	50	11.8	22	5.2	14	3.3	44	10.4	1.73	1.12
Local access television	424	30	248	58.5	53	12.5	43	10.1	14	3.3	14	3.3	52	12.3	1.64	1.07
Commercial radio	419	35	252	60.1	42	10.0	48	11.5	17	4.1	16	3.8	44	10.5	1.67	1.12
Informational radio (e.g. highway advisory)	425	29	159	37.4	44	10.4	72	16.9	47	11.1	70	16.5	33	7.8	2.55	1.54
Electronic Road Signs	416	38	134	32.2	34	8.2	52	12.5	61	14.7	90	21.6	45	10.8	2.84	1.63
Chambers of Commerce	427	27	247	57.8	42	9.8	51	11.9	26	6.1	28	6.6	33	7.7	1.85	1.28
Terminal Kiosks (airport, train or bus stations) with brochures, maps, etc.)	430	24	210	48.8	36	8.4	60	14.0	47	10.9	42	9.8	35	8.1	2.18	1.45
Terminal Kiosks (airport, train or bus stations) – electronic/;computer	429	25	259	60.4	42	9.8	38	8.9	22	5.1	24	5.6	44	10.3	1.73	1.22
Hotel information kiosks with brochures, maps, etc.	432	22	158	36.6	42	9.7	63	14.6	67	15.5	76	17.6	26	6.0	2.66	1.57
Hotel information kiosks – electronic/computer	424	30	247	58.3	39	9.2	37	8.7	32	7.5	33	7.8	36	8.5	1.88	1.35
Phone inquiry to park	429	25	91	21.2	34	7.9	90	21.0	72	16.8	129	30.1	13	3.0	3.27	1.52
Cell phone (to access current data	422	32	184	43.6	37	8.8	47	11.1	33	7.8	82	19.4	39	9.2	2.46	1.63
Personal Digital Assistant (PDA)	420	34	266	63.3	21	5.0	15	3.6	4	1.0	7	1.7	107	25.5	1.29	0.81
Current Internet travel information	425	29	94	22.1	19	4.5	41	9.6	77	18.1	160	37.6	34	8.0	3.49	1.62
Newspapers/magazine articles	427	27	75	17.6	33	7.7	89	20.8	98	23.0	120	28.1	12	2.8	3.37	1.44
Talk to people in local communities	431	23	153	35.5	45	10.4	81	18.8	58	13.5	68	15.8	26	6.0	2.61	1.51
Travel agent	427	27	277	64.9	42	9.8	35	8.2	17	4.0	16	3.7	40	9.4	1.59	1.09
In park shuttle – no fee	422	32	121	28.7	23	5.5	36	8.5	37	8.8	93	22.0	112	26.5	2.86	1.72
In park shuttle – fee	417	37	170	40.8	29	7.0	55	13.2	33	7.9	24	5.8	106	25.4	2.07	1.36
Public bus to park – fee	426	28	252	59.2	40	9.4	42	9.9	22	5.2	19	4.5	51	12.0	1.71	1.18
Park and ride	428	26	181	42.3	32	7.5	75	17.5	40	9.3	51	11.9	49	11.4	2.34	1.48
Park and Bike	424	30	255	60.1	29	6.8	29	6.8	21	5.0	28	6.6	62	14.6	1.72	1.28

While in Park:	N =	* =	(1) Not at All Likely		(2) Somewhat Not Likely		(3) Neither		(4) Somewhat Likely		(5) Very Likely		N/A		Mean	StDev
			Count	%	Count	%	Count	%	Count	%	Count	%	Count	%		
Tour Book / visitor guides	400	54	17	4.3	8	2.0	23	5.8	66	16.5	284	71.0	2	0.5	4.49	1.00
Internet – park web site	385	69	259	67.3	31	8.1	25	6.5	10	2.6	18	4.7	42	10.9	1.53	1.10
Internet – other web site	390	64	275	70.5	25	6.4	24	6.2	8	2.1	13	3.3	45	11.5	1.43	0.99
Friends/relative	388	66	179	46.1	36	9.3	43	11.1	31	8.0	55	14.2	44	11.3	2.26	1.54
Previous visits	382	72	54	14.1	7	1.8	21	5.5	35	9.2	183	47.9	82	21.5	3.95	1.55
Visitor/tourist information centers	402	52	18	4.5	2	0.5	26	6.5	49	12.2	304	75.6	3	0.7	4.55	0.98
Commercial television	393	61	278	70.7	24	6.1	21	5.3	3	0.8	3	0.8	63	16.0	1.26	0.70
Local access television	389	65	266	68.4	23	5.9	19	4.9	10	2.6	8	2.1	63	16.2	1.38	0.91
Commercial radio	386	68	262	67.9	26	6.7	29	7.5	8	2.1	12	3.1	49	12.7	1.46	1.00
Informational radio (e.g. highway advisory)	395	59	137	34.7	29	7.3	77	19.5	51	12.9	80	20.3	21	5.3	2.75	1.58
Electronic Road Signs	386	68	79	20.5	23	6.0	79	20.5	65	16.8	119	30.8	21	5.4	3.33	1.52
Chambers of Commerce	391	63	278	71.1	19	4.9	22	5.6	8	2.0	8	2.0	56	14.3	1.36	0.89
Terminal Kiosks (airport, train or bus stations) with brochures, maps, etc.)	391	63	220	56.3	14	3.6	25	6.4	23	5.9	28	7.2	81	20.7	1.79	1.36
Terminal Kiosks (airport, train or bus stations) – electronic/;computer	391	63	245	62.7	14	3.6	14	3.6	11	2.8	11	2.8	96	24.6	1.40	1.01
Hotel information kiosks with brochures, maps, etc.	397	57	185	46.6	21	5.3	43	10.8	38	9.6	51	12.8	59	14.9	2.26	1.56
Hotel information kiosks – electronic/computer	389	65	241	62.0	19	4.9	24	6.2	21	5.4	23	5.9	61	15.7	1.68	1.26
Phone inquiry to park	391	63	188	48.1	34	8.7	42	10.7	29	7.4	46	11.8	52	13.3	2.15	1.49
Cell phone (to access current data	389	65	184	47.3	21	5.4	43	11.1	30	7.7	63	16.2	48	12.3	2.32	1.61
Personal Digital Assistant (PDA)	389	65	245	63.0	12	3.1	8	2.1	8	2.1	7	1.8	109	28.0	1.29	0.86
Current Internet travel information	385	69	249	64.7	19	4.9	22	5.7	13	3.4	29	7.5	53	13.8	1.66	1.28
Newspapers/magazine articles	387	67	177	45.7	35	9.0	59	15.2	39	10.1	48	12.4	29	7.5	2.29	1.49
Talk to people in local communities	390	64	156	40.0	29	7.4	62	15.9	48	12.3	63	16.2	31	7.9	2.53	1.57
Travel agent	391	63	303	77.5	7	1.8	6	1.5	6	1.5	3	0.8	66	16.9	1.15	0.62
In park shuttle – no fee	396	58	76	19.2	14	3.5	56	14.1	65	16.4	161	40.7	24	6.1	3.59	1.55
In park shuttle -- fee	399	55	143	35.8	33	8.3	90	22.6	55	13.8	54	13.5	24	6.0	2.58	1.47
Public bus to park – fee	387	67	206	53.2	23	5.9	41	10.6	20	5.2	19	4.9	78	20.2	1.78	1.25
Park and ride	393	61	140	35.6	18	4.6	86	21.9	51	13.0	61	15.5	37	9.4	2.65	1.53
Park and Bike	394	60	218	55.3	30	7.6	41	10.4	27	6.9	29	7.4	49	12.4	1.90	1.35

SEKI Section VII: Transportation

31. How often do you use public transportation?

	Count	Percent
Daily	14	3.1
At least once per week	7	1.6
At least once per month	41	9.1
At least once per year	132	29.4
Never	255	56.8
	N =	449
	*** =**	5

32. Have you ever used public transpiration at a national park? YES NO

	Count	Percent
Yes:	244	54.1
Yosemite	131	62.7
Grand Canyon	60	24.6
Zion	53	21.7
Denali	17	7.0
Bryce	9	3.7
Yellowstone	7	2.9
Glacier	5	2.0
No:	207	45.9
Car more convenient	33	13.1
Had a car	31	12.4
Freedom/own schedule	25	10.0
Not aware of availability	12	4.9
Privacy	6	2.4
	N =	451
	*** =**	3

The reasons given by those who have not used public transportation in a national park included car more convenient (13.1%), had a car (12.4%), freedom/own schedule (10.0%), not aware it is available (4.9%), and privacy (2.4%).

SEKI Section VIII: General Information

33. Please indicate your gender.

	Count	Percent
Male	222	49.4
Female	227	50.6
	N =	449
	*** =**	5

34. In what year were you born? (Ages were calculated from this as shown.)

	Count	Percent
Under 19	1	0.2
19 – 34	65	14.8
35 – 50	170	38.7
51 - 65	143	32.6
66+	60	13.7
	N =	439
	***** =	15
	Mean	50
	StDev.	13.7

35. What race do you consider yourself? (please check all that apply)

	Count	Percent
Black / African American	4	0.9
Hispanic / Latino	13	3.0
White/Caucasian	403	91.6
Asian	20	4.5
American Indian/Native Alaskan	5	1.1
Native Hawaiian/Pacific Islander	1	0.2
Other	5	1.1
	N =	440
	***** =	14

36. Please tell us the primary language you speak at home.

	Count	Percent
English	428	96.0
Chinese	4	0.9
German	3	0.7
Dutch	3	0.7
Greek	2	0.4
Other	6	1.3
	N =	446
	***** =	8

37. What is the highest level of education that you have completed so far? (please check one)

	Count	Percent
Less than 12 years	5	1.1
High School Graduate	33	7.4
Technical / Vocational School	14	3.1
Some College	104	23.2
College Graduate	132	29.5
Graduate or Professional Degree	160	35.7
	N =	448
	***** =	6

38. Which of these categories includes you annual household income?

	Count	Percent
Under $20,000	17	4.2
$20,000 - $39,999	42	10.4
$40,000 - $59,999	79	19.6
$60,000 - $79,999	88	21.8
$80,000 - $99,999	70	17.4
$100,000 or more	107	26.6
	N =	403
	*** =**	51

39. Which of the following categories applies to you? (please check all that apply)

	Count	Percent
Employed full-time	235	52.3
Employed part-time	40	8.9
Self-employed	43	9.6
Homemaker	45	10.0
Retired	119	26.5
Unemployed	9	2.0
Student	25	5.6
	N =	449
	*** =**	5

March

- Strongly support keeping parks wilderness, but allowing reasonable habitat carrying capacity to visit, and enjoy in the least intrusive manner possible so non-polluting public transport with room for hiking/camping gear is reasonable. Also suggest strongly review private campgrounds on park edges, but extend to be compatible with regional environmental plans. It would help many parks surrounding if Forest Service were moved to Dept. of Interior, but not likely due to corporate selfishness (i.e. timber, mining and commercial recreation). Also many park boundaries are not habitat congruent
- Most of the activities my husband and I participate in are in the Forest and we access the park to get to the forest. With the recent change from forest to monument status I'm unclear on the future of outdoor activities in the area. I would like to see more bike paths in the park and more trails opened to bikes. I feel this is an environmentally friendly activity that has been excluded from the park. If you want more people to stop driving in the park, you need to offer them new ways to see the park, including by bike or even electric tram tours for those who are physically challenged or just lazy. Buses are a great idea but remember not everyone wants to be packed into an enclosed area with 100 other people. National Parks are about wide open spaces and being in nature and getting away from people not being forced into a bus full of people. I enjoy my right to roam this country freely as I am sure others do too. Please preserve that right. Thank you.
- I will be 50 this year and have been coming to Grant Grove since I was a baby and my parents before me. Please do not ruin this park by placing more restrictions on the people who visit here. If a mandatory shuttle is put in the park, I won't return. Teach people to respect our natural resources but don't restrict their use further. Enforce existing rules and laws.
- I would be more likely to use public transportation if I were traveling with someone, rather than alone. Alone, I am more likely to depend on a private vehicle. Transportation in Yosemite was more confusing than in Great Sequoia. Yosemite feels more like a city because of the buses. Good luck.
- Public transportation to the park from nearest cities, airports, train/bus stations would be fantastic. Shuttle service should be the only allowed motorized transportation within the national park system.
- I feel that the natural areas should remain preserved. Areas that have hotels and lodges can contain modern technologies, but these technologies should not disturb that which has been in harmony outside of these

technologies for centuries. When I say technologies, I mean the use of electronic signs and computers. There is a place for these technologies to exist and be f benefit to people, but those places should be already existing with other conveniences of modern society (hotels, lodges, houses). Campgrounds should be kept as close to the way they have been for years, to preserve the natural ecology. Technology and ecology can coexist on this planet as long as the people can see the importance of preserving that which cannot be replaced. Thank you.

- Visiting a national park by bus or shuttle would be completely unacceptable to us. We feel that we could not see the park as well and certainly couldn't see it as we enjoy seeing it. We want to be able to select our own stops without wasting our time at other's preferred stops. A bus would make a national park trip too inconvenient, too impersonal, and would waste too much of our very limited vacation time!
- I would like to have park access points at which vehicles could be left and public informative (guided-tour like) transportation would be available frequently. Then, like shuttles in downtown areas, one could get off and on at various sites to walk at one's own pace and be required to check into a hotel or leave by a specified time. Them other areas of the park could be open to family camping and individual cars driving in and through. Tram or cable car or cog railway access to major park sites would be other alternatives.
- We found that the route to the park was poorly marked in Fresno. We would use public transportation to the park if it were easily accessible from the airport and meshed well with out arrival/departure times. It would be helpful if this option were mentioned on the park website.
- We are campers (truck with camper) and not being able to drive to or in parks negates our going to them. Having shuttle buses to provide transportation in the park (i.e. Denali) is an excellent idea. But you have to have enough of them and make them easy to use. Also, we like the idea of limiting traffic in parks to preserve natural beauty, etc. But NPS needs to do a much improved job of informing the public of those limitations.
- The Sequoia National Park was breathtakingly beautiful fun and a very romantic place for couples to go – more cafes would be nice. And postcards of the snow in the park would be great … I couldn't find one!?
- Didn't know how much there was available (i.e. all the history and amazing views and trees and nature). Maybe more diverse/descriptive/creative marketing/advertising! It was a great time! Thanks.

May

- Actually, most of our time was spent outside of the park's boundaries. In the Converse Basin, Hoist Ridge, Hume Lake and mill Wood areas. I was impressed with the big stumps – Chicago stump. It was truly amazing that these trees could be removed and produced into lumber over 100 years ago, with minimal equipment and lots of ingenuity such as the chutes, the flume to Sanger. It would be hard to imagine the flume without the pictures in the book, "They Felled the Redwoods." I would recommend a video at visitor centers showing pictures of logging the redwoods in a positive nature. These men involved with cutting the redwoods should be looked up to in a positive nature.
- Recreational use of the park is "extremely important" if you mean hiking and enjoying the natural environment. If you mean other than seeing the trees, like skiing and snowmobiling, not appropriate.
- We had a wonderful time. Thank you for all of your efforts. May God bless you and may God continue to bless this country and the world.
- I'm an old hard rock climber from the 1960s. Just drove up for the day to see, feel and dream for a few hours. Keep up the good work. It is still very beautiful.
- I give thanks to those who dedicate their lives to share the wonder of nature with other human beings. You are true keepers of the forest and the dragonflies and salamanders can live on!
- I think the problem with transportation is that people want to be able to have all their "gear" at their disposal and on public transportation systems makes this hard.
- We are extremely impressed with the greatly improved infrastructure, public buildings, new stone work, and the consistency of architecture style "Neo-craftsman." The high quality and attention to detail is very impressive. Problem (all very few at that) – picnic areas are of driving distance from main attractions. Therefore, a lot of backtracking is done in search of picnic areas. Why aren't they (picnic areas) located in some proximity to large attractions/parking?

- For handicapped or partially handicapped visitors – "activity" is limited. (photography, birding, native trees and shrubs, wildflowers). More labels for plants and trees would be nice. When there are "school tours" in progress it would be nice to have someone directing visitors not involved with children.
- I really enjoy the bus systems at Grand Canyon and Yosemite. I have visited Sequoia/Kings Canyon more than three dozen times since '57. I love the parks. I would love to see a shuttle system! I have backpacked both parks, brought girl scouts for week long trips, brought foreign students and my family. We love how clean the park is. Foreign visitors always remark on how clean the park is. A shuttle system would help keep the park even cleaner. Thanks for the chance to participate in this survey.
- I enjoyed the public transportation systems in both Zion and the South Rim of Grand Canyon. They work great, have plenty of buses, and are easy to use. It might be tougher to set up a system at Sequoia/Kings Canyon because of the size, how spread out it is, and the fact that it isn't a one-way in and out road. You could probably do well shutting down the one-way in/out roads and using shuttles on them, but the main road would be more difficult. I am all for the shuttle system. It sometimes takes a little more time, but is good for the park, for hikers, and for all visitors. My visit was during a not-so-busy time so the congestion wasn't too bad, but I'm sure summers are crazy. My visit was cut short by a big snowfall so I didn't get to visit as many places as I'd hoped and go hiking as I'd planned.
- I do not like buses or shuttles in or outside of the park. I feel that people can travel safer with their own car. In the park you should have three-wheeled electric transportation or golf carts. This kind of transportation would work on trails that are paved or well-worn dirt paths. This kind of transportation is food for disabled or elderly. OR What would be safe would be a 4-lane highway in or out of park even 6 lanes in some parts of highway in or out of park. This would be a safe way to travel. We all pay taxes for roads and highways and it is time for a new highway 180 and park roads.
- I believe we should use some type of insect killer (e.g. DDT or other available ones) to rid the park of things like the bark beetle especially when it is not a native of the area.
- This survey appears to be looking for attitudes concerning mass transportation for this park. My attitude would be decidedly negative. As it stands I can take an impromptu trip to S/KC; decide to go, prepare, go, enjoy, return, cook dinner. If mass transportation were a requirement any trip to the park would require pre-planning; when do buses run? What are their destinations? Do I need to make transfers? What times do buses return? In other words, any trip to the park would be planned around public transportation. Also, what do campers do? If you plan to use an RV, can you? If you are tent-camping do you have to unload all your gear and put it on some form of public transport?
- In the face of increasing population pressure our parks have done well to survive. Preservation of the remarkable natural features is crucial to our national well-being – make it the key rule. There is a place for options to the way in which we do things but a park can not be all things to all people. I question the need of a plethora of information before and in the park. It is interesting to discover things and to have the flexibility to be able to change a trip to fit conditions (weather or wife's backache). I have no fixed schedule and this allows me the freedom to travel "off season" when competition is less. Yes, we are a social culture, but I do not go to a park to see other people. One must plan to have an easier existence rather than a more difficult one. Many of the "features" asked about in this survey would detract from the quality of any park and turn it instead into an "amusement park" – somehow I am not impressed with the concept of a "roller coaster ride" to see "Smoky the Bear" – it reeks of Southern California hucksterism. It all needs to be ??, quiet and unobtrusive. I've no solution to the thigh use problem, but perhaps a bicycle access only may solve it. Many of the "information" means are more "buzz words" than anything else – a person can do a huge amount with an adequate map and compass, though the GPS is well on the way to replacing a compass at least, but it cannot replace a map. An electronic device depends on ?? power – consider entropy!
- Often times I've found that the National Park websites do not give enough information to help plan a trip well. Sometimes the most convenient way to plan is to call the park, but I have found that park contacts are reluctant to give helpful information over the phone, which leaves much of the planning to be done once you arrive at the park, which can lead to problems. Upon arrival, rangers are very helpful, but it would be much better if websites or phone service were improved so planning could be done beforehand.
- I came to visit a friend in Cambria, CA. We came to Sequoia because it was a manageable (time) trip. Because we came the week before everything "opened" it was not crowded. The park is magnificent … because of its natural beauty. Do what it takes to preserve that. People pollution will ruin the natural/tourist appeal.

- I and my family have visited Sequoia and Kings Canyon National Park since 1957. Last summer a none day backpack trip out of Sequoia. Over the years one or more visits per year is enjoyed. We are tent campers! Parking, then walking/biking/shuttle bus a must.
- I guess I used a reservation service (to make hotel reservation), wish I'd known they were a reservation service. The only phone number on several websites goes to them. We had big troubles with the reservation service lying to us. The individual lodge's phone numbers need to be posted on websites, so the public does not get cheated like we did. [note: visitor stayed at Grant Grove Village]
- One main reason that I do not use public transportation in National Parks is that they stop too long at places that are less interesting to me and not long enough at places of great interest. In Yosemite, where would could get on and off at will, it worked better.
- The National Park Service continues to do a great job! Keep up the good work … the parks are just as beautiful as they were 30 years ago!
- A shuttle in the park would be a nice thing whether I have to pay or not. For a lot of people it would be easier than driving on curvy roads. Lots of people use their brakes too much, rather than lower gears. I've seen enough near-accidents that this alone makes a shuttle attractive. It would save gas during busy summer months, and protect ecosystems. If there already is any sort of public transit in the park I'm unaware of it, but it would be nice.
- The entrance to Kings Canyon Park was a joke. Generals Highway needs work. Depletion of frogs at Hume Lake (found 50 dead, large, tadpoles). Lovely park.
- While leaving the park (Big Stump Entrance) at 2:30pm traffic was backed up 2 miles at the gate. People were turning around on the 2-lane road creating a dangerous situation. On busy weekend multiple pay lines would speed throughput. Signs on the road indicating how long the line is would make it safer/less frustrating while waiting. Once in the park a shuttle would be nice – included in the cost of entrance fee.
- Stayed in Azalea Campground. We wished Sunset or Crystal Springs were open, since it was Memorial Day weekend.
- The road from about the area of the General Grant Tree to the visitor center had a lot of potholes. I believe the area was in Tulare County, when we passed the county road sign the condition of the road was rough. The private road was smooth, less likely to cause driver hazards when not needing to avoid holes. Also less likely to have collisions on the better maintained roads.
- Kings Canyon – refusal to extend temporary handicapped parking pass – I have a chronic asthmatic condition which requires medication as needed, and under doctor supervision. I live at sea level and need time to adjust to altitudes above 4000'. I try to be independent and am careful of avoiding asthmatic crisis. I carry a doctor's note and my medication at all times on my person. Although I am not confined to a wheelchair, or with oxygen connections, I do have limitations. For someone who is an asthmatic, I think that a temporary pass to parking would not be abusing a requirement. I would be able to function independently w/o being a burden, or being deprived of enjoying the national parks at whatever the altitude, etc. The lodges have been helpful in room assignments by allocating rooms which do not require use of stairs. For others with similar conditions, I think that an extension of temporary parking for handicapped would be beneficial.
- Gorgeous park!
- Visited the park Memorial Day weekend on Thurs. and Fri. had a fantastic experience! Visited Yosemite on Sat. – too many people, too much traffic! Left early. Too much recreation. Too much controlled access to sites and not as well kept as Sequoia and Kings Canyon.
- Use of own vehicle is somewhat important because Kings and Sequoia are very spread out. Less important in Yosemite, for example.
- In addition to the subject parks, my wife and I visited Yosemite for the first time. We were frustrated for two reasons. 1. We drove well into the heart of Yosemite before reaching visitor center where we might procure park information and aids to identify various peaks and numerous waterfalls. It does seem to make sense to hand out such info at the park gates. 2. We loved the waterfalls! But our constant question to each other was, "which one is this beauty?" Tastefully carved or hewn wooden signs in natural tones would see, to me to be appropriate -– and helpful.

- Get the names of the trees and groves changed in Sequoia NP. They are stupid/sexist and only promote violent past of this screwy nation!
- Electronic signs appropriate because the posted signs [the day visitor was at park] were all for previous day.
- We arrived at Sequoia to find it had closed due to snow. On the road we had known only about rain. Near the entrance there was a sign saying trails were open. Only at the gate did we discover that driving without 4-wheel drive was hazardous. Unfortunately, don't think we will be this way again. I think the radio news might have said something, or perhaps storm warnings night have been issued before – I understand that the storm was expected for a few days. Needless to say this was unavoidable in the end but very disappointing. The storm was unusual for so late in the season. We did have reservations that had to be cancelled.
- We enjoyed our stay in Azalea campground (4 nights). We prefer to travel with our own RV and set our own pace. We would like to see an RV dump station in the Azalea area. It would encourage us to return. The information guide was somewhat clear. I could have used better information on the hikes/trails. Zion's trail & hike guide is great. Overall, we enjoyed the Kings Canyon portion of the park more than the Sequoia part. If I return I will recreate in the Kings Canyon only, unless there is a park and ride transportation for Sequoia. I would take a transit system in the Sequoia area. I prefer my own vehicle in the kings Canyon area. It was stunning.
- I traveled to Sequoia in May and left before going to Kings Canyon because a snow/rain storm was coming in – too old to camp. During summer I can imagine the crowds – perhaps a shuttle from lodging and campgrounds to popular stops for no fee or small fee would be useful then – could have some vehicles equipped to carry bikes. Would like to increase food storage containers at hiking areas if only shuttle service allowed.

July

- We were told by the nice lady handing out these surveys that there was road work in Kings Canyon. It would be nice if the park information entrance would post this at the entrance. Also post congested area of the park so you can visit something else. We enjoyed Kings Canyon more than Yosemite because it was not as congested!
- It is very difficult for those of us who drive a great distance to know exactly what day we will arrive at the park. I would like to see a system that immediately upon entering the park, we would be able to pay for and secure a campsite at any of the drive-in campgrounds where a site is available (a particular site at one campground). Two things that need to be addressed: 1) People are reserving sites and not using them. Some arrangement should be made to allow that site to be used by someone after a certain time if the reserver is not coming (they could call). Campgrounds are shown full when in reality some sites are never used that night. 2) I have noticed that vendors are using employees who cannot speak nor understand English fluently. There are plenty of Americans who need jobs and do speak English. It's quite upsetting to walk into a restaurant, pay double for food, and also have to deal with someone who can't understand English.
- This was our first visit to the area and picked areas we wanted to see that we knew would be popular. Next time will choose less popular areas. Definitely not as congested as Yosemite!
- My traveling companion thought it might be nice to have occasional, small, refreshment areas that serve ice cream and cold drinks. She says flashing electronic signs and Christmas tree lights would not be appropriate.
- The shuttle system at Zion works great. I think the same system would work at Sequoia. Allow those with hotel reservations to park their car at hotel and require shuttle to be used to sightsee. Campers could work it the same way. Those without reservations must take shuttle from outside park. Think of all the additional asphalt parking lots that could be removed and restored back to the forest!
- It would be nice to be able to make Internet reservations 24/7 instead of only between 7am – 7pm. A very good job has been done to educate the public on bear safety and rules. It would be good to also direct these rules to trash pick up as well.
- I have vacationed at Sequoia regularly (almost every year) since I was born – I love this place. As a child we stayed every year at Kaweah Village cabins. It was always my favorite vacation spot. As an adult, my family comes at least once a year – and sometimes more if we can fit it in. We bring extended family and friends and introduce them to Sequoia. The other national parks that we visit never draw me like Sequoia. Yosemite and Grand Canyon seem like congested cities instead of unspoiled wilderness. The loss of the cabins at Giant Forest Village is one that is bittersweet – it will help the trees but the experience cannot be matched in accommodations currently available at Sequoia. We have stayed at campsites in tents, rented RVs, personal travel trailers and at Wuksachi Lodge, which all have benefits; however, the housekeeping cabin experience is the best. In the past

five years, the staff at markets, the cleanliness of the shower area, the availability of goods at the stores (mkt and souvenirs) have all turned for the worse. It seems like NPS and Delaware Park Services want to make a bad experience to keep the tourists away (I will undoubtedly be back every year I am able -–regardless!). My suggestions for future facilities: cabin area (housekeeping) at Wuksachi Village, cable/satellite TV/internet access at Wuksachi Lodge, Lodgepole internet cafe, clean & adequate shower and restroom facilities, deli/fast food service (we waited almost 2 hours for breakfast order of pancakes, eggs, hashbrowns – so we won't go back) for a quick meal. I believe the park service has taken the right steps to restore the Giant Forest Village – now the plan needs to focus on how to bring the visitor experience to the levels of today's expectations: clean facilities, customer-focused staff, and computer/electronic access.

- We really enjoyed our day through the Sequoias! We were thankful though to have our son guide us through. Your rangers on duty were very gracious and knowledgeable.
- We try to visit the Redwoods every decade. Our grown children have fond memories of these childhood vacations. My husband is a hiker and loves state and national parks. We buy a $50 park entrance fee every year. We brought the Frommer's Guide for touring California and basically planned our vacation from it.
- During the summer season more rangers to move traffic through entry gates: Need some type of traffic control on roads to enforce use at turnouts – this will reduce congestion.
- Cell [phone]service would be helpful. Making visitors take public transportation would cause our family to stop staying at national parks.
- I would like to see at least one gas station in the park. I would hope that no more campgrounds will be closed down permanently. I camped many years in Sequoia at Paradise and Sunset campgrounds. Now my grandchildren do not get to enjoy them. We miss the dump station at Azalea campground greatly! We do not want to be forced to use "public transportation" to arrive at the park. We have eaten in the Grant Grove coffee shop for 25 years or more, and have enjoyed it. However, with the new updated coffee shop you can't even get a hamburger for dinner, and the prices if the food they do have is outrageous!
- The purpose of this trip was to visit and deliver food to my husband and son who are hiking a portion of the Pacific Crest Trail so I'm probably not your typical visitor. However, we've been here before as tourists camping at Cedar Grove and we love the park and forest. Please continue to preserve its beauty and limit human impact. We appreciate the safe roads and the clean campgrounds – what would be absolutely ideal would be to keep RV campers and tent campers separate as each have different reasons for being here. Us tent campers want peace and quiet, no generators, no late night activity, no noisy rowdy adult or child behavior at any time. Thank you very much. Keep up your good work.
- Great trip! Wonderful experience for our family.
- We thought the shuttle bus system at Yosemite convenient but a little annoying. Maybe if they had been the only source of transportation within the park, we would have been more appreciative. The central "village" area could be bicycles or buses only with the parking lots exterior to this area.
- We feel privileged to be close to the park in question and really enjoy coming here. The Azalea campground has been very crowded but we know the other camps are closed because of dead tree removal. Our main problem concerns RV waste dumping. For years we had this facility readily available at the entrance of Azalea. Our friends and my husband and I miss this facility very much. What can we do to help restore this important station to make out trips more comfortable!
- I noticed there weren't enough signs regarding snow chains near the entrances to the park. I plan to be going back to the park in winter, and I wouldn't want to get stuck without them. Also, the signs weren't posted with turn-out areas where a person could pull off the road to install them. Otherwise, the park was great!
- We've been coming to Sequoia Grant Grove (Azalea) since 1969. What we really miss is the dump station that was closed approximately 2000. We would often stay the 14 day limit. Now we can only stay 4-5 days. It's an inconvenience now to have to travel miles to seek a dump station. We now come to relax. We've done all the sightseeing there is to do which is great. We leave because of the dumping problem. Also, you have an area designated for "tents only" at Azalea campground. No campers or RVs allowed but yet the tent campers take a lot of spaces where the campers and RVs are allowed and the "tent only" area is not full, thus limiting the spaces for campers and RVs in the other area.
- Comments on transportation in Sequoia National Park. We have been coming to the park regularly every year for the past eight years and last year had an annual pass. Last summer we visited the park, and tried to go to Moro

Rock and Round Meadow. We could not deal with the traffic. There was no place to park! We have visited the park four times this year and saw improvements planned for the General Sherman Tree area when we visited the new Giant Forest Museum. The General Sherman Tree area is also a problem parking area, at least in the summer. The plan seems a marked improvement and I do support a local shuttle service serving the Giant Forest Village area – all these places which cannot support the vehicle traffic based on demand. Maybe from Lodgepole, or even Dorst, to Wolverton, Giant Forest Museum, Moro Rock, Round Meadow, etc. Since we drive from Los Angeles and usually camp, or stay at the lodge, a shuttle service from outside the park would not serve our needs very well. And it doesn't seem a very workable plan to close Generals Highway to through traffic. We enter the park through both south and north entrances, depending on the trip. But once we are settled in, a shuttle service would beat the congestion in the more popular areas. I have been to Grant Grove area as well, but am not as familiar with the problems there. However, it would seem a shuttle there might work as well. Have been to the Cedar Grove area of Kings Canyon as well, but not in a number of years. I cannot comment on this area. I am considering camping in this area, though restricting access would be troublesome for this reason. But again, a local shuttle service for these pockets would probably be a workable convenience. Then connections between the local services could work, although, due to travel time between localities, would not be as frequent or as convenient in all likelihood. But the service would probably be used during peak summer activities. I would encourage keeping the fares low. I have a family of 5 and sometimes feel taken advantage of when fares do not recognize that families participate in visiting national parks. Perhaps consideration of a family fee structure in addition to a per person fare would be a good idea. I hope my thoughts have been helpful to you.

- We were very surprised to find 2 out of 3 Grant Grove campgrounds were closed! Didn't see any info on this on the website. Given that 12 of the 14 campgrounds in Kings Canyon / Sequoia are first-come, first-serve, this info would definitely affect my travel plans for what I was certain would be a busy weekend.
- We took R245 out of the park. This very "snaky" road made my husband and myself very nervous. There should be some warning about this road.
- Regarding transportation – motor homes are a problem – slow and use of turnouts not commonly enforced. If the park service adheres to the practice of 1) preserving the park then 2) providing rec. use, and has transportation practices that follow that agenda, then I think the park/transportation departments will earn well deserved respect. Good luck and keep up the good work.
- In Yosemite there were lots of bike paths but there weren't any in Kings Canyon – otherwise we would have brought ours. Also, bikes not allowed on trails, a mountain bike trail or two would be nice. A parking lot at the entrance would have been nice to car pool in (when meeting folks from out of town). Like the idea of shuttling people in but what about those who are camping and have a car full of stuff? A shuttle/tour bus might be good for day trippers, but personally, wouldn't want to drive 5 hours for it. Maybe have a "rent an electric golf cart" station – and make that the only way to have a "personal vehicle" while in the park. Allows for folks to drag camping stuff around.
- We have made 7 trips to Kings Canyon since 1980 and they have all been tent camping. We enjoy it there immensely! Please keep it the way it is.
- We, as a family, have loved and enjoyed all the park has to offer for over 25 years. We love to backpack and hike back into the park and see the beauty as God intended it to be. But in the last few years, it seems to be more difficult to do so. We usually find a campsite as a base ("home") for the week we're there, and then go for short excursions from there. It is very difficult now to dump the camper tanks, take a shower between the hours they are open and the crowded conditions at those facilities, and with many young grandchildren doing the occasional loads of laundry is a whole day adventure, thus, wasting a big chunk of your vacation time. I really feel that these areas need to be addressed, as many people camp with RVs (also the getting gas situation, because RVs don't usually get good gas mileage and if you travel about seeing the park you sometimes need to refill before you go down the hill). I think the impact of these facilities on a small area of the total acreage of the parks is well worth it. The parks are for everyone to enjoy and restore themselves, and at this time, it feels like the park is visitor unfriendly. Thank you.
- My wife and I toured all the parks listed at item 20 this ear [total of 7]. We were very please with the natural beauty the parks had to offer, but were shocked at the poor condition of the park facilities at most places other than visitor centers, which were usually very nice. The bathrooms were pitiful most places. I felt embarrassed to see people from other countries having to use them in our famous national parks. Fix them ... every one of them!!! Public transportation worked fairly well but it is limiting. When traveling long distances to arrive, it is not ideal to have to be tied to a bus schedule. The ranger led programs were our favorite activities at each park,

but they were very limited in availability. No ranger led activities were available at Yellowstone the last week of May when we were at the park, which was very disappointing. Those activities should be increased.

- We believe the railings on Moro Rock are not adequate as smaller children could easily fall through the existing railings and they do not make you feel at all safe. Also, smoking should be limited to directly outside the visitor centers to reduce the risk of fires and cigarette butts littering the parks.
- We had a great trip. The parks were well-run, rangers helpful, roads good. Will return. Wuksachi Lodge far too expensive. Food dreadful and service terrible. Would not return.
- Please bring the shuttle back! We missed so much because we have a motor home and no tow vehicle.
- Great places to visit! Thanks!
- Our trip took 1 ½ months – we didn't know we were going to Sequoia National Park until our relatives took us since they live close. They have been there many times. We were in several states and once province on this trip. The rates for senior citizens have been very helpful to us and we were pleased with the clean campgrounds, trails, signs with maps, etc.
- My recent experience with public transportation at Grand Canyon was disappointing. My family does not need to spend our limited vacation time figuring out the system, then waiting on the system's timetable. Additionally, we prefer to spend the time together, not with groups of complete strangers. I no longer visit the Grand Canyon annually as I once did. I also discourage our tourists from visiting because of its limited public transportation system.
- Just a comment or two! 1) At Mesa Verde in Colorado there is a shuttle to various sites and even a tramway (from the visitor center) but there is no way to get from the park entrance to the visitor center except by car or walking (15 miles up hill). 2) Yosemite is very well organized. 3) Kings Canyon and Sequoia are for camping, hiking, etc. – more down to nature type place. Great fun. Thanks.
- Azalea campground [crowded]. You need to finish work on Sunset and Crystal Springs. 2 years closed is excessive.
- Slideshow at Lodgepole is very interesting. Talked with several rangers – all very helpful.
- Mileage to the different areas, at intervals, rather than driving forever (it seems) to get somewhere. Also letting us know how many miles of mountain driving we are in for!
- If you need to have buses they should be free, included with entrance fee. Smaller buses running frequently best. They need more turnouts on highway 180 so people can pass buses. You already charge admission by carload that encourages 3-4 people per car. Perhaps let bike and ride in free. Have buses equipped to haul bikes.
- Convenient and varied forms of public transportation to and within the national parks is a great idea. Please remember that there are all types of people who want to visit the parks and that they have different physical abilities. The parks need to remain accessible to everyone, not just those that are in top physical condition.
- Even though we drive a relatively short distance to these parks, we would prefer public transportation within the parks. The few times we've used shuttles within parks, their use did not pose any inconvenience. But then, we make deliberate decisions to avoid all parks during peak holiday times. We don't like the crowds, noise, traffic, etc.
- Great area to ride / needs bike lanes on roads
- The park roads could use a few more guardrails. The drop off along the edges of the roads is sometimes pretty steep.
- I would be willing to use a shuttle but would like to have detailed information on schedules and drop off/pick up locations. I'm a serious hiker/backpacker and would like to continue to have access to various trails in park and surrounding locations (I did Weaver Lake trail) but I recognize the need to preserve the park's natural resources.
- Road to Mineral King – too scary. Some of the hiking trails not well marked. Need more info along hiking trails as to how far from one place to another, etc.
- We felt the in park shuttles work well at other parks. They reduce congestion and slow traffic to safe speeds. We would be willing to use them for a reasonable fee.
- A park & ride system is needed in Yosemite! Since we are retired we try to visit parks in spring or fall and haven't found a problem with our car. We do take shuttles if there are a lot of convenient stops in the park and frequent shuttles. The shuttles should be free or inexpensive. Bryce Canyon National Park has a great shuttle

system and also a tour shuttle that stopped at various scenic spots with time to see them. We don't mind a reasonable fee for a tour shuttle. If there is any kind of shuttle system, there should be clear maps available in lots of places or given at the entrance (shuttles need to be frequent, uncrowded, and inexpensive).

- Park lodging is overpriced, but we loved our visit to the park.
- I think a shuttle service from campgrounds to scenic areas, museums, visitor centers, and viewing areas would be great. A tram tour of the park would be nice, too. The winding roads in the park are hard on vehicles and it would be nice to have a driver familiar with the roads to do the driving!
- In Sequoia, from the Three Rivers entrance to elevation of forest is a tortuous drive for a private driver or a shuttle driver. What about considering an aerial tramway – like the one at Scandia Peak in Albuquerque, NM – for moving numbers of people in an environmentally safe manner? Then trams could be used to ferry people at elevation (~4500 ft).

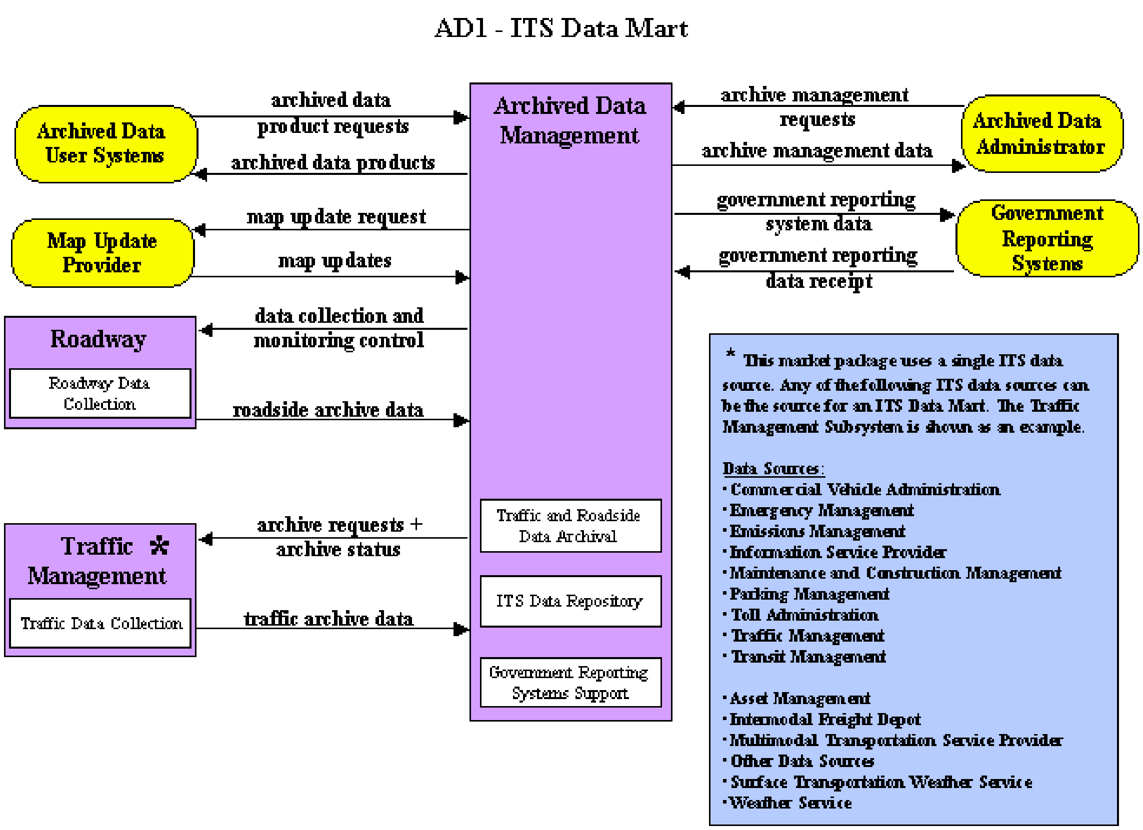
APPENDIX I: DESCRIPTION OF NATIONAL ITS ARCHITECTURE MARKET PACKAGES

Description of market packages as mentioned in Table 9-2, Table 9-18, and Table 9-37.

Archived Data Management

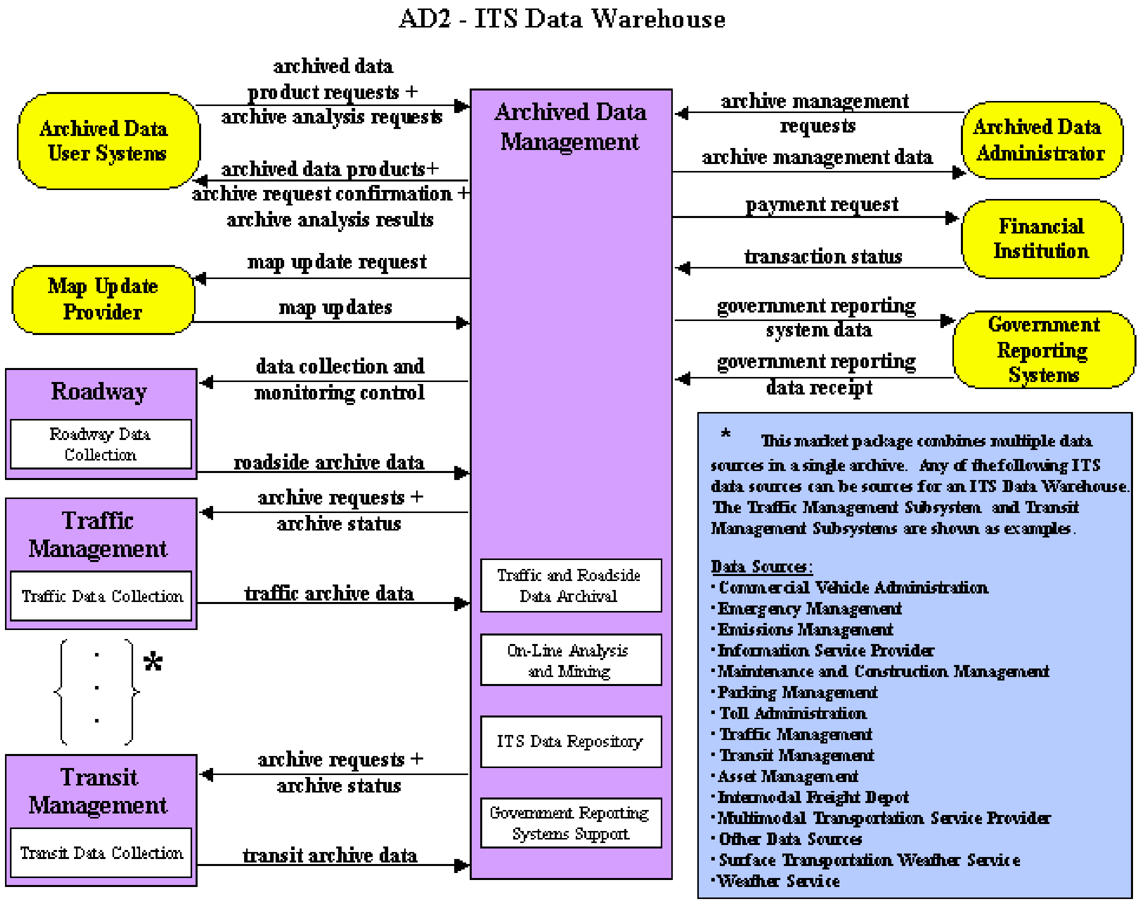
AD1 – ITS Data Mart

This market package provides a focused archive that houses data collected and owned by a single agency, district, private sector provider, research institution, or other organization. This focused archive typically includes data covering a single transportation mode and one jurisdiction that is collected from an operational data store and archived for future use. It provides the basic data quality, data privacy, and meta data management common to all ITS archives and provides general query and report access to archive data users.



AD2 – ITS Data Warehouse

This market package includes all the data collection and management capabilities provided by the ITS Data Mart, and adds the functionality and interface definitions that allow collection of data from multiple agencies and data sources spanning across modal and jurisdictional boundaries. It performs the additional transformations and provides the additional meta data management features that are necessary so that all this data can be managed in a single repository with consistent formats. The potential for large volumes of varied data suggests additional on-line analysis and data mining features that are also included in this market package in addition to the basic query and reporting user access features offered by the ITS Data Mart.

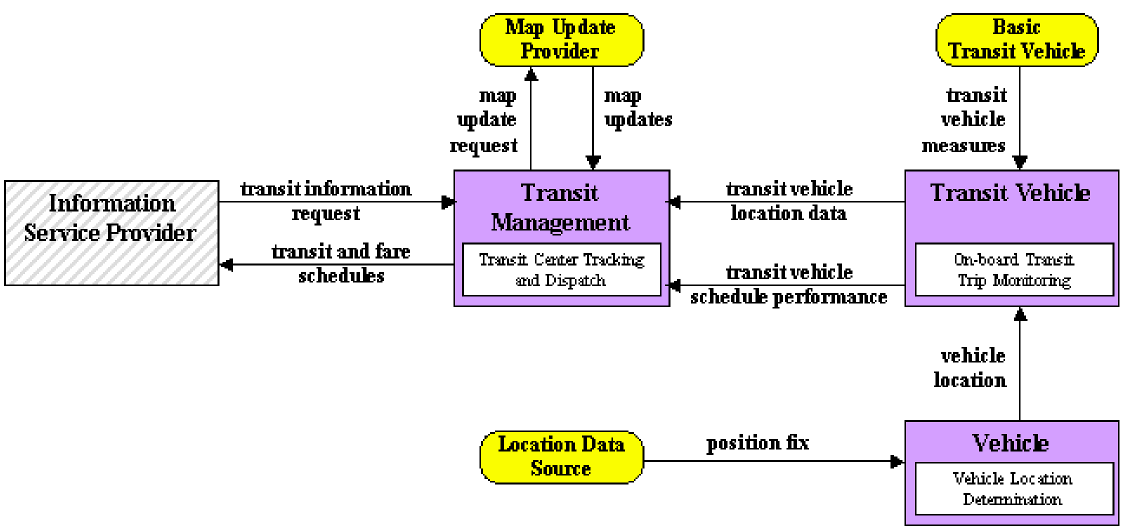


Public Transportation

APTS1 – Transit Vehicle Tracking

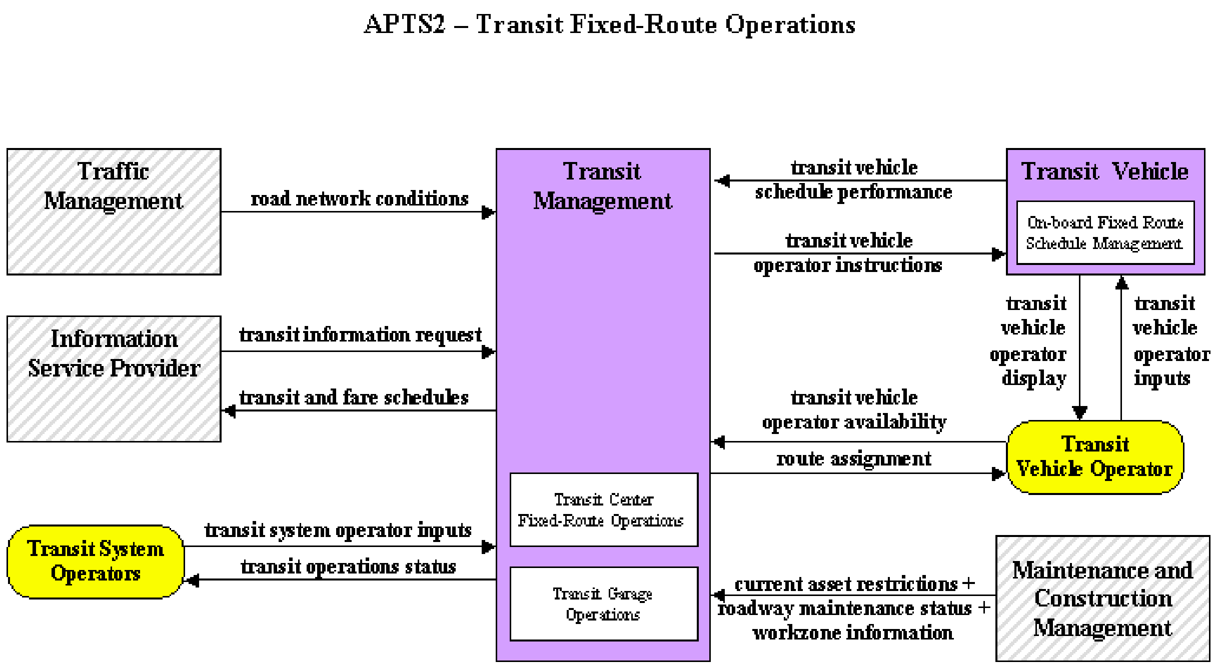
This market package monitors current transit vehicle location using an Automated Vehicle Location System. The location data may be used to determine real time schedule adherence and update the transit system's schedule in real-time. Vehicle position may be determined either by the vehicle (e.g., through GPS) and relayed to the infrastructure or may be determined directly by the communications infrastructure. A two-way wireless communication link with the Transit Management Subsystem is used for relaying vehicle position and control measures. Fixed route transit systems may also employ beacons along the route to enable position determination and facilitate communications with each vehicle at fixed intervals. The Transit Management Subsystem processes this information, updates the transit schedule and makes real-time schedule information available to the Information Service Provider.

APTS1 – Transit Vehicle Tracking



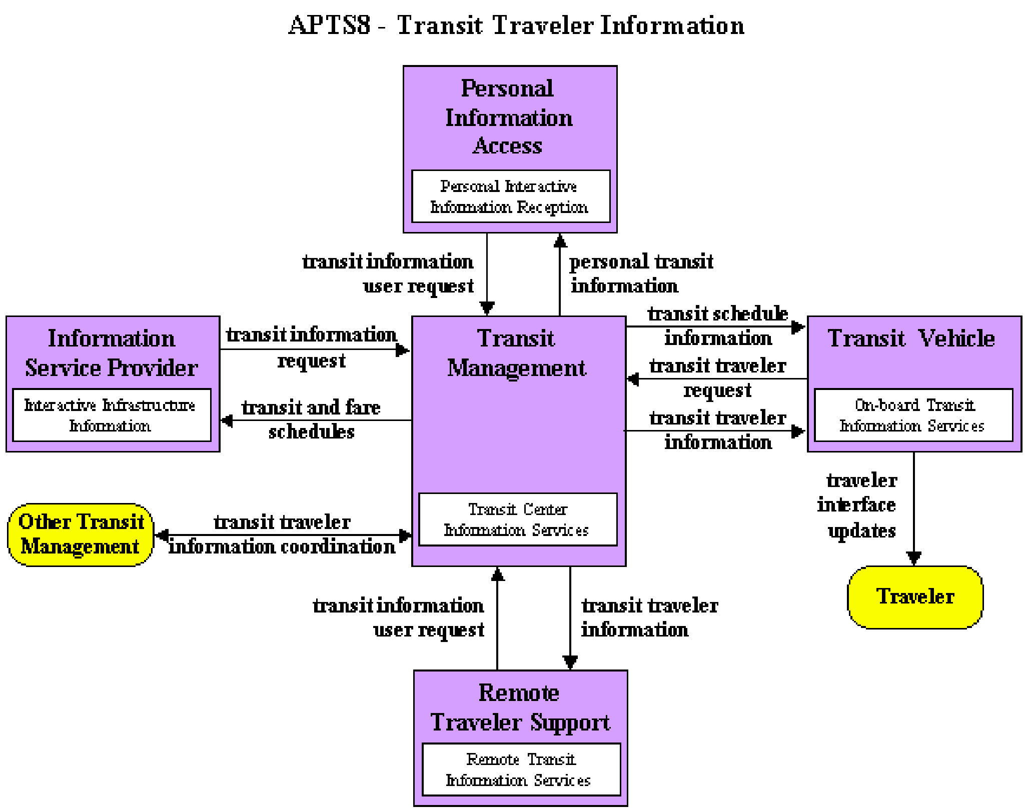
APTS2 – Transit Fixed-Route Operations

This market package performs vehicle routing and scheduling, as well as automatic driver assignment and system monitoring for fixed-route transit services. This service determines current schedule performance using AVL data and provides information displays at the Transit Management Subsystem. Static and real time transit data is exchanged with Information Service Providers where it is integrated with that from other transportation modes (e.g. rail, ferry, air) to provide the public with integrated and personalized dynamic schedules.



APTS8 – Transit Traveler Information

This market package provides transit users at transit stops and on-board transit vehicles with ready access to transit information. The information services include transit stop annunciation, imminent arrival signs, and real-time transit schedule displays that are of general interest to transit users. Systems that provide custom transit trip itineraries and other tailored transit information services are also represented by this market package.

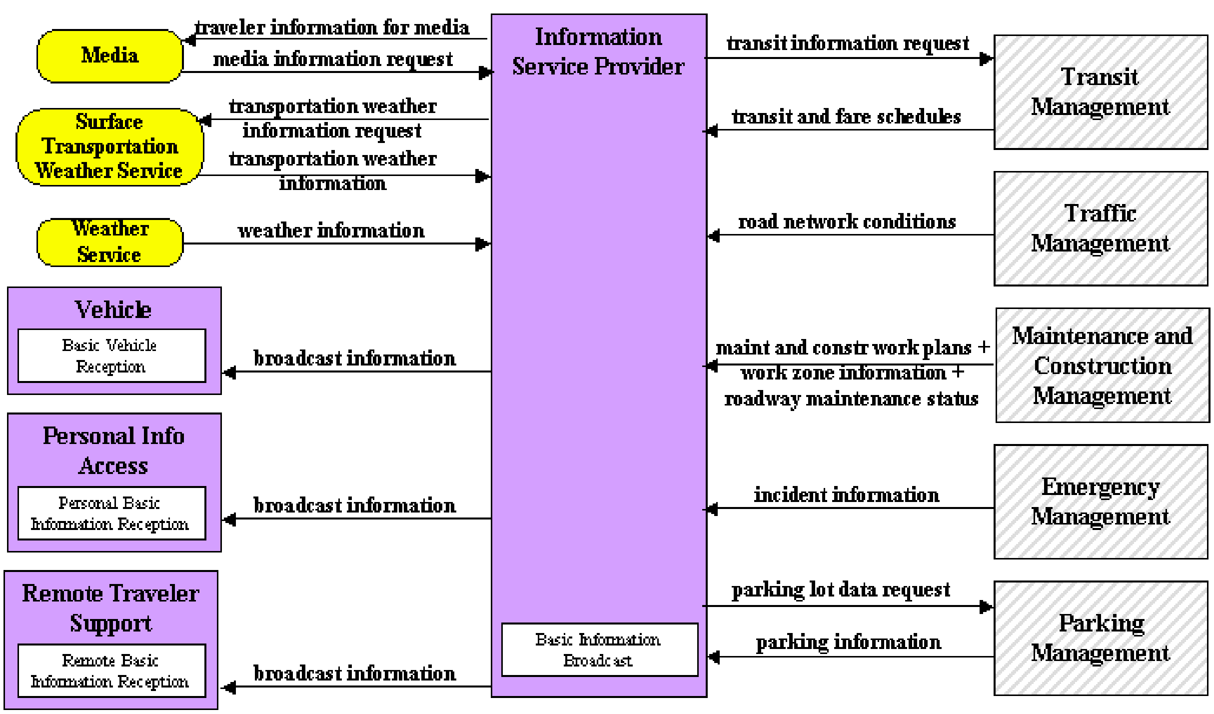


Traveler Information

ATIS1 – Broadcast Traveler Information

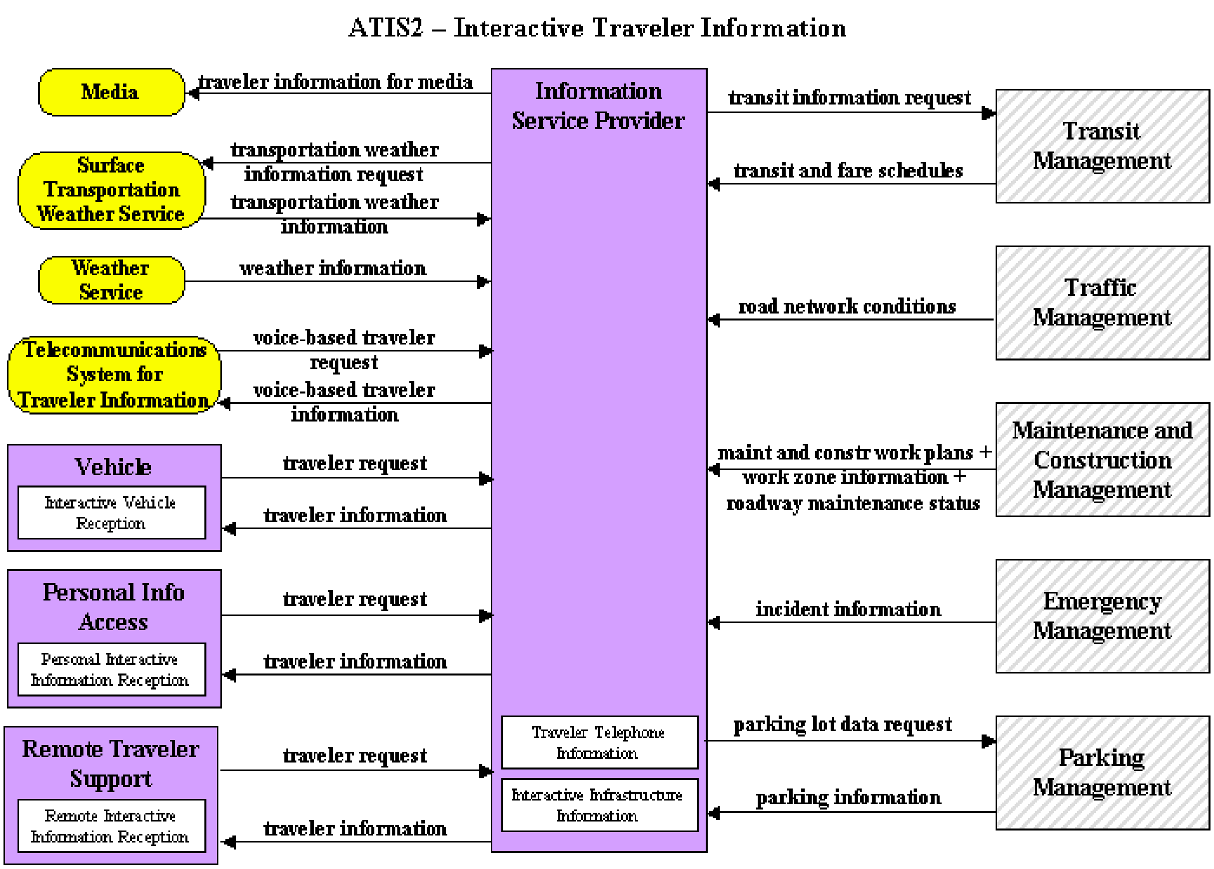
This market package collects traffic conditions, advisories, general public transportation, toll and parking information, incident information, air quality and weather information, and broadly disseminates this information through existing infrastructures and low cost user equipment (e.g., FM subcarrier, cellular data broadcast). The information may be provided directly to travelers or provided to merchants and other traveler service providers so that they can better inform their customers of travel conditions. Different from the market package ATMS6 - Traffic Information Dissemination, which provides localized HAR and CMS information capabilities, ATIS1 provides a wide area digital broadcast service. Successful deployment of this market package relies on availability of real-time traveler information from roadway instrumentation, probe vehicles or other sources.

ATIS1 – Broadcast Traveler Information



ATIS2 – Interactive Traveler Information

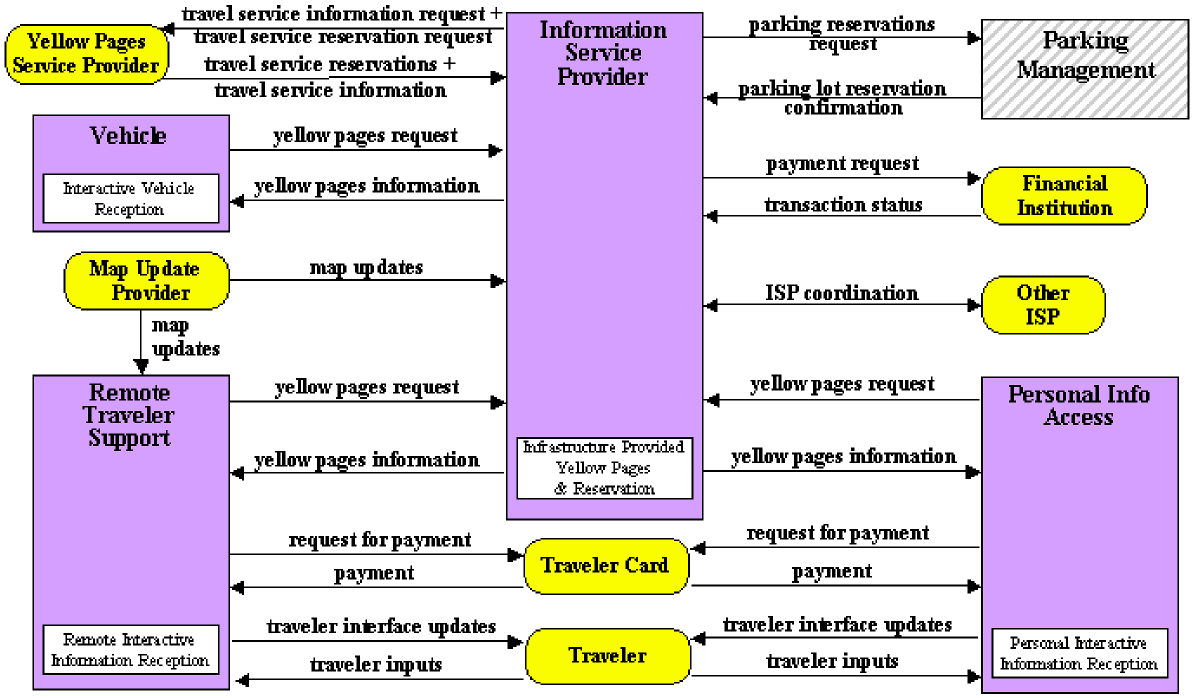
This market package provides tailored information in response to a traveler request. Both real-time interactive request/response systems and information systems that "push" a tailored stream of information to the traveler based on a submitted profile are supported. The traveler can obtain current information regarding traffic conditions, transit services, ride share/ride match, parking management, and pricing information. A range of two-way wide-area wireless and wireline communications systems may be used to support the required data communications between the traveler and Information Service Provider. A variety of interactive devices may be used by the traveler to access information prior to a trip or en route including phone, kiosk, Personal Digital Assistant, personal computer, and a variety of in-vehicle devices. This market package also allows merchants to receive traffic information to their personal devices or remote traveler systems to better inform customers of road travel conditions. Successful deployment of this market package relies on availability of real-time transportation data from roadway instrumentation, probe vehicles or other means. A traveler may also input personal preferences and identification information via a "traveler card" that can convey information to the system about the traveler as well as receive updates from the system so the card can be updated over time.



ATIS7 – Yellow Pages and Reservation

This market package provides yellow pages and reservation services to the user. These additional traveler services may be provided using the same basic user equipment used for Interactive Traveler Information. This market package provides multiple ways for accessing information either while en route in a vehicle using wide-area wireless communications or pre-trip via wireline connections.

ATIS7 - Yellow Pages and Reservation

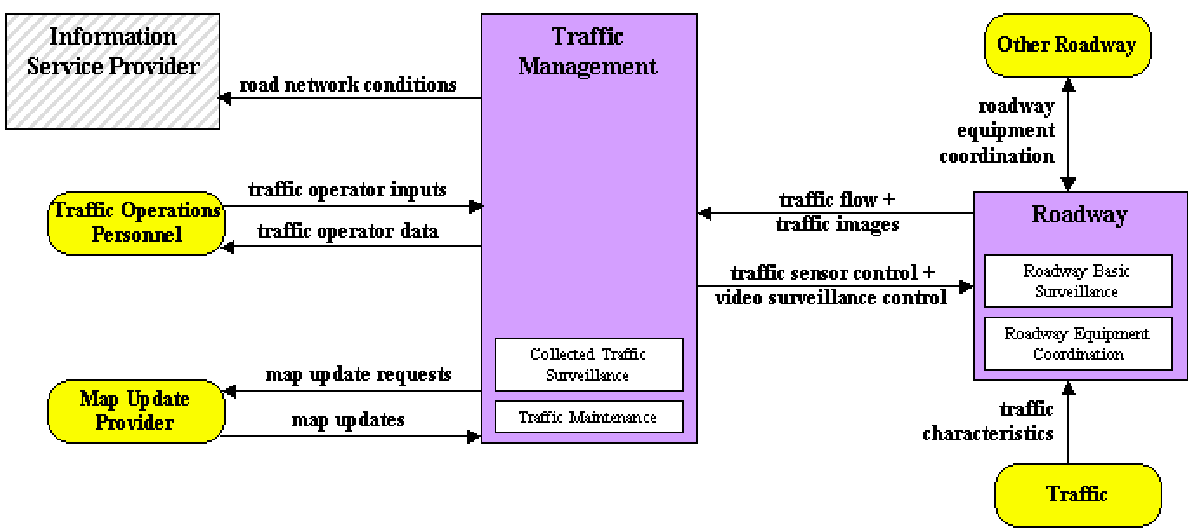


Traffic Management

ATMS01 – Network Surveillance

This market package includes traffic detectors, other surveillance equipment, the supporting field equipment, and wireline communications to transmit the collected data back to the Traffic Management Subsystem. The derived data can be used locally such as when traffic detectors are connected directly to a signal control system or remotely (e.g., when a closed-circuit television [CCTV] system sends data back to the Traffic Management Subsystem). The data generated by this market package enables traffic managers to monitor traffic and road conditions, identify and verify incidents, detect faults in indicator operations, and collect census data for traffic strategy development and long range planning. The collected data can also be analyzed and made available to users and the Information Service Provider Subsystem.

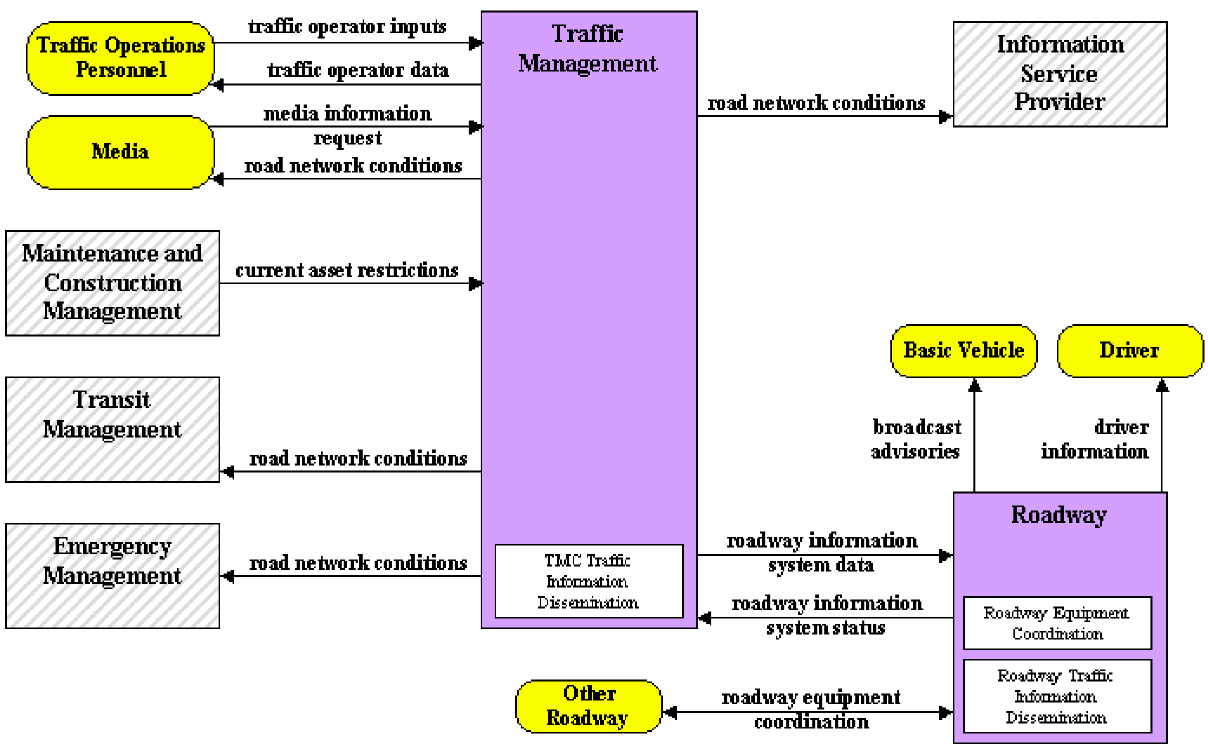
ATMS01 – Network Surveillance



ATMS06 – Traffic Information Dissemination

This market package allows traffic information to be disseminated to drivers and vehicles using roadway equipment such as changeable message signs or highway advisory radio. This package provides a tool that can be used to notify drivers of incidents; careful placement of the roadway equipment provides the information at points in the network where the drivers have recourse and can tailor their routes to account for the new information. This package also covers the equipment and interfaces that provide traffic information from a traffic management center to the media (for instance via a direct tie-in between a traffic management center and radio or television station computer systems), Transit Management, Emergency Management, and Information Service Providers. A link to the Maintenance and Construction Management subsystem allows real time information on road/bridge closures due to maintenance and construction activities to be disseminated.

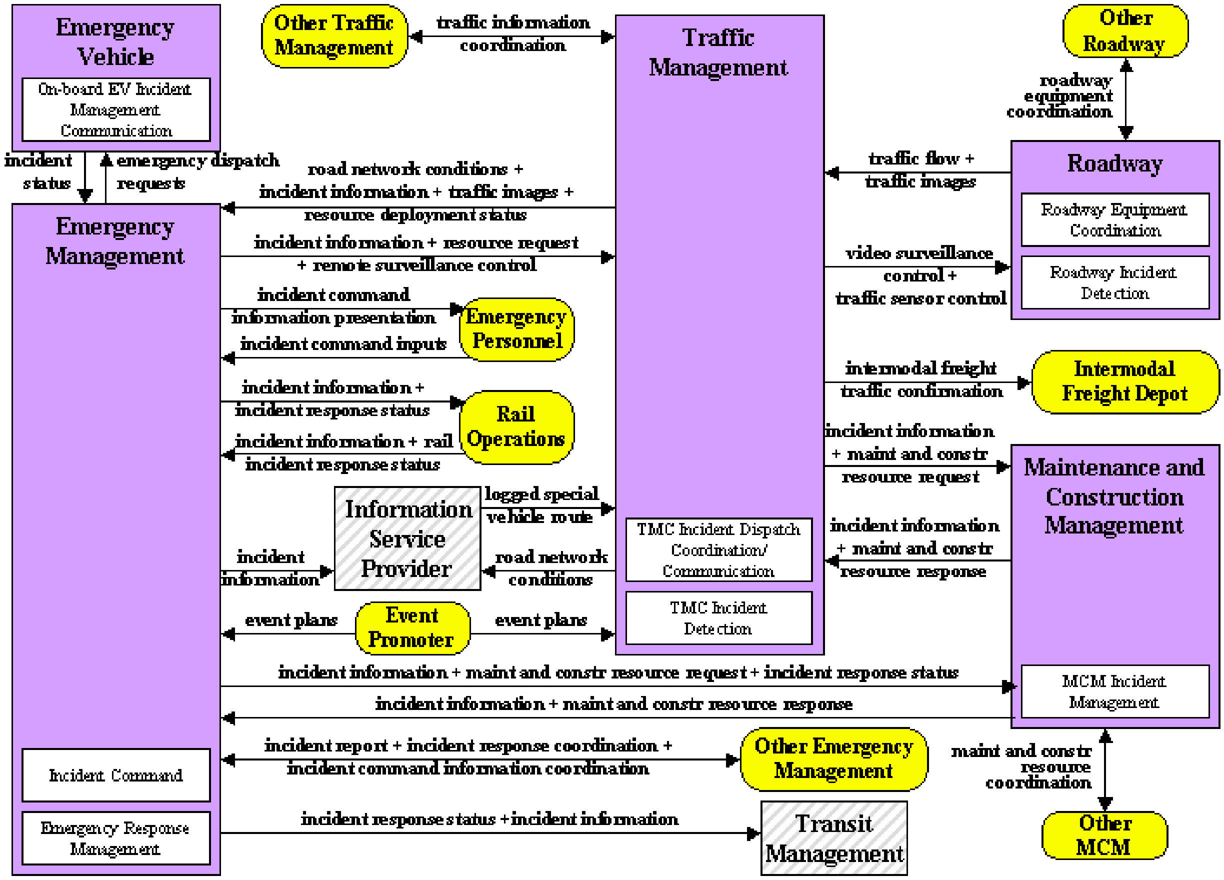
ATMS06 – Traffic Information Dissemination



ATMS08 – Incident Management System

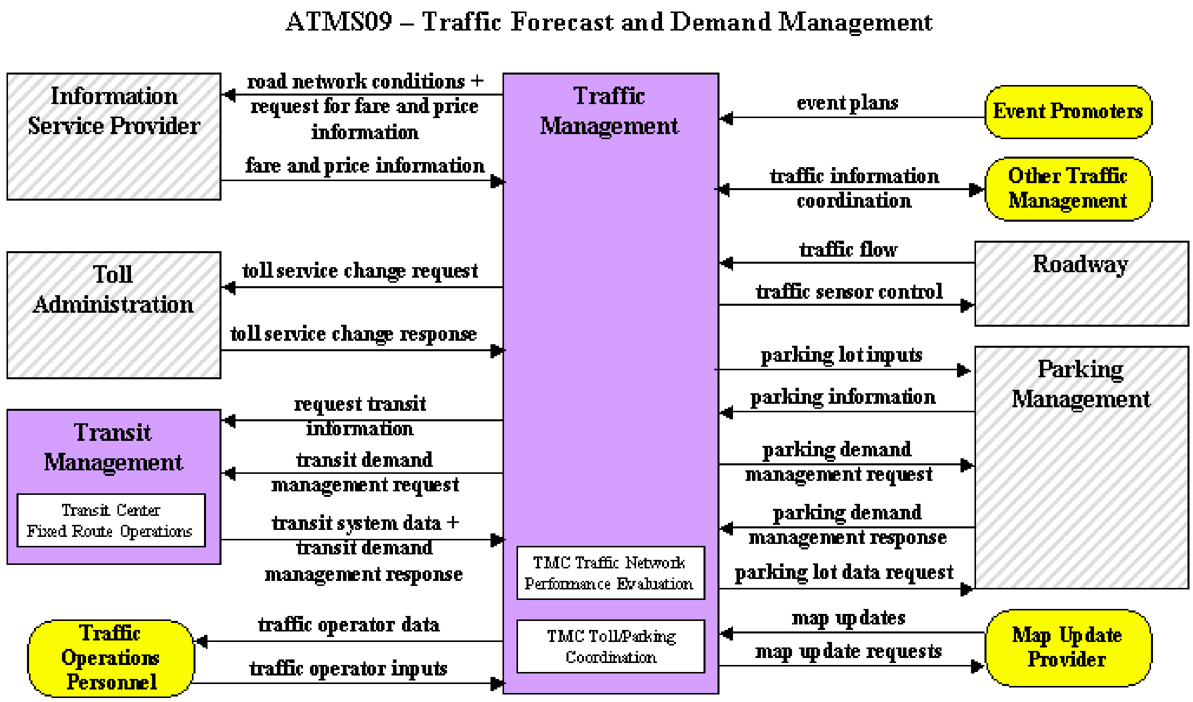
This market package manages both unexpected incidents and planned events so that the impact to the transportation network and traveler safety is minimized. The market package includes incident detection capabilities through roadside surveillance devices (e.g. CCTV) and through regional coordination with other traffic management, maintenance and construction management and emergency management centers as well as weather service entities and event promoters. Information from these diverse sources are collected and correlated by this market package to detect and verify incidents and implement an appropriate response. This market package supports traffic operations personnel in developing an appropriate response in coordination with emergency management, maintenance and construction management, and other incident response personnel to confirmed incidents. The response may include traffic control strategy modifications or resource coordination between center subsystems. Incident response also includes presentation of information to affected travelers using the Traffic Information Dissemination market package and dissemination of incident information to travelers through the Broadcast Traveler Information or Interactive Traveler Information market packages. The roadside equipment used to detect and verify incidents also allows the operator to monitor incident status as the response unfolds. The coordination with emergency management might be through a computer-aided dispatch (CAD) system or through other communication with emergency field personnel. The coordination can also extend to tow trucks and other allied response agencies and field service personnel.

ATMS08 – Traffic Incident Management System



ATMS09 – Traffic Forecast and Demand Management

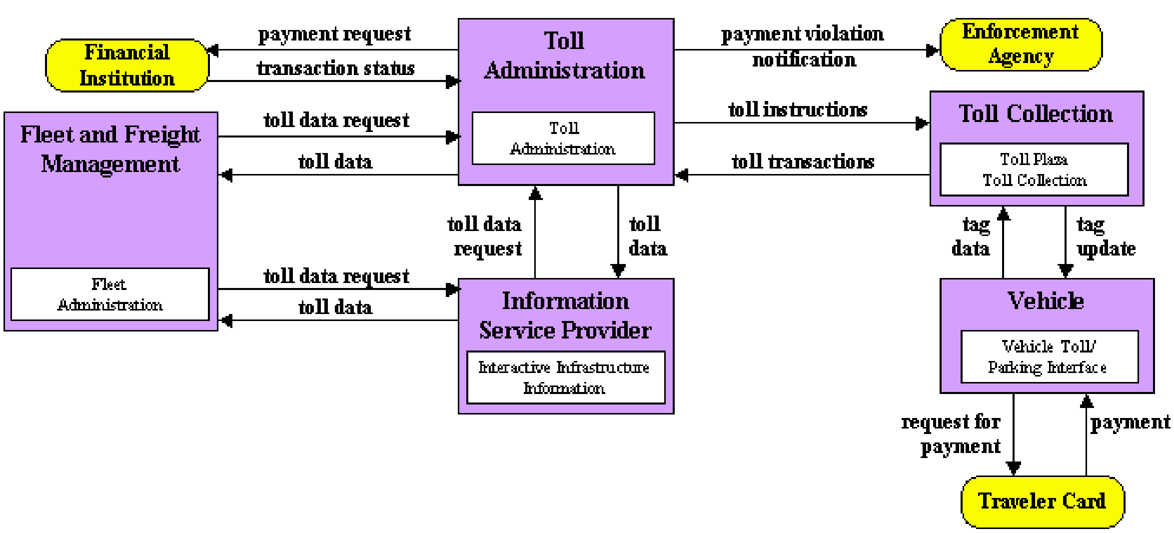
This market package includes advanced algorithms, processing, and mass storage capabilities that support historical evaluation, real-time assessment, and forecast of the roadway network performance. This includes the prediction of travel demand patterns to support better link travel time forecasts. The source data would come from the Traffic Management Subsystem itself as well as other traffic management centers and forecasted traffic loads derived from route plans supplied by the Information Service Provider Subsystem. This market package provides data that supports the implementation of TDM programs, and policies managing both traffic and the environment. The package collects information on vehicle pollution levels, parking availability, usage levels, and vehicle occupancy to support these functions. Demand management requests can also be made to Toll Administration, Transit Management, and Parking Management Subsystems.



ATMS10 – Electronic Toll Collection

This market package provides toll operators with the ability to collect tolls electronically and detect and process violations. The fees that are collected may be adjusted to implement demand management strategies. Dedicated short range communication between the roadway equipment and the vehicle is required as well as wireline interfaces between the toll collection equipment and transportation authorities and the financial infrastructure that supports fee collection. Vehicle tags of toll violators are read and electronically posted to vehicle owners. Standards, inter-agency coordination, and financial clearinghouse capabilities enable regional, and ultimately national interoperability for these services. The toll tags and roadside readers that these systems utilize can also be used to collect road use statistics for highway authorities. This data can be collected as a natural by-product of the toll collection process or collected by separate readers that are dedicated to probe data collection.

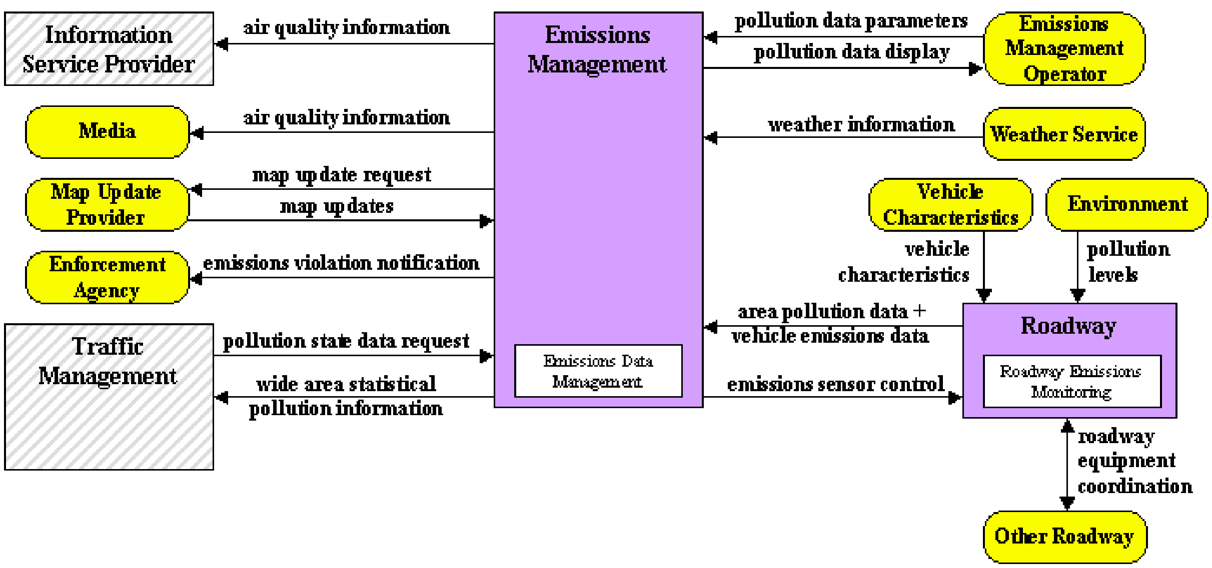
ATMS10 – Electronic Toll Collection



ATMS11 – Emission Monitoring and Management

This market package monitors individual vehicle emissions and provides general air quality monitoring using distributed sensors to collect the data. The collected information is transmitted to the emissions management subsystem for processing. Both area wide air quality monitoring and point emissions monitoring are supported by this market package. For area wide monitoring, this market package measures air quality, identifies sectors that are non-compliant with air quality standards, and collects, stores and reports supporting statistical data. For point emissions monitoring, this market package measures tail pipe emissions and identifies vehicles that exceed emissions standards. The gathered information can be used to implement environmentally sensitive TDM programs, policies, and regulations.

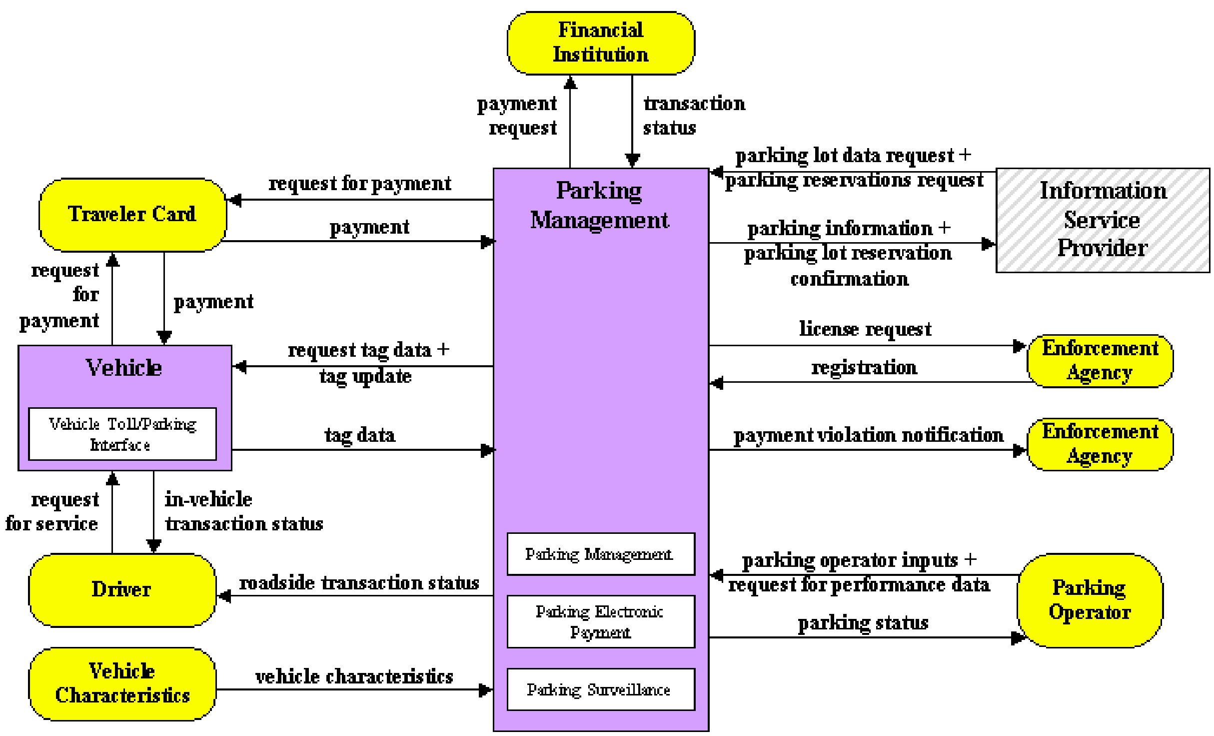
ATMS11 – Emissions Monitoring and Management



ATMS16 – Parking Facility Management

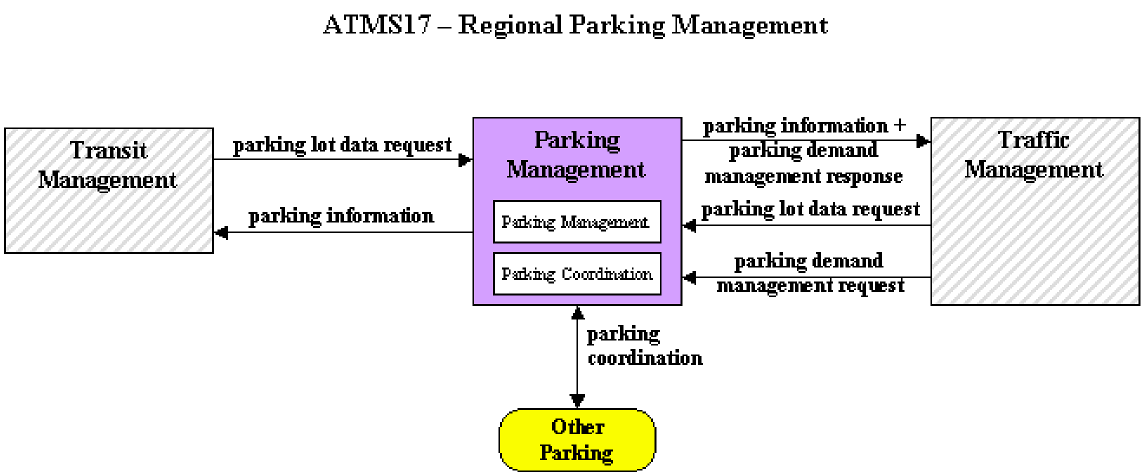
This market package provides enhanced monitoring and management of parking facilities. It assists in the management of parking operations, coordinates with transportation authorities, and supports electronic collection of parking fees. This market package collects current parking status, shares this data with Information Service Providers and Traffic Management, and collects parking fees using the same in-vehicle equipment utilized for electronic toll collection or contact or proximity traveler cards used for electronic payment.

ATMS16 – Parking Facility Management



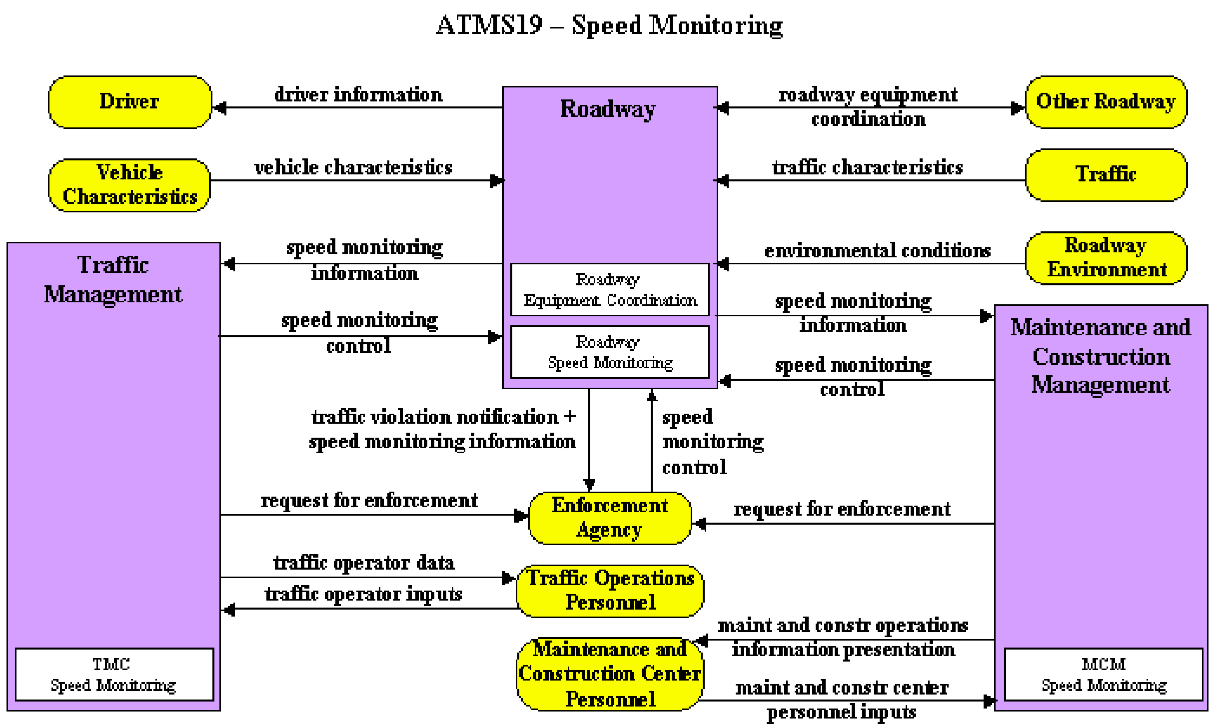
ATMS17 – Regional Parking Management

This market package supports coordination between parking facilities to enable regional parking management strategies.



ATMS19 – Speed Monitoring

This market package monitors the speeds of vehicles traveling through a roadway system. If the speed is determined to be excessive, roadside equipment can suggest a safe driving speed. Environmental conditions may be monitored and factored into the safe speed advisories that are provided to the motorist. This service can also support notifications to an enforcement agency to enforce the speed limit on a roadway system.

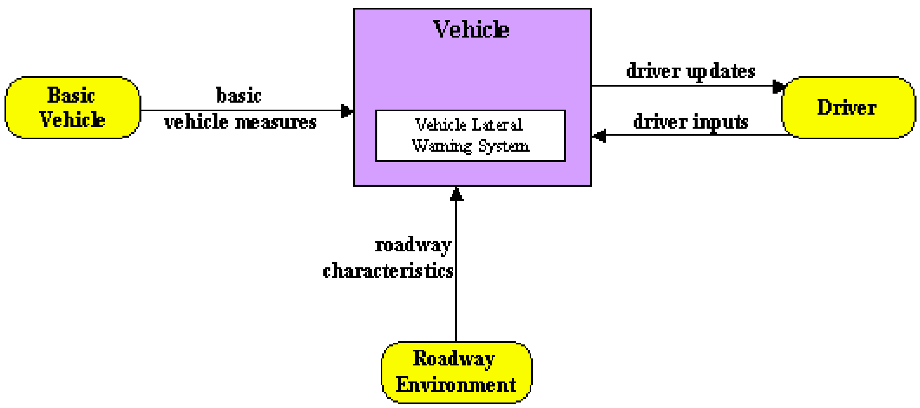


Vehicle Safety

AVSS04 – Lateral Safety Warning

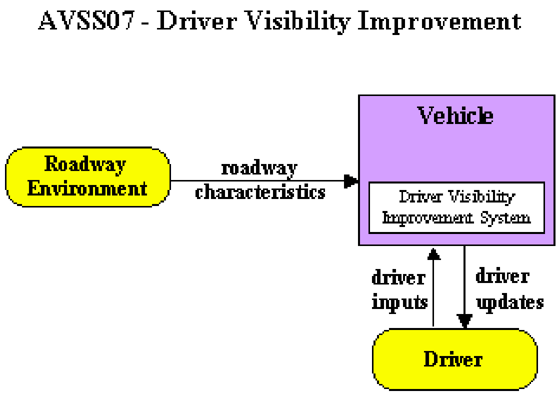
This market package allows for lateral warning. It utilizes safety sensors and collision sensors. It requires on-board sensors to monitor the areas to the sides of the vehicle and present warnings to the driver about potential hazards.

AVSS04 - Lateral Safety Warning



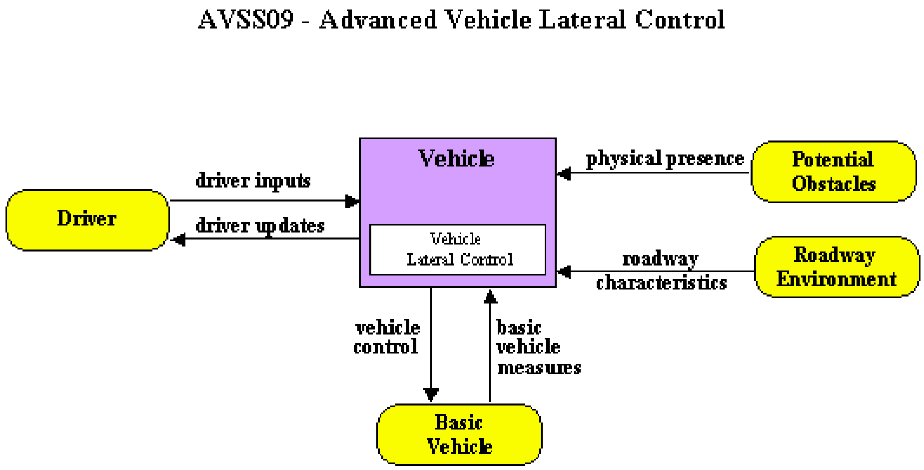
AVSS07 – Driver Visibility Improvement

This market package will enhance driver visibility using an enhanced vision system. On-board display hardware is needed.



AVSS09 – Advanced Vehicle Lateral Control

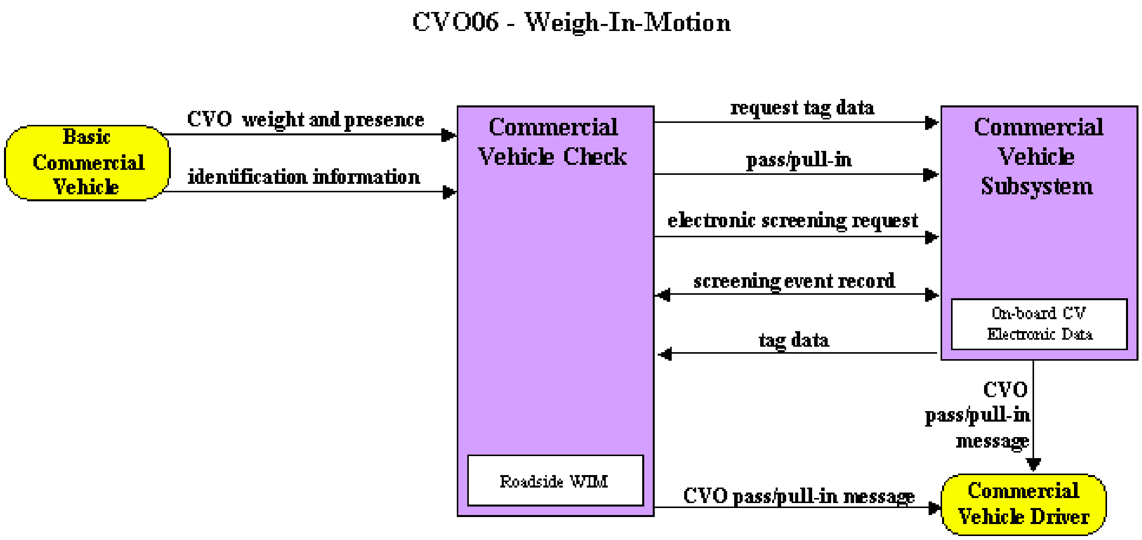
This market package automates the steering control on board the vehicle. It utilizes safety sensors and collision sensors combined with vehicle dynamics processing to control the steering. It requires on-board sensors to measure lane position and lateral deviations and a processor for controlling the vehicle steering.



Commercial Vehicle Operations

CVO06 – Weigh-in-Motion

This market package provides for high speed weigh-in-motion with or without Automated Vehicle Identification (AVI) capabilities. This market package provides the roadside equipment that could be used as a stand-alone system or to augment the Electronic Clearance (CVO03) market package.

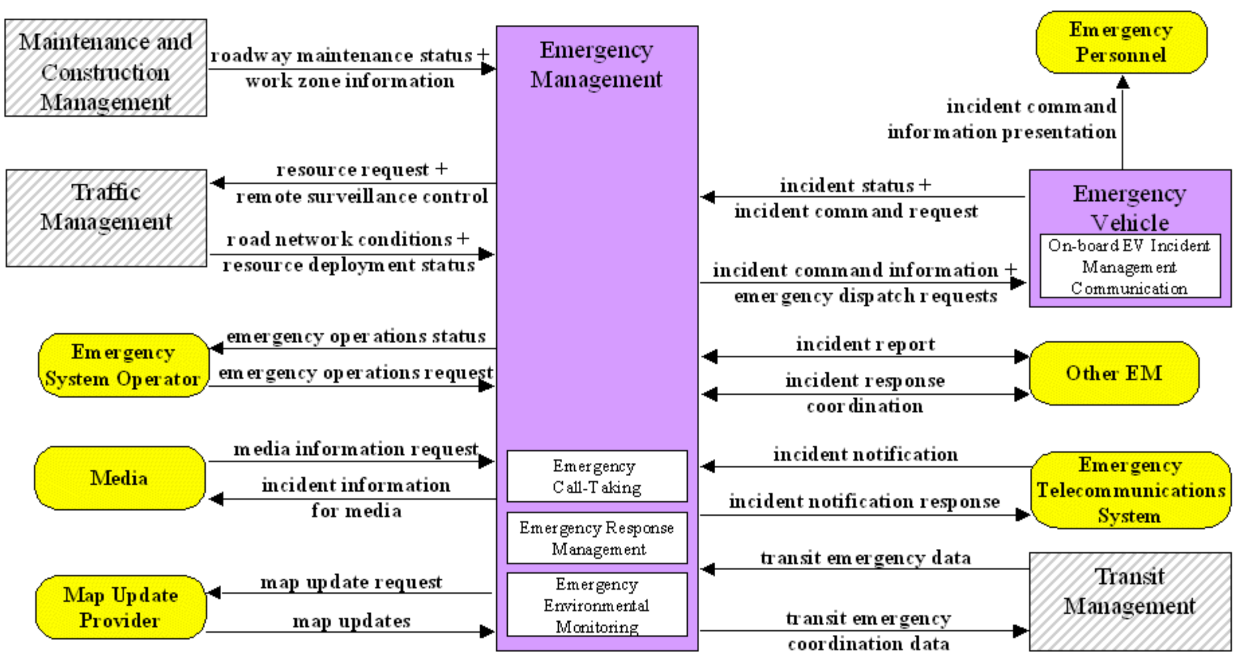


Emergency Management

EM1 – Emergency Response

This market package includes emergency vehicle equipment, equipment used to receive and route emergency calls, and wireless communications that enable safe and rapid deployment of appropriate resources to an emergency. Coordination between Emergency Management Subsystems supports emergency notification and coordinated response between agencies. Existing wide area wireless communications would be utilized between the Emergency Management Subsystem and an Emergency Vehicle to enable an incident command system to be established and supported at the emergency location. Public safety, traffic management, and many other allied agencies may each participate in the coordinated response managed by this package.

EM1 - Emergency Response

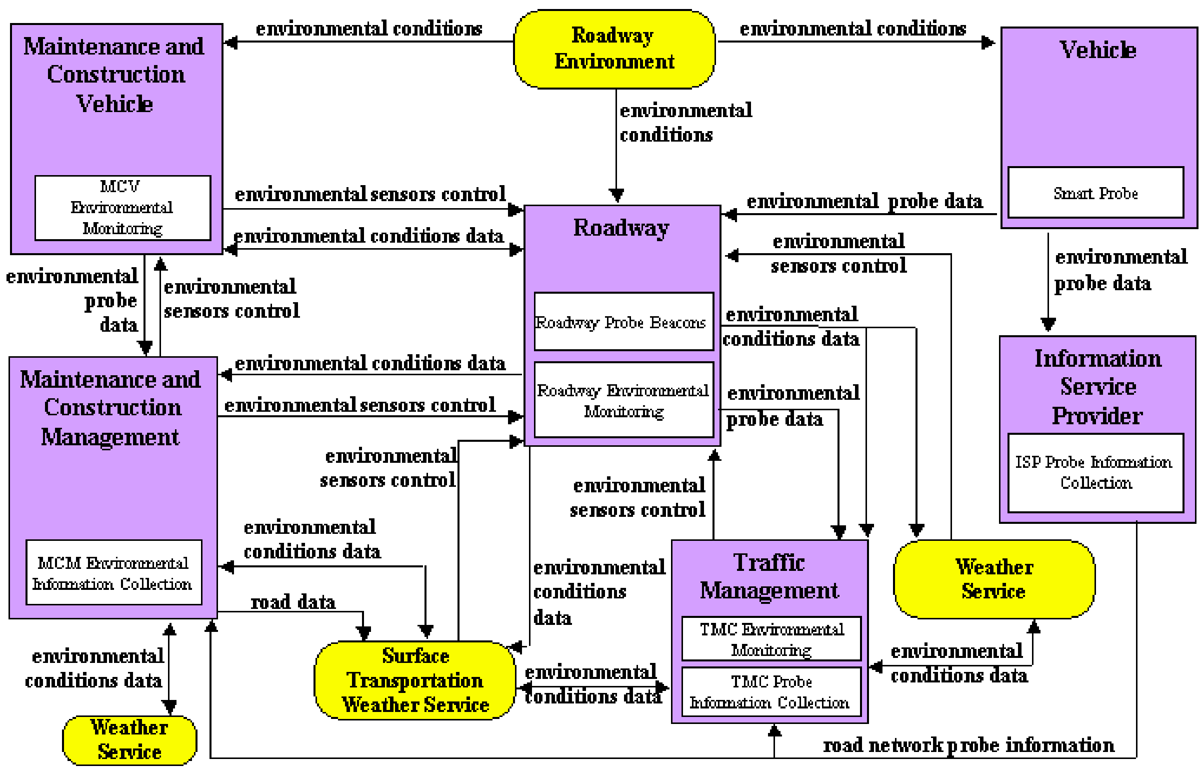


Maintenance and Construction Management

MC03 – Road Weather Data Collection

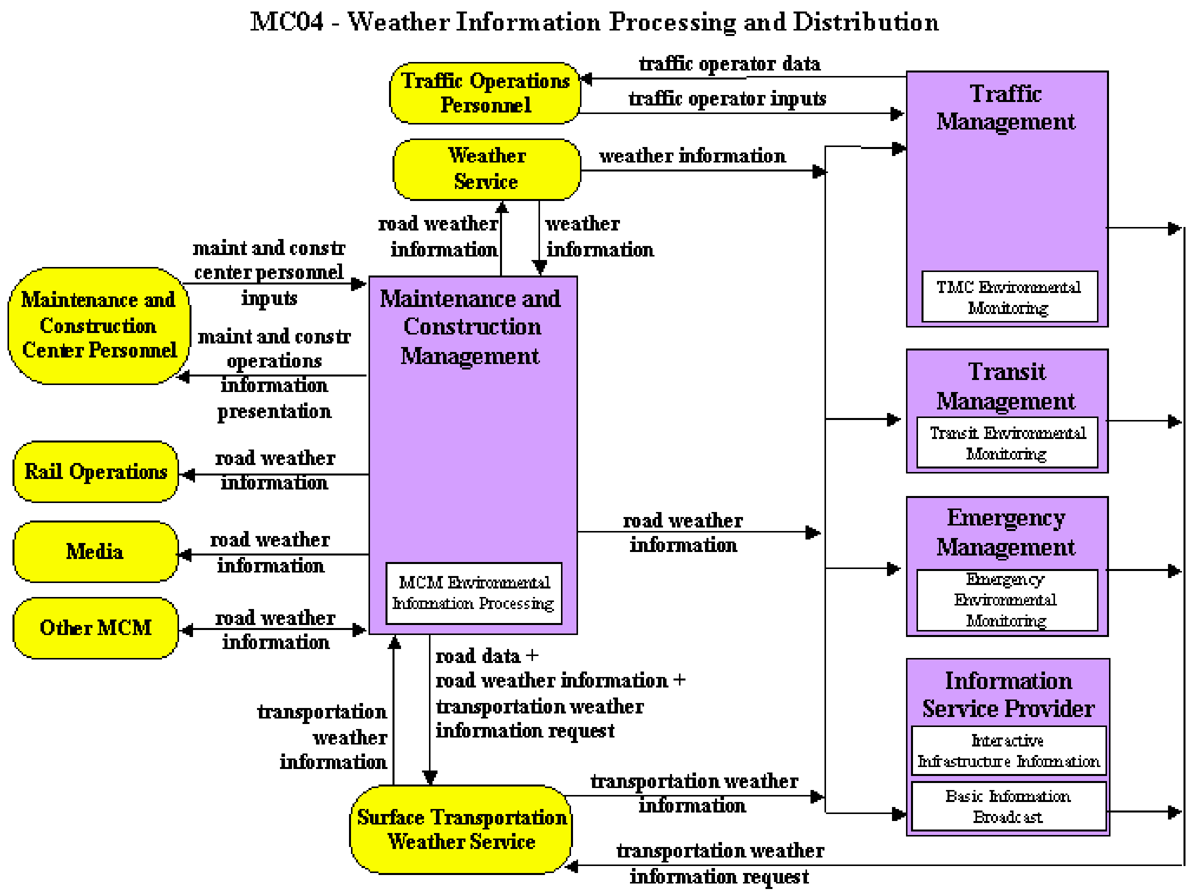
This market package collects current road and weather conditions using data collected from environmental sensors deployed on and about the roadway (or guideway in the case of transit related rail systems). In addition to fixed sensor stations at the roadside, sensing of the roadway environment can also occur from sensor systems located on Maintenance and Construction Vehicles and on-board sensors provided by auto manufacturers. The collected environmental data is used by the Weather Information Processing and Distribution Market Package to process the information and make decisions on operations.

MC03 – Road Weather Data Collection



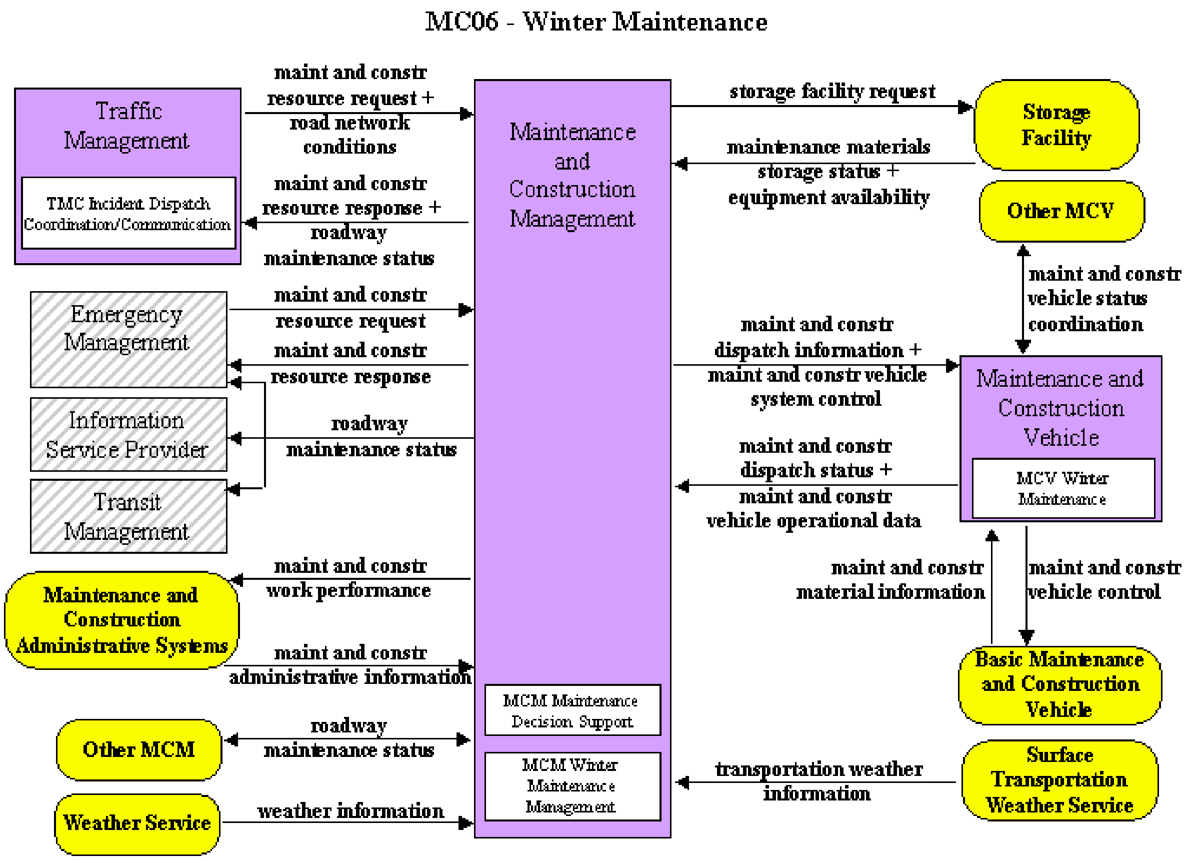
MC04 – Weather Information Processing and Distribution

This market package processes and distributes the environmental information collected from the Road Weather Data Collection market package. This market package uses the environmental data to detect environmental hazards such as icy road conditions, high winds, dense fog, etc. so system operators and decision support systems can make a decision on corrective actions to take. The continuing updates of road condition information and current temperatures can be used by system operators to more effectively deploy road maintenance resources, issue general traveler advisories, issue location specific warnings to drivers using the Traffic Information Dissemination market package, and aid operators in scheduling work activity.



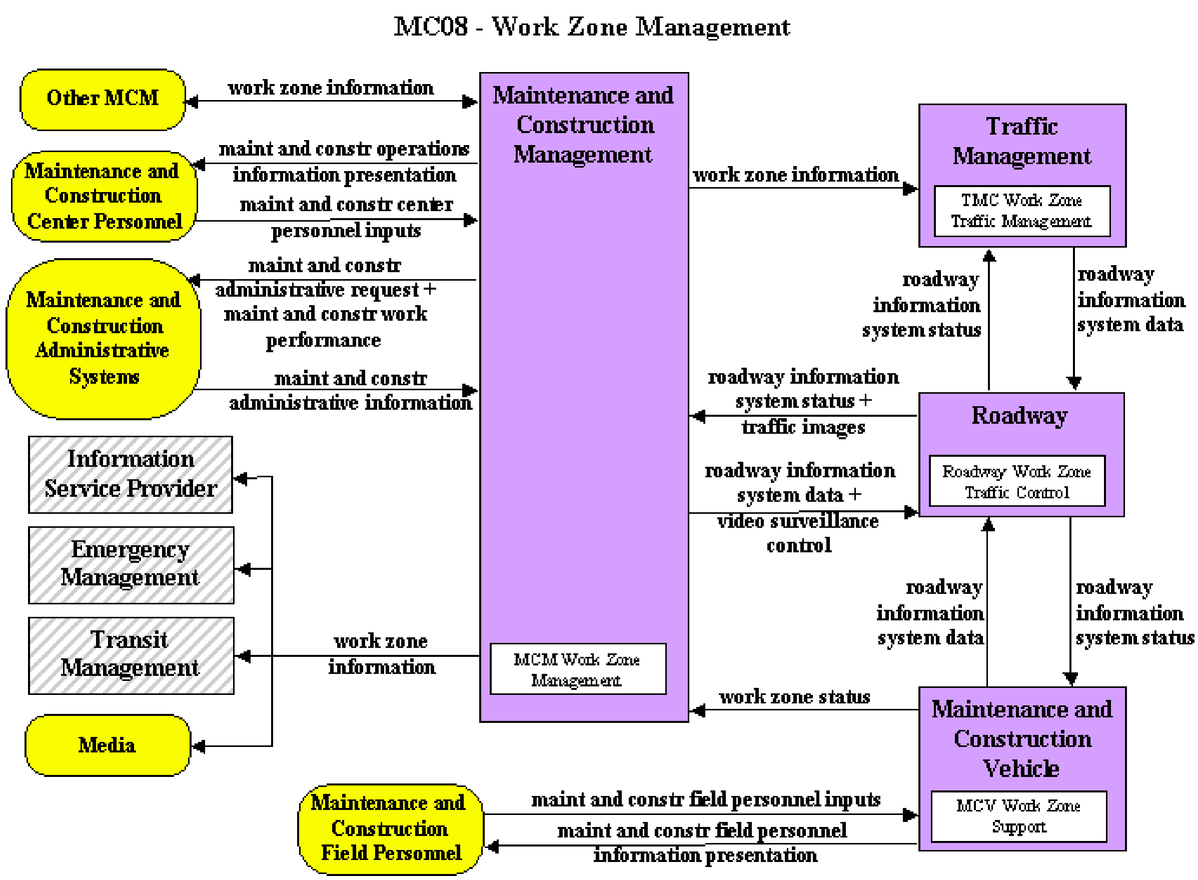
MC06 – Winter Maintenance

This market package supports winter road maintenance including snow plow operations, roadway treatments (e.g., salt spraying and other anti-icing material applications), and other snow and ice control activities. This package monitors environmental conditions and weather forecasts and uses the information to schedule winter maintenance activities, determine the appropriate snow and ice control response, and track and manage response operations.



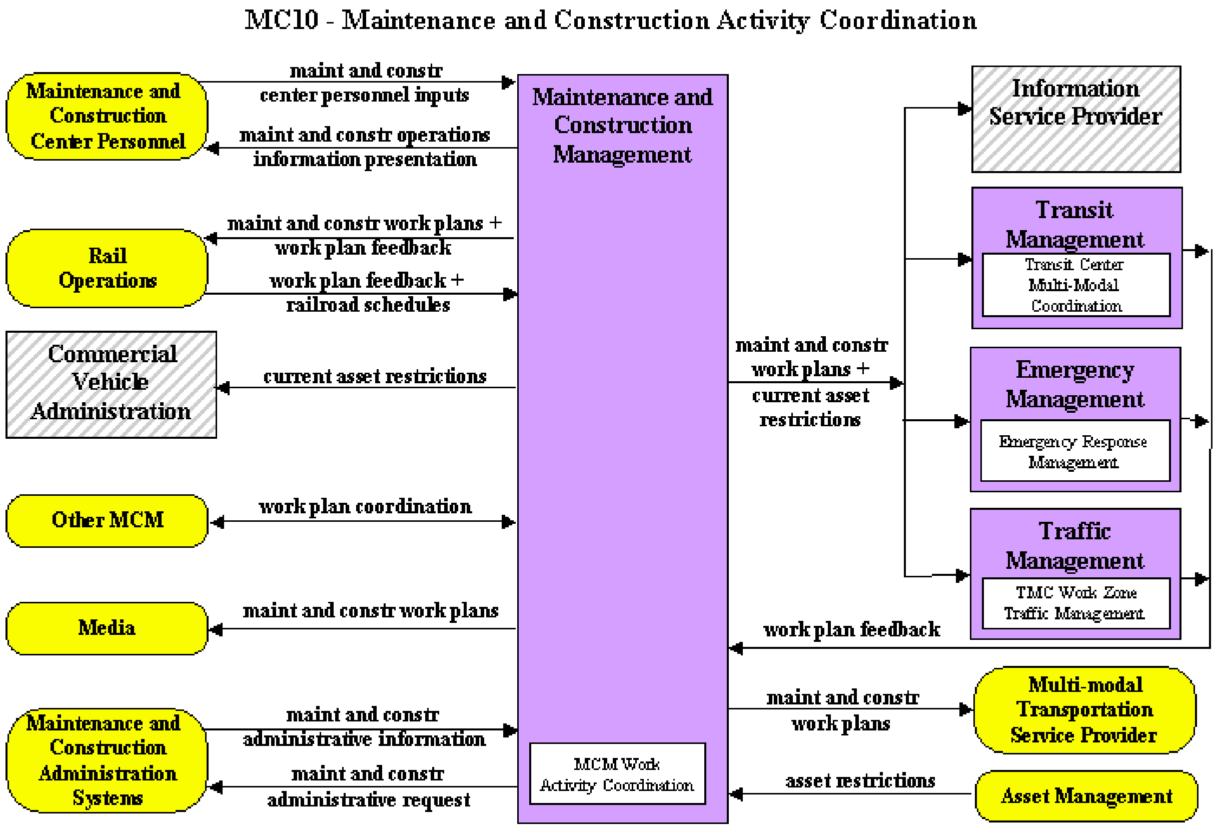
MC08 – Work Zone Management

This market package directs activity in work zones, controlling traffic through portable changeable message signs (CMS) and informing other groups of activity (e.g., Information Service Provider, Traffic Management, other maintenance and construction centers) for better coordination management. Work zone speeds and delays are provided to the motorist prior to the work zones.



MC10 – Maintenance and Construction Activity Coordination

This market package supports the dissemination of maintenance and construction activity to centers which can utilize it as part of their operations, or to the Information Service Providers who can provide the information to travelers.



APPENDIX J: DESCRIPTION OF NATIONAL ITS ARCHITECTURE SUBSYSTEMS AND TERMINATORS

This section lists all terminators and subsystems that are included in the ITS themes described in Chapter 9. Most of these themes have been defined in the National ITS Architecture. Those designated with an asterisk (*) have been added based on the unique ITS themes appropriate for national parks.

This appendix can be helpful in a couple of ways. First, this appendix provides connectivity with the terminology of the National ITS Architecture, which will facilitate a park's ITS projects being integrated into its surrounding region. Second, as a park is considering technological upgrades to one of their systems in the park, this appendix can be helpful in showing how the system upgrade can be scoped to maximize its potential functionality.

Each physical entity is characterized as either a terminator or a subsystem. The themes in which it is included are also listed. Finally, the description included in the National ITS Architecture is provided. If the physical entity was not included in the National ITS Architecture, a short description has been created.

Archived Data Administrator – Terminator

Themes: SEKI 2

Description: This terminator represents the human operator who provides overall data management, administration, and monitoring duties for the ITS data archive. Unlike the manager of the operational databases, the archive data administrator's role is focused on the archive and covers areas such as establishing user authentication controls, monitoring data quality, and initiating data import requests.

Archived Data Management – Subsystem

Themes: GGNRA 1, GGNRA 2, GGNRA 3, SEKI 1, SEKI 2, OTHER 2

Description: The Archived Data Management Subsystem collects, archives, manages, and distributes data generated from ITS sources for use in transportation administration, policy evaluation, safety, planning, performance monitoring, program assessment, operations, and research applications. The data received is formatted and tagged with attributes that define the data source, conditions under which it was collected, data transformations, and other information (i.e. meta data) necessary to interpret the data. The subsystem can fuse ITS generated data with data from non-ITS sources and other archives to generate information products utilizing data from multiple functional areas, modes, and jurisdictions. The subsystem prepares data products that can serve as inputs to federal, state, and local data reporting systems. This subsystem may be implemented in many different ways. It may reside within an operational center and provide focused access to a particular agency's data archives. Alternatively, it may operate as a distinct center that collects data from multiple agencies and sources and provides a general data warehouse service for a region.

Archived Data User Systems – Terminator

Themes: GGNRA 2, SEKI 2

Description: This terminator represents the systems users employ to access archived data. The general interface provided from this terminator allows a broad range of users (e.g. planners, researchers, analysts, operators) and their systems (e.g. databases, models, analytical tools, user interface devices) to acquire data and analyses results from the archive.

Basic Maintenance and Construction Vehicle – Terminator

Themes: OTHER 3

Description: This terminator represents a specialized form of the Basic Vehicle used by maintenance fleets. It supports the on-board equipment that control the non-ITS systems such as the actual operation of the snow plow, as well as any non-ITS sensor equipment that monitors the amount of materials (e.g., sand or salt) on-board. The monitoring of the Basic Maintenance and Construction Vehicle mechanical condition and mileage provides the major inputs for maintenance vehicle activity scheduling.

Basic Transit Vehicle – Terminator

Themes: SEKI 2

Description: This terminator represents a specialized form of the Basic Vehicle that interfaces with and hosts ITS electronics. The Basic Transit Vehicle may be a bus, paratransit vehicle, light rail vehicle, or other vehicle designed to carry passengers. The Basic Transit Vehicle includes the non-ITS on-board systems (e.g., engine, brakes, drive train, odometer). The monitoring of the Basic Transit Vehicle mechanical condition and mileage provides the major inputs for vehicle maintenance activity scheduling. The Basic Transit Vehicle can also accept disable commands resulting from a remote vehicle disable command or from a failure of the vehicle operator to be properly authenticated.

Basic Vehicle – Terminator

Themes: GGNRA 3, GGNRA 4, GGNRA 7, SEKI 1, SEKI 3, SEKI 8, OTHER 2, OTHER 3

Description: This terminator represents the basic vehicle platform that interfaces with and hosts ITS electronics. The Basic Vehicle terminator provides an interface to drive train, driver convenience and entertainment systems, and other non-ITS electronics on-board the vehicle. This interface allows general vehicle systems (e.g., the stereo speaker system) to be shared by ITS and non-ITS systems. It also allows monitoring and control of the vehicle platform for advanced vehicle control system applications.

Campground Reservation Management* – Terminator

Themes: OTHER 1

Description: This terminator represents a system that receives and tracks reservations on camping areas within one or more national parks or public recreation areas.

Driver – Terminator

Themes: GGNRA 3, GGNRA 4, GGNRA 7, SEKI 1, SEKI 3, SEKI 8, SEKI 9, OTHER 2, OTHER 3

Description: This terminator represents the human entity that operates a licensed vehicle on the roadway. Included are operators of private, Transit, Commercial, and Emergency vehicles where the data being sent or received is not particular to the type of vehicle. Thus this terminator originates driver requests and receives driver information that reflects the interactions which might be useful to all drivers, regardless of vehicle classification. The Driver terminator is the operator of the Basic Vehicle terminator. Information and interactions which are unique to drivers of a specific vehicle type (e.g., fleet interactions with transit, commercial, or emergency vehicle drivers) are covered separately.

Emergency Management – Subsystem

Themes: GGNRA 7, SEKI 5

Description: The Emergency Management Subsystem represents public safety, emergency management, and other allied agency systems that support incident management, disaster response and evacuation, security monitoring, and other security and public safety-oriented ITS applications. The subsystem includes the functions associated with fixed and mobile public safety communications centers including public safety call taker and dispatch centers operated by police (including transit police), fire, and emergency medical services. It includes the functions associated with Emergency Operations Centers that are activated at local, regional, state, and federal levels for emergencies and the portable and transportable systems that support Incident Command System operations at an incident. This subsystem also represents other allied systems including centers associated with towing and recovery, freeway service patrols, HAZMAT response teams, and mayday service providers.

The subsystem manages sensor and surveillance equipment used to enhance transportation security of the roadway infrastructure (including bridges, tunnels, interchanges, and other key roadway segments) and the public transportation system (including transit vehicles, public areas such as transit stops and stations, facilities such as transit yards, and transit infrastructure such as rail, bridges, tunnels, or bus guideways). The subsystem provides security/surveillance services to improve traveler security in public areas not a part of the public transportation system.

This subsystem monitors alerts, advisories, and other threat information and prepares for and responds to identified emergencies. It interfaces with other Emergency Management Subsystems to support coordinated emergency response involving multiple agencies. The subsystem stores, coordinates, and utilizes emergency response and evacuation plans to facilitate this coordinated response. As the response progresses, situation information including damage assessments, response status, evacuation information, and resource information are shared to keep all allied agencies appraised of the response. Interface with the Transit Management Subsystem allows coordinated use of transit vehicles to facilitate response to major emergencies and to support evacuation efforts. The Emergency Management Subsystem also provides a focal point for coordination of the emergency and evacuation information that is provided to the traveling public, including wide-area alerts when immediate public notification is warranted.

The subsystem tracks and manages emergency vehicle fleets using real-time road network status and routing information from the other center subsystems to aide in selecting the emergency vehicle(s) and routes that will provide the most timely response. Interface with the Traffic Management Subsystem allows strategic coordination in tailoring traffic control to support emergency vehicle ingress and egress, implementation of special traffic restrictions and closures, evacuation traffic control plans, and other special strategies that adapt the transportation system to better meet the unique demands of an emergency.

Emergency Telecommunications System – Terminator

Themes: GGNRA 7

Description: This terminator represents the telecommunications systems that connect a caller with a Public Safety Answering Point (PSAP). These systems transparently support priority wireline and wireless caller access to the PSAP through 9-1-1 and other access mechanisms like 7 digit local access numbers, and motorist aid call boxes. The calls are routed to the appropriate PSAP, based on caller location when this information is available. When available, the caller's location and call-back number are also provided to the PSAP by this interface.

Emergency Vehicle – Subsystem

Themes: GGNRA 7

Description: This subsystem resides in an emergency vehicle and provides the sensory, processing, storage, and communications functions necessary to support safe and efficient incident response. The subsystem represents a range of vehicles including those operated by police, fire, and emergency medical services. In addition, this subsystem represents other incident response vehicles including towing and recovery vehicles and freeway service patrols. The Emergency Vehicle Subsystem includes two-way communications to support coordinated response to emergencies in accordance with an associated Emergency Management Subsystem. Emergency vehicles are equipped with automated vehicle location capability for monitoring by vehicle tracking and fleet management functions in the Emergency Management Subsystem. Using these capabilities, the appropriate emergency vehicle to respond to each emergency is determined. Route guidance capabilities within the vehicle enable safe and efficient routing to the emergency. In addition, the emergency vehicle may be equipped to support signal preemption through communications with the Roadway Subsystem.

Emissions Management – Subsystem

Themes: SEKI 8

Description: This subsystem operates at a fixed location and may co-reside with the Traffic Management Subsystem or may operate in its own distinct location depending on regional preferences and priorities. This subsystem provides the capabilities for air quality managers to monitor and manage air quality. These capabilities include collecting emissions data from distributed emissions sensors within the roadway subsystem. These sensors monitor general air quality within each sector of the area and also monitor the emissions of individual vehicles on the roadway. The sector emissions measures are collected, processed, and used to identify sectors exceeding safe pollution levels. This information is provided to traffic management to implement strategies intended to reduce emissions in and around the problem areas. Emissions data associated with individual vehicles, supplied by the Roadway Subsystem, is also processed and monitored to identify vehicles that exceed standards. This subsystem provides any functions necessary to inform the violators and otherwise ensure timely compliance with emissions standards.

Enforcement Agency – Terminator

Themes: OTHER 4

Description: This terminator represents the systems that receive reports of violations detected by various ITS facilities including individual vehicle emissions, toll violations, CVO violations, excessive speed in work zones, etc.

Entrance Gate* – Terminator

Themes: SEKI 4, OTHER 2, OTHER 4

Description: This terminator represents the equipment that is used to process passenger cars, trucks, bicycles, pedestrians and others who come through the entrance gate of a park. This includes equipment to read the identification of a vehicle, to check this information against an existing database, and to provide a signal indication to vehicles whether they need to pull in to collect information before proceeding into the park.

Entrance Gate Management* – Subsystem

Themes: OTHER 2

Description: This subsystem would be responsible for coordinating operations between entrance gates, in order to know the total vehicle traffic that has entered and left the park.

Environment – Terminator

Themes: SEKI 8

Description: This terminator represents the natural surroundings in which the ITS operates. These surroundings include conditions such as snow, rain, fog, pollution, dust, temperature, humidity, solar radiation, and man made electromagnetic (RF) effects. Environmental conditions must be monitored by the ITS Architecture so that Travelers may be informed and control strategies can reflect adverse environmental conditions in a timely fashion.

Event Promoters – Terminator

Themes: GGNRA 1, GGNRA 5

Description: This terminator represents Special Event Sponsors that have knowledge of events that may impact travel on roadways or other modal means. Examples of special event sponsors include sporting events, conventions, motorcades/parades, and public/political events. These promoters interface to the ITS to provide event information such as date, time, estimated duration, location, and any other information pertinent to traffic movement in the surrounding area.

Financial Institution – Terminator

Themes: SEKI 7, OTHER 1, OTHER 4

Description: This terminator represents the organization that handles all electronic fund transfer requests to enable the transfer of funds from the user of the service to the provider of the service. The functions and activities of financial clearinghouses are subsumed by this entity.

Gateway Smart Card Administrator* – Subsystem

Themes: OTHER 4

Description: This subsystem represents a clearinghouse which pools merchants in the gateway communities which might be interested in allowing customers to use a park-based smart card.

Gateway Yellow Pages Service Provider* – Terminator

Themes: OTHER 1, OTHER 4

Description: This terminator represents the individual organizations that provide any service oriented towards the Traveler in the gateway communities around a park. Example services that could be included are gas, food, lodging, vehicle repair, points of interest, and recreation areas. Also included are services specifically directed toward bicyclists and pedestrians such as bicycle shops and parking locations and bicycle and pedestrian rest areas. The Service Providers may pay a fee to have their services advertised to travelers. The interface with the Service Provider is necessary so that accurate, up-to-date service information can be provided to the traveler and to support electronic reservation capabilities included in the ITS User Services.

Information Service Provider – Subsystem

Themes: GGNRA 5, GGNRA 6, GGNRA 7, SEKI 1, SEKI 2, SEKI 6, SEKI 7, SEKI 8, OTHER 1, OTHER 2, OTHER 3, OTHER 5

Description: This subsystem collects, processes, stores, and disseminates transportation information to system operators and the traveling public. The subsystem can play several different roles in an integrated ITS. In one role, the ISP provides a general data warehousing function, collecting information from transportation system operators and redistributing this information to other system operators in the region and other ISPs. In this information redistribution role, the ISP provides a bridge between the various transportation systems that produce the information and the other ISPs and their subscribers that use the information. The second role of an ISP is focused on delivery of traveler information to subscribers and the public at large. Information provided includes basic advisories, traffic and road conditions, transit schedule information, yellow pages information, ridematching information, and parking information. The subsystem also provides the capability to provide specific directions to travelers by receiving origin and destination requests from travelers, generating route plans, and returning the calculated plans to the users. In addition to general route planning for travelers, the ISP also supports specialized route planning for vehicle fleets. In this third role, the ISP function may be dedicated to, or even embedded within, the dispatch system. Reservation services are also provided in advanced implementations. The information is provided to the traveler through the Personal Information Access Subsystem, Remote Traveler Support Subsystem, and various Vehicle Subsystems through available communications links. Both basic one-way (broadcast) and personalized two-way information provision are supported. The subsystem provides the capability for an informational infrastructure to connect providers and consumers, and gather the market information needed to assist in the planning of service improvements and in maintenance of operations.

In-park Yellow Pages Service Provider* – Terminator

Themes: OTHER 1

Description: This terminator represents the individual organizations that provide any service oriented towards the Traveler within the boundary of a park. Example services that could be included are gas, food, lodging, vehicle repair, points of interest, and recreation areas. Also included are services specifically directed toward bicyclists and pedestrians such as bicycle shops and parking locations and bicycle and pedestrian rest areas. The Service Providers may pay a fee to have their services advertised to travelers. The interface with the Service Provider is necessary so that accurate, up-to-date service information can be provided to the traveler and to support electronic reservation capabilities included in the ITS User Services.

Location Data Source – Terminator

Themes: GGNRA 4, GGNRA 5, GGNRA 6, SEKI 2, OTHER 5

Description: This terminator provides accurate position information. Systems which use GPS, terrestrial trilateration, or driver inputs are all potential examples of Location Data Sources. This terminator contains sensors such as radio position receivers (e.g. GPS) and/or dead reckoning sensors (e.g. odometer, differential odometer, magnetic compass, gyro, etc.). This terminator implies that some additional functionality associated with developing an absolute position is outside the system and will not be directly modeled by the logical or physical architecture representations of the system.

Maintenance and Construction Management – Subsystem

Themes: GGNRA 1, GGNRA 5, SEKI 5, SEKI 6, OTHER 3

Description: The Maintenance and Construction Management Subsystem monitors and manages roadway infrastructure construction and maintenance activities. Representing both public agencies and private contractors that provide these functions, this subsystem manages fleets of maintenance, construction, or special service vehicles (e.g., snow and ice control equipment). The subsystem receives a wide range of status information from these vehicles and performs vehicle dispatch, routing, and resource management for the vehicle fleets and associated equipment. The subsystem participates in incident response by deploying maintenance and construction resources to an incident scene, in coordination with other center subsystems. The subsystem manages equipment at the roadside, including environmental sensors and automated systems that monitor and mitigate adverse road and surface weather conditions. The subsystem manages the repair and maintenance of both non-ITS and ITS equipment including the traffic controllers, detectors, changeable message signs, signals, and other equipment associated with the roadway infrastructure. Additional interfaces to weather information providers (the weather service and surface transportation weather service providers) provide current and forecast weather information that can be fused with other data sources and used to support advanced decision support systems that increase the efficiency and effectiveness of maintenance and construction operations.

The subsystem remotely monitors and manages ITS capabilities in work zones, gathering, storing, and disseminating work zone information to other systems. It manages traffic in the vicinity of the work zone and advises drivers of work zone status (either directly at the roadside or through an interface with the Information Service Provider or Traffic Management subsystems.) It schedules and manages the location and usage of maintenance assets (such as portable changeable message signs).

Construction and maintenance activities are tracked and coordinated with other systems, improving the quality and accuracy of information available regarding closures and other roadway construction and maintenance activities.

Maintenance and Construction Vehicle – Subsystem

Themes: OTHER 3

Description: This subsystem resides in a maintenance, construction, or other specialized service vehicle or equipment and provides the sensory, processing, storage, and communications functions necessary to support highway maintenance and construction. All types of maintenance and construction vehicles are covered, including heavy equipment and supervisory vehicles. The subsystem provides two-way communications between drivers/operators and dispatchers and maintains and communicates current location and status information. A wide range of operational status is monitored, measured, and made available, depending on the specific type of vehicle or equipment. For example, for a snow plow, the information would include whether the plow is up or down and material usage information. The subsystem may also contain capabilities to monitor vehicle systems to support maintenance of the vehicle itself and other sensors that monitor environmental conditions including the road condition and surface weather information. This subsystem can represent a diverse set of mobile environmental sensing platforms, including wheeled vehicles and any other vehicle that collects and reports environmental information.

Map Update Provider – Terminator

Themes: SEKI 2, SEKI 7, OTHER 5

Description: This terminator represents a third-party developer and provider of digitized map databases used to support ITS services. It supports the provision of the databases that are required exclusively for route guidance (navigable maps) as well as those that are used exclusively for display by operators, e.g. Fleet-Freight Managers (restricted routes) and at traveler information points, e.g. kiosks (display maps).

Media – Terminator

Themes: SEKI 1, SEKI 3, SEKI 6, SEKI 8, OTHER 2, OTHER 3

Description: This terminator represents the information systems that provide traffic reports, travel conditions, and other transportation-related news services to the traveling public through radio, TV, and other media. Traffic and travel advisory information that are collected by ITS are provided to this terminator. It is also a source for traffic flow information, incident and special event information, and other events which may have implications for the transportation system.

Other EM – Terminator

Themes: GGNRA 7

Description: Representing other Emergency Management centers, systems or subsystems, this terminator provides a source and destination for ITS data flows between various communications centers operated by public safety agencies, emergency management agencies, other allied agencies, and private companies that participate in coordinated management of highway-related incidents, including disasters. The interface represented by this terminator enables emergency management activities to be coordinated across jurisdictional boundaries and between functional areas. In the Physical Architecture this terminator is a reciprocal Emergency Management Subsystem (EM) implying the requirements for general networks connecting many allied agencies. The interface between this terminator and the EM supports coordination of incident management information between many different centers providing Public Safety Answering Point (both public or private sector implementations), Public Safety Dispatch, Emergency Operations Centers, and other functions that participate in the detection, verification, response, recovery and clearance of incidents, including disasters. This terminator also supports interface to other allied agencies like utility companies that also participate in the coordinated response to selected highway-related incidents.

Other MCM – Terminator

Themes: SEKI 6

Description: Representing another Maintenance and Construction Management center or subsystem, this terminator is intended to provide a source and destination for ITS information flows between maintenance and construction management functions. It enables maintenance and construction operations to be coordinated across jurisdictions or between public and private sectors. In the Physical Architecture, this terminator is a reciprocal Maintenance and Construction Management Subsystem (MCMS).

Other MCV – Terminator

Themes: OTHER 3

Description: This terminator represents another ITS Maintenance and Construction Vehicle Subsystem. It provides a source and destination for ITS information transfers between maintenance and construction vehicles. These information transfers allow vehicle operational status, environmental information, and work zone intrusion warnings or alarms to be shared between vehicles.

Other Parking – Terminator

Themes: GGNRA 3, GGNRA 4

Description: Representing another parking facility, system or subsystem, this terminator provides a source and destination for information that may be exchanged between peer parking systems. This terminator enables parking management activities to be coordinated between different parking operators or systems in a region. In the Physical Architecture this terminator is a reciprocal Parking Management Subsystem.

Other Roadway – Terminator

Themes: SEKI 3, SEKI 9

Description: Representing another roadway system or subsystem, this terminator provides a source and destination for information that may be exchanged between peer roadway subsystems. The interface to this terminator enables direct coordination between field equipment. Examples include the direct interface between sensors and other roadway devices (e.g., Changeable Message Signs) and the direct interface between roadway devices (e.g., adjacent traffic control equipment).

Other TM – Terminator

Themes: GGNRA 1, GGNRA 5

Description: Representing another Traffic Management center, system or subsystem, this terminator is intended to provide a source and destination for ITS data flows between peer (e.g. inter-regional) traffic management functions. It enables traffic management activities to be coordinated across different jurisdictional areas. In the Physical Architecture, this terminator is a reciprocal Traffic Management Subsystem (TMS).

Park Management* – Subsystem

Themes: GGNRA 2, OTHER 1, OTHER 4

Description: This subsystem represents staff who manage the operations of the national park on a day-to-day basis. It may include people within a variety of administrative divisions, depending upon the organization of the park’s functions. Some of the park management roles include managing limited-access visitor activities at the park, including site tours; managing entrance into the park; collecting visitation statistics (visitors, cars, tour buses, transit riders, bicyclists, pedestrians); and being responsible for day-to-day operational decisions and long-term planning efforts.

Parking Management – Subsystem

Themes: GGNRA 3, GGNRA 4, GGNRA 5, SEKI 1, OTHER 1

Description: The Parking Management Subsystem provides electronic monitoring and management of parking facilities. It supports a dedicated short-range communications (DSRC) link to the Vehicle Subsystem that allows electronic collection of parking fees. It also includes the instrumentation, signs, and other infrastructure that monitors parking lot usage and provides local information about parking availability and other general parking information. This portion of the subsystem functionality must be located in the parking facility where it can monitor, classify, and share information with customers and their vehicles. The subsystem also interfaces with the financial infrastructure and broadly disseminates parking information to other operational centers in the region. Note that the latter functionality may be located in a back office, remote from the parking facility.

Parking Operator – Terminator

Themes: GGNRA 3, SEKI 1

Description: This terminator is the human entity that may be physically present at the parking lot facility to monitor the operational status of the facility.

Personal Information Access – Subsystem

Themes: GGNRA 5, GGNRA 6, GGNRA 7, SEKI 1, SEKI 2, SEKI 6, SEKI 7, SEKI 8, OTHER 1, OTHER 2, OTHER 3, OTHER 5

Description: This subsystem provides the capability for travelers to receive formatted traffic advisories from their homes, place of work, major trip generation sites, personal portable devices, over multiple types of electronic media. These capabilities also provide basic routing information and allow users to select those transportation modes that allow them to avoid congestion, or more advanced capabilities to allow users to specify those transportation parameters that are unique to their individual needs and receive travel information. This subsystem provides travelers with the capability to receive route planning from the infrastructure at fixed locations such as in their homes, their place of work, and at mobile locations using personal portable devices and vehicle-based devices. In addition to end user devices, this subsystem may also represent a device that is used by a merchant or other service provider to receive traveler information and relay important information to their customers. This subsystem also provides the capability to initiate a distress signal and cancel a prior-issued manual request for help.

Potential Obstacles – Terminator

Themes: OTHER 3

Description: Any object that possesses the potential of being sensed and struck and thus also possesses physical attributes. Potential Obstacles include roadside obstructions, other vehicles, pedestrians, infrastructure elements or any other element which is in a potential path of the vehicle. This terminator represents the physical obstacles which possess properties which enable detection using sensory functions included as part of the ITS architecture. These physical attributes are represented as a data input to the system.

Remote Traveler Support – Subsystem

Themes: GGNRA 4, GGNRA 5, GGNRA 6, GGNRA 7, SEKI 1, SEKI 2, SEKI 6, SEKI 7, SEKI 8, OTHER 1, OTHER 2, OTHER 3

Description: This subsystem provides access to traveler information at transit stations, transit stops, other fixed sites along travel routes (e.g., rest stops, merchant locations), and major trip generation locations such as special event centers, hotels, office complexes, amusement parks, and theaters. Traveler information access points include kiosks and informational displays supporting varied levels of interaction and information access. At transit stops, simple displays providing schedule information and imminent arrival signals can be provided. This basic information may be extended to include multi-modal information including traffic conditions and transit schedules along with yellow pages information to support mode and route selection at major trip generation sites. Personalized route planning and route guidance information can also be provided based on criteria supplied by the traveler. The subsystem also supports electronic payment of transit fares.

In addition to the traveler information provisions, this subsystem also supports security and safety monitoring of public areas. This monitoring includes traveler activated silent alarms, as well as surveillance and sensor equipment. The surveillance equipment includes video (e.g. CCTV cameras) and/or audio systems. The sensor equipment includes threat sensors (e.g.

chemical agent, toxic industrial chemical, biological, explosives, and radiological sensors) and object detection sensors (e.g. metal detectors).

Roadway – Subsystem

Themes: GGNRA 1, GGNRA 2, GGNRA 3, GGNRA 4, GGNRA 5, GGNRA 7, SEKI 1, SEKI 3, SEKI 5, SEKI 6, SEKI 7, SEKI 8, SEKI 9, OTHER 2

Description: This subsystem includes the equipment distributed on and along the roadway that monitors and controls traffic and monitors and manages the roadway itself. Equipment includes traffic detectors, environmental sensors, traffic signals, highway advisory radios, changeable message signs, CCTV cameras and video image processing systems, grade crossing warning systems, and freeway ramp metering systems. HOV lane management, reversible lane management functions, and barrier systems that control access to transportation infrastructure such as roadways, bridges and tunnels are also supported. This subsystem also provides the capability for environmental monitoring including sensors that measure road conditions, surface weather, and vehicle emissions. In adverse conditions, automated systems can be used to apply anti-icing materials, disperse fog, etc. Work zone systems including work zone surveillance, traffic control, driver warning, and work crew safety systems are also included. To enhance security, safeguard systems such as blast shields, exhaust systems and other automated and remotely controlled systems to protect transportation infrastructure are also provided. In advanced implementations, this subsystem supports automated vehicle safety systems by safely controlling access to and egress from an Automated Highway System through monitoring of, and communications with, AHS vehicles. Intersection collision avoidance functions are provided by determining the probability of a collision in the intersection and sending appropriate warnings and/or control actions to the approaching vehicles.

Roadway Environment – Terminator

Themes: SEKI 3, OTHER 3

Description: This terminator represents the physical condition and geometry of the road surface and the conditions surrounding the roadway. The geometry of the roadway and the road surface characteristics must be sensed and interpreted to support automated vehicle control services. Surrounding conditions may include fog, ice, snow, rain, wind, etc. which will influence the way in which a vehicle can be safely operated on the roadway. The condition of the roadway must be monitored by the architecture to enable corrective action and information dissemination regarding roadway conditions which may adversely affect travel. This physical interface carries these physical condition and geometry attributes which must be sensed, interpreted, and processed by functions internal to the system to achieve ITS User Service functionality.

Smart Card Management* – Subsystem

Themes: OTHER 4

Description: This subsystem coordinates smart card activities across all national park service units. This includes registration of smart card accounts, billing customers, recording and monitoring usage, and communicating with various parks through any park-specific protocols which may be in place.

Traffic – Terminator

Themes: GGNRA 1

Description: The Traffic terminator represents the collective body of vehicles that travel on surface streets, arterials, highways, expressways, tollways, freeways, or any other vehicle travel surface. Traffic depicts the vehicle population from which traffic flow surveillance information is collected (average occupancy, average speed, total volume, average delay, etc.), and to which traffic control indicators are applied (intersection signals, stop signs, ramp meters, lane control barriers, variable speed limit indicators, etc.). All sensory and control elements that interface to this vehicle population are internal to ITS.

Traffic Management – Subsystem

Themes: GGNRA 1, GGNRA 2, GGNRA 3, GGNRA 4, GGNRA 5, GGNRA 7, SEKI 1, SEKI 3, SEKI 5, SEKI 6, SEKI 8, SEKI 9, OTHER 2, OTHER 3

Description: The Traffic Management Subsystem monitors and controls traffic and the road network. It represents centers that manage a broad range of transportation facilities including freeway systems, rural and suburban highway systems, and urban and suburban traffic control systems. This subsystem communicates with the Roadway Subsystem to monitor and manage traffic flow and monitor the condition of the roadway, surrounding environmental conditions, and field equipment status. This subsystem coordinates with the Maintenance and Construction Management Subsystem to maintain the road network and coordinate and adapt to maintenance activities, closures, and detours. Incidents are detected, verified, and incident information is provided to allied agencies, drivers (through Roadway Subsystem highway advisory radio and changeable message signs), and information service providers. This subsystem also manages traffic and transportation resources to support allied agencies in responding to, and recovering from, incidents ranging from minor traffic incidents through major disasters. When required, special traffic management strategies are implemented to support evacuation and reentry. The Traffic Management Subsystem supports HOV lane management and coordination, road pricing, and other demand management policies that can alleviate congestion and influence mode selection. It also manages reversible lane facilities and barrier and safeguard systems that control access to transportation infrastructure. The subsystem communicates with other Traffic Management Subsystems to coordinate traffic information and control strategies in neighboring jurisdictions. It also coordinates with rail operations to support safer and more efficient highway traffic management at highway-rail intersections. Finally, the Traffic Management Subsystem provides the capabilities to exercise control over those devices utilized for automated highway system (AHS) traffic and vehicle control.

Traffic Operations Personnel – Terminator

Themes: GGNRA 1, SEKI 8, SEKI 9

Description: This terminator represents the human entity that directly interfaces with vehicle traffic operations. These personnel interact with traffic control systems, traffic surveillance systems, incident management systems, work zone management systems, and travel demand management systems to accomplish ITS services. They provide operator data and command inputs to direct systems' operations to varying degrees depending on the type of system and the deployment scenario. All functionality associated with these services that might be automated in the course of ITS deployment is modeled as internal to the architecture.

Transit Driver – Terminator

Themes: SEKI 2

Description: This terminator represents the human entity that is a special form of the Driver terminator that receives and provides additional information that is specific to Transit (including demand responsive transit) operations. This information will not be received by other types of Driver. The Transit Driver terminator operates the Transit Vehicle terminator and represents random route drivers, flexible fixed route drivers and fixed route drivers. The fixed route drivers require minimal information such as run times and passenger loading. The flex fixed and random route drivers require additional information such as dynamically changing routes.

Transit Fleet Manager – Terminator

Themes: SEKI 2

Description: This terminator represents the human entity that is responsible for planning the operation of transit fleets, including monitoring and controlling the transit fleet route schedules and the transit fleet maintenance schedules. This comprises planning routes and schedules for either daily use or for special occasions as distinct from making day to day variations to schedules and routes.

Transit Management – Subsystem

Themes: GGNRA 2, GGNRA 4, GGNRA 5, GGNRA 6, SEKI 2, OTHER 1

Description: The Transit Management Subsystem manages transit vehicle fleets and coordinates with other modes and transportation services. It provides operations, maintenance, customer information, planning and management functions for the transit property. It spans distinct central dispatch and garage management systems and supports the spectrum of fixed route, flexible route, paratransit services, transit rail, and bus rapid transit (BRT) service. The subsystem's interfaces allow for communication between transit departments and with other operating entities such as emergency response services and traffic management systems. This subsystem receives special event and real-time incident data from the traffic management subsystem. It provides current transit operations data to other center subsystems. It interfaces with the Emergency Management Subsystem to allow coordinated use of transit vehicles to facilitate response to major emergencies or evacuations. The Transit Management Subsystem collects and stores accurate ridership levels and implements corresponding fare structures. It collects operational and maintenance data from transit vehicles, manages vehicle service histories, and assigns vehicle operators and maintenance personnel to vehicles and routes. The Transit Management Subsystem also provides the capability for automated planning and scheduling of public transit operations. It furnishes travelers with real-time travel information, continuously updated schedules, schedule adherence information, transfer options, and transit routes and fares. In addition, the subsystem supports transit security features. This includes monitoring silent alarms, both passenger and operator initiated, on-board transit vehicles. It also includes the capability to support transit vehicle operator authentication and the capability to remotely disable a transit vehicle. The subsystem includes the capability to monitor for a transit vehicle being off the assigned route. The subsystem also includes the capability to alert operators and police to potential incidents identified by these security features.

Transit System Operators – Terminator

Themes: SEKI 2

Description: This terminator represents the human entities that are responsible for all aspects of the Transit subsystem operation including planning and management. They actively monitor, control, and modify the transit fleet routes and schedules on a day to day basis. The modifications will be to take account of abnormal situations such as vehicle breakdown, vehicle delay, etc. These personnel may also be responsible for demand responsive transit operation and for managing emergency situations within the transit network.

Transit User – Terminator

Themes: GGNRA 4

Description: This terminator represents the human entities using Public Transit vehicles. They may be in the act of embarking or debarking the vehicles and are thus sensed for the purpose of determining passenger loading and fares, or on the vehicles and able to request and receive information.

Transit Vehicle – Subsystem

Themes: GGNRA 4, GGNRA 5, GGNRA 6, SEKI 2

Description: This subsystem resides in a transit vehicle and provides the sensory, processing, storage, and communications functions necessary to support safe and efficient movement of passengers. The types of transit vehicles containing this subsystem include buses, paratransit vehicles, light rail vehicles, other vehicles designed to carry passengers, and supervisory vehicles. The subsystem collects accurate ridership levels and supports electronic fare collection. The subsystem supports a traffic signal prioritization function that communicates with the roadside subsystem to improve on-schedule performance. Automated vehicle location functions enhance the information available to the Transit Management Subsystem enabling more efficient operations. On-board sensors support transit vehicle maintenance. The subsystem supports on-board security and safety monitoring. This monitoring includes transit user or vehicle operator activated alarms (silent or audible), as well as surveillance and sensor equipment. The surveillance equipment includes video (e.g. CCTV cameras), audio systems and/or event recorder systems. The sensor equipment includes threat sensors (e.g. chemical agent, toxic industrial chemical, biological, explosives, and radiological sensors) and object detection sensors (e.g. metal detectors). In addition, the subsystem supports vehicle operator authentication prior to operation of the vehicle and remote vehicle disabling. The subsystem also furnishes travelers with real-time travel information, continuously updated schedules, transfer options, routes, and fares.

Traveler – Terminator

Themes: SEKI 7, OTHER 1, OTHER 5

Description: This terminator represents any individual who uses transportation services. The interfaces to the traveler provide general pre-trip and en-route information supporting trip planning, personal guidance, and requests for assistance in an emergency that are relevant to all transportation system users. The terminator represents users of a public transportation system and addresses interfaces these users have within a transit vehicle or at transit facilities such as roadside stops and transit centers. This general terminator is supplemented in the architecture by the specific “Driver” terminator that supports interfaces that are specific to drivers.

Traveler Card – Terminator

Themes: SEKI 4, SEKI 7, OTHER 1, OTHER 4

Description: This terminator represents the entity that enables the actual transfer of electronic information from the user of a service (i.e. a traveler) to the provider of the service. This may include the transfer of funds through means of an electronic payment instrument. The device, like a smart card, may also hold and update the traveler’s information such as personal profiles or trip histories.

Vehicle – Subsystem

Themes: GGNRA 4, GGNRA 5, GGNRA 6, GGNRA 7, SEKI 2, SEKI 4, OTHER 1, OTHER 3, OTHER 4

Description: This subsystem provides the sensory, processing, storage, and communications functions necessary to support efficient, safe, and convenient travel. These functions reside in general vehicles including personal automobiles, commercial vehicles, emergency vehicles, transit vehicles, or other vehicle types. Information services provide the driver with current travel conditions and the availability of services along the route and at the destination. Both one-way and two-way communications options support a spectrum of information services from low-cost broadcast services to advanced, pay for use personalized information services. Route guidance capabilities assist in formulation of an optimal route and step by step guidance along the travel route. Advanced sensors, processors, enhanced driver interfaces, and actuators complement the driver information services so that, in addition to making informed mode and route selections, the driver travels these routes in a safer and more consistent manner. Initial collision avoidance functions provide “vigilant co-pilot” driver warning capabilities. More advanced functions assume limited control of the vehicle to maintain safe headway. Ultimately, this subsystem supports completely automated vehicle operation through advanced communications with other vehicles in the vicinity and in coordination with supporting infrastructure subsystems. Pre-crash safety systems are deployed and emergency notification messages are issued when unavoidable collisions do occur.

Vehicle Characteristics – Terminator

Themes: GGNRA 3, GGNRA 4, SEKI 1, SEKI 8, SEKI 9

Description: This terminator represents the external view of an individual vehicle. It includes vehicle characteristics such as height, width, length, weight, and other properties (e.g., magnetic properties, number of axles) that allow an individual vehicle to be detected and measured or classified. This external view of an individual vehicle is also used as a source of visible data that supports individual vehicle imaging requirements in the architecture.

ITS subsystems at the roadside sense these characteristics and generate ITS data flows. These individual vehicle characteristics are important for toll collection, parking management, and other applications that identify and measure individual vehicles. See also the related “Traffic” terminator which represents physical characteristics of many vehicles in the aggregate that is measured for general traffic applications.

Weather Service – Terminator

Themes: GGNRA 1, GGNRA 3, GGNRA 5, SEKI 3

Description: This terminator provides weather, hydrologic, and climate information and warnings of hazardous weather including thunderstorms, flooding, hurricanes, tornadoes, winter weather, tsunamis, and climate events. It provides atmospheric weather observations and forecasts that are collected and derived by the National Weather Service, private sector providers, and various research organizations. The interface provides formatted weather data products suitable for on-line processing and integration with other ITS data products as well as Doppler radar images, satellite images, severe storm warnings, and other products that are formatted for presentation to various ITS users.

APPENDIX K: DESCRIPTION OF NATIONAL ITS ARCHITECTURE INFORMATION FLOWS

This appendix provides detailed descriptions for all of the information flows included in the ITS themes presented in Chapter 9. Most of these information flows are included in the National ITS Architecture. Some flows have been included in the National ITS Architecture, but have a different source and/or destination for a particular theme. The language of the National ITS Architecture has been preserved. Other flows, designated by an asterisk (*), are not in the National ITS Architecture, and were included to provide appropriate functionality to the ITS themes.

In addition to helping promote conformity with the National ITS Architecture, this chapter can help a park to define the data dictionary and communications requirements for various information flows, based on the full array of partners who may provide or require a certain type of information.

Information Flow	Source	Destination	ITS Theme	National ITS Architecture Description
air quality information	Emissions Management	Information Service Provider	SEKI 8	Aggregated region-wide measured air quality data and possible pollution incident information.
	Information Service Provider	Media	SEKI 8	
	Information Service Provider	Personal Information Access	SEKI 8	
	Information Service Provider	Remote Traveler Support	SEKI 8	
	Information Service Provider	Traffic Management	SEKI 8	
archive analysis requests	Archived Data User Systems	Archived Data Management	GGNRA 2	A user request that initiates data mining, analytical processing, aggregation or summarization, report formulation, or other advanced processing and analysis of archived data. The request also includes information that is used to identify and authenticate the user and support electronic payment requirements, if any.
archive analysis results	Archived Data Management	Archived Data User Systems	GGNRA 2	Processed information products, supporting meta data, and any associated transaction information resulting from data mining, analytical processing, aggregation or summarization, report formulation, or other on-line processing and analysis of archived data.
archive management data	Archived Data Management	Archived Data Administrator	SEKI 2	Information used to support the management of an ITS archive including database reports on the condition and quality of the archived data, status of the import and collection process, reports that monitor archive usage, and any special requests that require direct action by the administrator (e.g., requests for access to new data sources).
archive management requests	Archived Data Administrator	Archived Data Management	SEKI 2	Commands, requests, and queries that support the administration and management of an ITS data archive.
archive request confirmation	Archived Data Management	Archived Data User Systems	GGNRA 2	Confirmation that an archive request has been received and processed with information on the disposition of the request.

Information Flow	Source	Destination	ITS Theme	National ITS Architecture Description
archive requests	Archived Data Management	Maintenance and Construction Management	GGNRA 1	A request to a data source for information on available data (i.e. “catalog”) or a request that defines the data to be archived. The request can be a general subscription intended to initiate a continuous or regular data stream or a specific request intended to initiate a one-time response from the recipient.
		Park Management*	GGNRA 2	
		Parking Management	GGNRA 3, SEKI 1	
		Traffic Management	GGNRA 2, GGNRA 3, OTHER 2	
		Transit Management	GGNRA 2, SEKI 2	
		Weather Service	GGNRA 1, GGNRA 3	
	Traffic Management	Archived Data Management	GGNRA 1	
archive status	Archived Data Management	Maintenance and Construction Management	GGNRA 1	Notification that data provided to an archive contains erroneous, missing, or suspicious data or verification that the data provided appears valid. If an error has been detected, the offending data and the nature of the potential problem are identified.
		Park Management*	GGNRA 2	
		Parking Management	GGNRA 3, SEKI 1	
		Traffic Management	GGNRA 1, GGNRA 2, OTHER 2	
		Transit Management	GGNRA 2, SEKI 2	
		Weather Service	GGNRA 1	

Information Flow	Source	Destination	ITS Theme	National ITS Architecture Description
archived data product requests	Archived Data User Systems	Archived Data Management	GGNRA 2, SEKI 2	A user-specified request for archived data products (i.e. data, meta data, or data catalogs). The request also includes information that is used to identify and authenticate the user and support electronic payment requirements, if any.
archived data products	Archived Data Management	Archived Data User Systems	GGNRA 2, SEKI 2	Raw or processed data, meta data, data catalogs and other data products provided to a user system upon request. The response may also include any associated transaction information.
basic vehicle measures	Basic Vehicle	Vehicle	OTHER 3	Information provided to on-board ITS equipment from the vehicle platform indicating current vehicle status.
broadcast advisories	Roadway	Basic Vehicle	GGNRA 3, GGNRA 4, GGNRA 7, SEKI 1, SEKI 3, SEKI 8, OTHER 2	General broadcast advisories that are provided over wide-area wireless communications direct to the vehicle radio. These analog advisory messages may provide similar content to ITS broadcast information flows, but include no digital data component. Existing Highway-Advisory Radio (HAR) advisory messages are a prime example of this flow.
broadcast information	Information Service Provider	Personal Information Access	GGNRA 7, SEKI 1, SEKI 6, SEKI 7, OTHER 2, OTHER 3	General broadcast information that contains link travel times, incidents, advisories, transit services and a myriad of other traveler information.
		Remote Traveler Support	GGNRA 7, SEKI 1, SEKI 6, SEKI 7, OTHER 2, OTHER 3	
		Vehicle	GGNRA 7	
campground reservation confirmation*	Campground Reservation Management*	Information Service Provider	OTHER 1	Confirms the status and availability of a request for a reservation at a campground.

Information Flow	Source	Destination	ITS Theme	National ITS Architecture Description
campground reservation request*	Information Service Provider	Campground Reservation Management*	OTHER 1	Visitor request for a campground reservation, including any requirements regarding campsite size, facilities, desired location, and special requirements.
capacity availability*	Entrance Gate Management*	Traffic Management	OTHER 2	Current availability of vehicle capacity within the park.
capacity instructions*	Traffic Management	Entrance Gate Management*	OTHER 2	Information that allows individual entrance gates to be managed to support park-wide vehicle capacity objectives.
capacity management request*	Traffic Management	Entrance Gate Management*	OTHER 2	Request to limit vehicle admissions to park to better manage capacity.
capacity management response*	Entrance Gate Management*	Traffic Management	OTHER 2	Response to request to limit vehicle admissions to park.
card data*	Gateway Smart Card Administrator*	Smart Card Management*	OTHER 4	Unique card ID and related personal information.
card update*	Smart Card Management*	Gateway Smart Card Administrator*	OTHER 4	Update data held in card which can be read by another device.
driver information	Roadway	Driver	GGNRA 3, GGNRA 4, GGNRA 7, SEKI 1, SEKI 3, SEKI 8, SEKI 9, OTHER 2	General advisory and traffic control information provided to the driver while en route.
driver inputs	Driver	Vehicle	OTHER 3	Driver commands to the vehicle.
driver instructions	Transit Management	Transit Vehicle	SEKI 2	Transit service instructions, traffic information, road conditions, and other information for both transit and paratransit drivers.
driver updates	Vehicle	Driver	OTHER 3	Information displayed or otherwise conveyed by the vehicle to the driver.

Information Flow	Source	Destination	ITS Theme	National ITS Architecture Description
emergency dispatch requests	Emergency Management	Emergency Vehicle	GGNRA 7	Emergency vehicle dispatch instructions including incident location and available information concerning the incident.
emissions data	Roadway	Traffic Management	SEKI 8	Emissions data and associated imagery collected by roadside equipment.
entrance gate coordination*	Entrance Gate*	Entrance Gate Management*	OTHER 2	Information that enables entrance gate activities to be coordinated across all entrance gates within a park.
	Entrance Gate Management*	Entrance Gate*	OTHER 2	
environmental conditions	Roadway Environment	Roadway	SEKI 3	Current road conditions (e.g., surface temperature, subsurface temperature, moisture, icing, treatment status) and surface weather conditions (e.g., air temperature, wind speed, precipitation, visibility) that are measured by environmental sensors.
environmental conditions data	Roadway	Traffic Management	SEKI 3	Current road conditions (e.g., surface temperature, subsurface temperature, moisture, icing, treatment status) and surface weather conditions (e.g., air temperature, wind speed, precipitation, visibility) as measured and reported by environmental sensors.
	Traffic Management	Weather Service	SEKI 3	
	Weather Service	Traffic Management	SEKI 3	
environmental sensors control	Traffic Management	Roadway	SEKI 3	Data used to configure and control environmental sensors.
event plans	Event Promoters	Traffic Management	GGNRA 1, GGNRA 5	Plans for major events possibly impacting traffic.
incident command information	Emergency Management	Emergency Vehicle	GGNRA 7	Information that supports local management of an incident. It includes resource deployment status, hazardous material information, traffic, road, and weather conditions, evacuation advice, and other information that enables emergency or maintenance personnel in the field to implement an effective, safe incident response.
incident command request	Emergency Vehicle	Emergency Management	GGNRA 7	Request for resources, commands for relay to other allied response agencies, and other requests that reflect local command of an evolving incident response.

Information Flow	Source	Destination	ITS Theme	National ITS Architecture Description
incident information	Emergency Management	Information Service Provider	GGNRA 7	Notification of existence of incident and expected severity, location, time and nature of incident.
		Traffic Management	GGNRA 7, SEKI 5	
	Maintenance and Construction Management	Traffic Management	SEKI 5	
	Traffic Management	Emergency Management	GGNRA 7, SEKI 5	
		Maintenance and Construction Management	SEKI 5	
incident notification	Emergency Telecommunications System	Emergency Management	GGNRA 7	The notification of an incident including its nature, severity, and location.
incident notification response	Emergency Management	Emergency Telecommunications System	GGNRA 7	Interactive acknowledgement and verification of the incident information received, requests for additional information, and general information on incident response status.
incident report	Emergency Management	Other EM	GGNRA 7	Report of an identified incident including incident location, type, severity and other information necessary to initiate an appropriate incident response.
	Other EM	Emergency Management	GGNRA 7	
incident response coordination	Emergency Management	Other EM	GGNRA 7	Incident response procedures, resource coordination, and current incident response status that are shared between allied response agencies to support a coordinated response to incidents. The flow also coordinates a positive hand off of responsibility for all or part of an incident response between agencies.
	Other EM	Emergency Management	GGNRA 7	
incident status	Emergency Vehicle	Emergency Management	GGNRA 7	Information gathered at the incident site that more completely characterizes the incident and provides current incident response status.

Information Flow	Source	Destination	ITS Theme	National ITS Architecture Description
maint and constr archive data	Maintenance and Construction Management	Archived Data Management	GGNRA 1	Information describing road construction and maintenance activities identifying the type of activity, the work performed, and work zone information including work zone configuration and safety (e.g., a record of intrusions and vehicle speeds) information.. For construction activities, this information also includes a description of the completed infrastructure, including as-built plans as applicable. Content may include a catalog of available information, the actual information to be archived, and associated meta data that describes the archived information.
maint and constr dispatch information	Maintenance and Construction Management	Maintenance and Construction Vehicle	OTHER 3	Information used to dispatch maintenance and construction vehicles, equipment, and crews. This information includes routing information, traffic information, road restrictions, incident information, environmental information, decision support information, maintenance schedule data, dispatch instructions, personnel assignments, and corrective actions.
maint and constr dispatch status	Maintenance and Construction Vehicle	Maintenance and Construction Management	OTHER 3	Current maintenance and construction status including work data, operator status, crew status, and equipment status.
maint and constr vehicle control	Maintenance and Construction Vehicle	Basic Maintenance and Construction Vehicle	OTHER 3	Control data sent from on-board ITS systems to control maintenance and construction vehicle equipment, including control of materials dispersion rate and other control functions that will vary with vehicle type and application.
maint and constr vehicle status coordination	Maintenance and Construction Vehicle	Other MCV	OTHER 3	Maintenance and construction vehicle status information that is shared between vehicles. This includes environmental conditions and the operational status of the vehicles.
	Other MCV	Maintenance and Construction Vehicle	OTHER 3	
maint and constr work plans	Maintenance and Construction Management	Information Service Provider	GGNRA 5, SEKI 6	Future construction and maintenance work schedules and activities including anticipated closures with anticipated impact to the roadway, alternate routes, anticipated delays, closure times, and durations.
		Traffic Management	SEKI 6	

Information Flow	Source	Destination	ITS Theme	National ITS Architecture Description
map update request	Information Service Provider	Map Update Provider	SEKI 7	Request for a map update which could include a new underlying map or map layer updates.
	Personal Information Access	Map Update Provider	OTHER 5	
	Remote Traveler Support	Map Update Provider	SEKI 7	
	Transit Management	Map Update Provider	SEKI 2	
map updates	Map Update Provider	Information Service Provider	SEKI 7	Map update which could include a new underlying static or real-time map or map layer(s) update.
		Personal Information Access	OTHER 5	
		Remote Traveler Support	SEKI 7	
		Transit Management	SEKI 2	
mode change*	Driver	Transit User	GGNRA 4	Visitor response to change from driving access to transit access.
park reservation confirmation*	Park Management*	Information Service Provider	OTHER 1	Confirmation of park reservation request.

Information Flow	Source	Destination	ITS Theme	National ITS Architecture Description
park reservation request*	Information Service Provider	Park Management*	OTHER 1	Reservation request for participation in select park activities.
parking archive data	Parking Management	Archived Data Management	GGNRA 3, SEKI 1	Data used to analyze and monitor trends in parking demand, pricing, and operational actions. Content may include a catalog of available information, the actual information to be archived, and associated meta data that describes the archived information.
parking availability	Parking Management	Traffic Management	GGNRA 3, GGNRA 4, SEKI 1	Current parking lot occupancy, parking availability, and cost information.
parking coordination	Other Parking	Parking Management	GGNRA 3, GGNRA 4	Information that enables parking management activities to be coordinated between different parking operators or systems in a region.
	Parking Management	Other Parking	GGNRA 3, GGNRA 4	
parking information	Parking Management	Information Service Provider	GGNRA 5, SEKI 1	General parking information and current parking availability.
parking lot data request	Information Service Provider	Parking Management	GGNRA 5, SEKI 1	Request for parking lot occupancy, fares, and availability. The request can be a subscription that initiates as-needed information updates as well as a one-time request for information.
parking lot reservation confirmation*	Parking Management	Park Management*	OTHER 1	Confirmation for parking lot reservation.

Information Flow	Source	Destination	ITS Theme	National ITS Architecture Description
parking operator inputs	Parking Operator	Parking Management	GGNRA 3, SEKI 1	Local parking operator inputs that query current status and control the operation of the parking management system.
parking reservations requests*	Park Management*	Parking Management	OTHER 1	Reservation request for parking lot.
parking status	Parking Management	Parking Operator	GGNRA 3, SEKI 1	Parking lot operational status.
pass/pull in	Entrance Gate*	Vehicle	SEKI 4	Message sent to transponder-equipped vehicle indicating whether to bypass entrance gate or requesting pull in to get more timely park information.
payment	Gateway Yellow Pages Service Provider*	Gateway Smart Card Administrator*	OTHER 4	Payment of some kind (e.g., toll, parking, fare) by traveler which, in most cases, can be related to a credit account.
	Traveler Card	Gateway Yellow Pages Service Provider*	OTHER 4	
		Personal Information Access	SEKI 7, OTHER 1	
		Remote Traveler Support	SEKI 7, OTHER 1	
		Vehicle	SEKI 4, OTHER 4	
payment request	Information Service Provider	Financial Institution	SEKI 7, OTHER 1	Request for payment from financial institution.
	Smart Card Management*	Financial Institution	OTHER 4	
payment violation notification	Park Management*	Enforcement Agency	OTHER 4	Notification to enforcement agency of a toll, parking, or transit fare payment violation.

Information Flow	Source	Destination	ITS Theme	National ITS Architecture Description
physical presence	Potential Obstacles	Vehicle	OTHER 3	Detection of an obstacle by a vehicle. Obstacle could include animals, other vehicles, pedestrians, rocks in roadway etc.
pollutant levels	Environment	Emissions Management	SEKI 8	Atmospheric pollutant levels as monitored by air quality sensors.
		Roadway	SEKI 8	
pollution data	Roadway	Emissions Management	SEKI 8	Measured emissions data comprised of various atmospheric pollutants.
pollution data display	Emissions Management	Traffic Operations Personnel	SEKI 8	Both reference and current pollution status details for a given geographic area.
pollution data parameters	Traffic Operations Personnel	Emissions Management	SEKI 8	Nominal pollution data compliance (reference) levels for each sector of an urban area.
position fix	Location Data Source	Vehicle	GGNRA 4, GGNRA 5, GGNRA 6, SEKI 2, OTHER 5	Information which provides a traveler's or vehicle's geographical position.
request for payment	Gateway Smart Card Administrator*	Gateway Yellow Pages Service Provider*	OTHER 4	Request to deduct cost of service from user's payment account.
	Gateway Yellow Pages Service Provider*	Traveler Card	OTHER 4	
	Personal Information Access	Traveler Card	SEKI 7, OTHER 1	
	Remote Traveler Support	Traveler Card	SEKI 7, OTHER 1	
	Vehicle	Traveler Card	SEKI 4, OTHER 4	
request for performance data	Parking Operator	Parking Management	GGNRA 3, SEKI 1	Request issued by a service provider for current parking service performance data.

Information Flow	Source	Destination	ITS Theme	National ITS Architecture Description
request for road network conditions	Information Service Provider	Traffic Management	GGNRA 5, OTHER 2, OTHER 3	Request for traffic information, road conditions, surface weather conditions, incident information, and other road network status. The request specifies the region/route of interest, the desired effective time period, and other parameters that allow preparation of a tailored response. The request can be a subscription that initiates as-needed information updates as well as a one-time request for information.
request tag data	Entrance Gate*	Vehicle	SEKI 4	Request for tag information including credit identity, stored value card cash, etc.
resource deployment status	Emergency Management	Traffic Management	SEKI 5	Status of traffic management center resource deployment identifying the resources available and their current deployment status.
	Maintenance and Construction Management	Traffic Management	SEKI 5	
	Traffic Management	Emergency Management	GGNRA 7	
resource request	Emergency Management	Traffic Management	GGNRA 7	A request for traffic management resources to implement special traffic control measures, assist in clean up, verify an incident, etc.
	Traffic Management	Maintenance and Construction Management	SEKI 5	
	Traffic Management	Emergency Management	SEKI 5	
road network conditions	Traffic Management	Information Service Provider	GGNRA 5, OTHER 2, OTHER 3	Current and forecasted traffic information, road and weather conditions, incident information, and other road network status. Either raw data, processed data, or some combination of both may be provided by this architecture flow.
		Maintenance and Construction Management	OTHER 3	

Information Flow	Source	Destination	ITS Theme	National ITS Architecture Description
road weather information	Traffic Management	Media	SEKI 3	Road conditions and weather information that are made available by road maintenance operations to other transportation system operators.
roadside archive data	Roadway	Archived Data Management	GGNRA 2	A broad set of data derived from roadside sensors that includes current traffic conditions, environmental conditions, and any other data that can be directly collected by roadside sensors. The data also indicates the status of the sensors and reports of any identified sensor faults.
roadway characteristics	Roadway Environment	Vehicle	OTHER 3	Detectable or measurable road characteristics such as friction coefficient and general surface conditions, road geometry and markings, etc. These characteristics are monitored or measured by ITS sensors and used to support advanced vehicle safety and control and road maintenance capabilities.
roadway equipment coordination	Other Roadway	Roadway	SEKI 3, SEKI 9	The direct flow of information between field equipment. This includes transfer of information between sensors and driver information systems or control devices (traffic signals, ramp meters, etc.), direct coordination between adjacent control devices, interfaces between detection and warning or alarm systems, and any other direct communications between field equipment. Both peer-to-peer and master-slave communications between field devices are covered by this flow.
	Roadway	Other Roadway	SEKI 3, SEKI 9	
roadway information system data	Information Service Provider	Roadway	SEKI 7	Information used to initialize, configure, and control roadside systems that provide driver information (e.g., changeable message signs, highway advisory radio, beacon systems). The flow can provide message content and delivery attributes, local message store maintenance requests, control mode commands, status queries, and all other commands and associated parameters that support remote management of these systems.
	Traffic Management	Roadway	GGNRA 3, GGNRA 4, GGNRA 7, SEKI 1, SEKI 3, SEKI 6, SEKI 8, OTHER 2	

Information Flow	Source	Destination	ITS Theme	National ITS Architecture Description
roadway information system status	Roadway	Information Service Provider	SEKI 7	Current operating status of changeable message signs, highway advisory radios, beacon systems, or other configurable field equipment that provides dynamic information to the driver.
		Traffic Management	GGNRA 3, GGNRA 4, GGNRA 7, SEKI 1, SEKI 3, SEKI 6, SEKI 8, OTHER 2	
roadway maintenance status	Maintenance and Construction Management	Information Service Provider	SEKI 6	Summary of maintenance fleet operations affecting the road network. This includes the status of winter maintenance (snow plow schedule and current status).
		Traffic Management	OTHER 3	
route assignment	Transit Management	Transit Driver	SEKI 2	Route assignment information for transit driver.
tag data	Vehicle	Entrance Gate*	SEKI 4, OTHER 4	Unique tag ID and related vehicle information.
tag update	Entrance Gate*	Vehicle	SEKI 4, OTHER 4	Update data held in tag which can be read by another roadside device (Commercial Vehicle Check Subsystem, Toll Collection Subsystem, etc.).
toll transactions	Entrance Gate*	Park Management*	OTHER 4	Detailed list of transactions from a toll station.
	Park Management*	Smart Card Management*	OTHER 4	

Information Flow	Source	Destination	ITS Theme	National ITS Architecture Description
traffic archive data	Archived Data Management	Traffic Management	GGNRA 1, GGNRA 2, GGNRA 3	Information describing the use and vehicle composition on transportation facilities and the traffic control strategies employed. Content may include a catalog of available information, the actual information to be archived, and associated meta data that describes the archived information.
	Traffic Management	Archived Data Management	OTHER 2	
traffic characteristics	Traffic	Roadway	GGNRA 1	Physical traffic characteristics which are monitored and translated into macroscopic measures like occupancy, volume, density, and average speed. Point measures support presence detection and individual vehicle measures like speed.
traffic flow	Roadway	Traffic Management	GGNRA 1, GGNRA 5, SEKI 6	Raw and/or processed traffic detector data which allows derivation of traffic flow variables (e.g., speed, volume, and density measures) and associated information (e.g., congestion, potential incidents).
traffic images	Roadway	Information Service Provider	GGNRA 5	High fidelity, real-time traffic images suitable for surveillance monitoring by the operator or for use in machine vision applications. This flow includes the images and the operational status of the surveillance system.
		Traffic Management	SEKI 5	
traffic information coordination	Other TM	Traffic Management	GGNRA 1, GGNRA 5	Traffic information exchanged between TMC's. Normally would include incidents, congestion data, traffic data, signal timing plans, and real-time signal control information.
	Traffic Management	Other TM	GGNRA 1, GGNRA 5	

Information Flow	Source	Destination	ITS Theme	National ITS Architecture Description
traffic operator data	Traffic Management	Traffic Operations Personnel	GGNRA 1, SEKI 9	Presentation of traffic operations data to the operator including traffic conditions, current operating status of traffic control equipment, maintenance activity status, incident status, and other information. The data keeps the operator appraised of current road network status, provides feedback to the operator as traffic control actions are implemented, and supports review of historical data and preparation for future traffic operations activities.
traffic operator inputs	Traffic Operations Personnel	Traffic Management	GGNRA 1, SEKI 9	Traffic operations requests for information, configuration changes, commands to adjust current traffic control strategies (e.g., adjust signal timing plans, change DMS messages), and other traffic operations data entry.
transaction status	Financial Institution	Information Service Provider	SEKI 7, OTHER 1	Response to transaction request. Normally dealing with a request for payment.
		Smart Card Management	OTHER 4	
transit and fare schedules	Transit Management	Information Service Provider	GGNRA 5, GGNRA 6, SEKI 2	Specific transit and fare schedule information including schedule adherence.
transit archive data	Transit Management	Archived Data Management	GGNRA 2, SEKI 2	Data used to describe and monitor transit demand, fares, operations, and system performance. Content may include a catalog of available information, the actual information to be archived, and associated meta data that describes the archived information.

Information Flow	Source	Destination	ITS Theme	National ITS Architecture Description
transit driver availability	Transit Driver	Transit Management	SEKI 2	Transit driver availability data that can be used to develop driver assignments and detailed operations schedules.
transit driver display	Transit Vehicle	Transit Driver	SEKI 2	Display (either video or audio) to transit driver containing status of various ITS services.
transit driver inputs	Transit Driver	Transit Vehicle	SEKI 2	Transit driver emergency request as well as fare transaction data.
transit fleet manager inputs	Transit Fleet Manager	Transit Management	SEKI 2	Instructions governing service availability, schedules, emergency response plans, transit personnel assignments, transit maintenance requirements, and other inputs that establish general system operating requirements and procedures.
transit information request	Information Service Provider	Transit Management	GGNRA 5, GGNRA 6, SEKI 2	Request for transit operations information including schedule and fare information. The request can be a subscription that initiates as-needed information updates as well as a one-time request for information.
transit information user request	Personal Information Access	Transit Management	SEKI 2	Request for special transit routing, real-time schedule information, and availability information.
	Remote Traveler Support	Transit Management	GGNRA 4, SEKI 2	
transit operations planning data	Transit Management	Transit Fleet Manager	SEKI 2	Accumulated schedule and fare information, emergency response plans, transit personnel information, maintenance records, and other information intended to support overall planning and management of a transit property.
transit operator display	Transit Management	Transit System Operators	SEKI 2	Display for transit operations personnel regarding performance of the transit fleet, current ridership and on-time performance.
transit reservation confirmation*	Transit Management	Park Management*	OTHER 1	Confirmation for transit reservation.
transit reservation request*	Park Management*	Transit Management	OTHER 1	Reservation request for transit.

Information Flow	Source	Destination	ITS Theme	National ITS Architecture Description
transit traveler information	Transit Management	Personal Information Access	SEKI 2	Transit information prepared to support transit users and other travelers. It contains transit schedules, real-time arrival information, fare schedules, and general transit service information.
		Remote Traveler Support	GGNRA 4, SEKI 2	
transit user inputs	Transit User	Remote Traveler Support	GGNRA 4	Requests from transit user through either an on-board or fixed location traveler information station.
transit user outputs	Remote Traveler Support	Transit User	GGNRA 4	Information for traveler from either an on-board or fixed location traveler information station.
transit vehicle location data	Transit Vehicle	Transit Management	GGNRA 4, GGNRA 5, GGNRA 6, SEKI 2	Current transit vehicle location and related operational conditions data provided by a transit vehicle.
transit vehicle measures	Basic Transit Vehicle	Vehicle	SEKI 2	Transit vehicle status measured by on-board ITS equipment.
transit vehicle schedule performance	Transit Vehicle	Transit Management	GGNRA 4, GGNRA 5, GGNRA 6, SEKI 2	Estimated times of arrival and anticipated schedule deviations reported by a transit vehicle.
travel service info	Gateway Yellow Pages Service Provider*	Information Service Provider	OTHER 1	Reservation information or yellow pages data.
	In-park Yellow Pages Service Provider*	Park Management	OTHER 1	
travel service request	Information Service Provider	Gateway Yellow Pages Service Provider*	OTHER 1	Request for reservation or other service (e.g., yellow pages).
	Park Management	In-park Yellow Pages Service Provider*	OTHER 1	

Information Flow	Source	Destination	ITS Theme	National ITS Architecture Description
traveler information	Information Service Provider	Personal Information Access	GGNRA 5, GGNRA 6, OTHER 5	Traveler information comprised of traffic status, advisories, incidents, payment information and many other travel-related data updates and confirmations.
		Remote Traveler Support	GGNRA 5, GGNRA 6	
traveler information for media	Information Service Provider	Media	SEKI 1, SEKI 6, OTHER 2, OTHER 3	General traveler information regarding incidents, unusual traffic conditions, transit issues, or other advisory information that has been desensitized and provided to the media.
traveler inputs	Traveler	Personal Information Access	SEKI 7, OTHER 1, OTHER 5	Request by a traveler to summon assistance, request travel information, make a reservation, or request any other traveler service.
		Remote Traveler Support	SEKI 7, OTHER 1	
traveler interface updates	Personal Information Access	Traveler	SEKI 7, OTHER 1, OTHER 5	Visual or audio information (e.g., routes, messages, guidance) to the traveler.
	Remote Traveler Support	Traveler	SEKI 7, OTHER 1	
traveler request	Personal Information Access	Information Service Provider	GGNRA 5, GGNRA 6, OTHER 5	Request by a traveler to summon assistance, request information, make a reservation, or initiate any other traveler service.
	Remote Traveler Support	Information Service Provider	GGNRA 5, GGNRA 6	
vehicle characteristics	Vehicle Characteristics	Parking Management	GGNRA 3, GGNRA 4, SEKI 1	The physical or visible characteristics of an individual vehicle that can be measured to classify a vehicle and imaged to uniquely identify a vehicle.
		Roadway	SEKI 8, SEKI 9	

Information Flow	Source	Destination	ITS Theme	National ITS Architecture Description
vehicle location	Vehicle	Maintenance and Construction Vehicle	OTHER 3	Location of vehicle and other vehicle characteristics which are exchanged between vehicle subsystems.
		Transit Vehicle	GGNRA 4, GGNRA 5, GGNRA 6, SEKI 2	
vehicle pollution criteria	Emissions Management	Roadway	SEKI 8	Vehicular pollution acceptance criteria.
vehicle size monitoring control	Traffic Management	Roadway	SEKI 9	Information used to configure and control automated vehicle size monitoring, warning, and enforcement systems.
vehicle size monitoring information	Roadway	Traffic Management	SEKI 9	System status including current operational state and logged information including measured vehicle sizes, warning messages displayed, and violation records.
video surveillance control	Traffic Management	Roadway	SEKI 5	Information used to configure and control video surveillance systems.
visitation archive data*	Park Management*	Archived Data Management	GGNRA 2	Information related to park visitors, including the number of visitors, aggregate statistics of modal choice (cars, tour buses, bicycle, pedestrian, public transit, etc.), statistics related to overnight usage of park facilities and other information that may be useful for real-time or planning purposes.
weather information	Traffic Management	Media	SEKI 3	Accumulated forecasted and current weather data (e.g., temperature, pressure, wind speed, wind direction, humidity, precipitation, visibility, light conditions, etc.).
	Weather Service	Archived Data Management	GGNRA 1, GGNRA 3	
		Information Service Provider	GGNRA 5	
		Traffic Management	GGNRA 1	

Information Flow	Source	Destination	ITS Theme	National ITS Architecture Description
work plan coordination	Maintenance and Construction Management	Other MCM	SEKI 6	Coordination of work plan schedules and activities between maintenance and construction organizations or systems. This information includes the work plan schedules and comments and suggested changes that are exchanged as work plans are coordinated and finalized.
	Other MCM	Maintenance and Construction Management	SEKI 6	
work plan feedback	Traffic Management	Maintenance and Construction Management	SEKI 6	Comments and suggested changes to proposed construction and maintenance work schedules and activities. This information influences work plan schedules so that they minimize impact to other system operations and the overall transportation system.
work zone information	Maintenance and Construction Management	Information Service Provider	SEKI 6	Summary of maintenance and construction work zone activities affecting the road network including the nature of the maintenance or construction activity, location, impact to the roadway, expected time(s) and duration of impact, anticipated delays, alternate routes, and suggested speed limits. This information may be augmented with images that provide a visual indication of current work zone status and traffic impacts.
		Other MCM	SEKI 6	
		Traffic Management	GGNRA 1, SEKI 6	
	Other MCM	Maintenance and Construction Management	SEKI 6	
yellow pages information	Information Service Provider	Personal Information Access	SEKI 7, OTHER 1	Travel service information covering tourist attractions, lodging, restaurants, service stations, emergency services, and other services and businesses of interest to the traveler.
		Remote Traveler Support	SEKI 7, OTHER 1	
		Vehicle	OTHER 1	
yellow pages request	Personal Information Access	Information Service Provider	SEKI 7, OTHER 1	Request for information through a yellow pages type service.
	Remote Traveler Support	Information Service Provider	SEKI 7, OTHER 1	
	Vehicle	Information Service Provider	OTHER 1	

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