FEASIBILITY REPORT FOR EARLY-WINNER PROJECT CONCEPTS

Sequoia and Kings Canyon National Parks

Technical Report

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GLOSSARY OF ABBREVIATIONS

Caltrans	California Department of Transportation
CMS	Changeable Message Sign
DOT	Department of Transportation
DRI	Division of Research and Innovation
FCC	Federal Communications Commission
HAR	Highway Advisory Radio (same as Traveler Information System, or TIS)
ITS	Intelligent Transportation Systems
MOU	Memorandum of Understanding
NPS	National Park Service
RWIS	Road Weather Information Systems
SEKI	Sequoia and Kings Canyon National Parks
TIS	Traveler Information System (same as Highway Advisory Radio, or HAR)
USDA	U.S. Department of Agriculture
WTI	Western Transportation Institute

ABSTRACT

Early-winner ITS applications are to be deployed as part of the ITS Applications in California National Parks research project, which is funded by the California Department of Transportation (Caltrans). This document describes six candidate early-winner project concepts that have been developed for Sequoia and Kings Canyon National Parks: a shared-use changeable message sign (CMS) agreement, upgrading the park's highway advisory radio (HAR) system, expanding the HAR system by adding other towers, installing a surveillance camera on the Milk Ranch tower, starting development of a park-wide visitor information database, and adding visitor information kiosks inside one or more of the park's visitor centers. For each project, the following information is provided: relationship to goals and objectives of phase 1 of the project, key stakeholders, draft operational concept, anticipated benefits, estimated costs, schedule for deployment, anticipated measures of effectiveness, qualitative assessment of cost-benefit and cost-effectiveness, a review of outstanding issues related to design and implementation, and a review of key strengths and weaknesses.

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INTRODUCTION

Because of the economic benefit and transportation impacts associated with the state's national parks, California Department of Transportation (Caltrans) Division of Research and Innovation (DRI) funded a research study to examine how intelligent transportation systems (ITS) could be used to address park transportation challenges. Phase 1 of this effort assessed the transportation needs and ITS solutions for the state's national parks by focusing on two demonstration parks, Golden Gate National Recreation Area and Sequoia and Kings Canyon National Parks. Caltrans DRI has funded a second phase of this project which includes, among other deliverables, the demonstration of early-winner projects in each park.

The purpose of this document is to develop a few early winner project ideas for Sequoia and Kings Canyon National Park (SEKI). This document is intended to inform key SEKI stakeholders of the characteristics of each project, their advantages and disadvantages, to help them make a more educated decision about how to proceed with a selected early-winner project.

For each project idea, the following items will be presented:

- A summary project description
- Related problems, objectives and themes from Phase 1 report (1)
- Required stakeholder involvement
- A rough operational concept of how the project would be used
- Anticipated benefits/results
- Estimated costs of installation, operations and maintenance
- Approximate timetable for implementation and evaluation
- Potential measures of effectiveness
- A qualitative assessment of estimated cost/benefit or cost-effectiveness
- Outstanding issues (technical, operational, maintenance)
- Strengths and weaknesses

SHARED-USE CMS

Project Description

Caltrans District 6 currently owns, operates and maintains a changeable message sign (CMS) on SR 180 approaching SEKI from the west (see Figure 1). It has been used for construction information and forest fire detour information (in cooperation with the Forest Service). However, there is not currently a convenient conduit for providing real-time information on the CMS that would affect the park during times when Caltrans is not actively using the sign.

(Photo courtesy of Texas Transportation Institute)

Figure 1: Existing Caltrans Changeable Message Sign along CA 180 near Orange Cove.

This project would not involve the deployment of new technologies, but would instead seek to develop formal agreements between SEKI, the Forest Service and Caltrans District 6 regarding usage of the CMS. The agreements would seek to do the following:

- List acceptable situations where SEKI and the Forest Service may put messages on the sign
- Provide message sets for messages that would be used in those situations
- Identify protocols for posting messages on CMS in a timely manner
- Delineate responsibilities for posting and removing messages and maintaining the signs

Relationship to Phase 1

Problems

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.

Queues at Entrance Stations. During peak times, park visitors may wait 20 to 25 minutes or more at park entrances to pay entrance fees. Safety is also an issue for vehicles approaching this entrance station 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.

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.

Objectives

1.1.2 Provide visitors with appropriate information at major transportation decision points

1.1.4 Provide weather, road condition, and chain requirement information to visitors

1.1.5 Provide construction and work zone information to visitors

1.1.8 Provide air quality information to visitors

1.2.1 Improve the safety of vehicles at or approaching congested entrance stations

Themes

Weather and Road Condition Information. 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.

Road Construction Information and Coordination. 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.

Emissions Monitoring. 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.

Stakeholders

- Caltrans District 6 TMC
- Sequoia and Kings Canyon National Parks
- Sequoia National Forest (USDA Forest Service)

Draft Operational Concept

The institution of a shared-use CMS agreement between Caltrans District 6 and the park and Forest Service has provided for greater utilization of the CMS, while not compromising traveler information needs. Caltrans District 6 continues to display messages according to its current protocols. However, on many weekend days the signs are blank. With this project, the park now uses these opportunities to provide information to help visitors. During the winter, for example, they used the signs to inform visitors of a time when Generals Highway was closed between Kings Canyon and Sequoia National Parks due to sudden snow. To do this, park staff contacted the District 6 TMC operator on duty and requested permission to post a message on the CMS. With park and Caltrans staff looking at the same guidelines, the TMC posted one of the pre-written messages, “ROAD CLOSED / AT GRANT GROVE / U-TURN AHEAD”. Once the road was re-opened, the park immediately called the TMC operator and had the message changed to, “WINTRY TRAVEL / IN SEQUOIA NP / BRING CHAINS” to advise potential park visitors that they may need to have chains given the recent snow. As the weather warmed and park maintenance staff were able to clear the roadways, the park contacted the TMC and had the message removed.

Anticipated Benefits

Sequoia and Kings Canyon National Parks and Sequoia National Forest

Using the SR 180 CMS could help to the park to provide better information to visitors earlier that will help visitors have a better experience.

Improved traveler information may reduce frustration of visitors, which would improve ranger interactions at entrance gates

Table 1: Potential Benefits of Shared-use CMS.

Example Use	Sample Message	Benefits
Warn of potential queues at Big Stump Entrance	"PARK VISITORS / EXPECT QUEUES / AT ENTRANCE"	• Reduce crashes at entrance gate • Improve visitor satisfaction (better information)
Inform visitors of chain requirements	"CHAINS REQUIRED / IN SEQUOIA NP"	• Enhance visitor convenience (less time)
Inform visitors of road closures	"ROAD CLOSED / AT GRANT VILLAGE"	• Improve visitor satisfaction (better information)

Caltrans District 6

Increased utilization of CMS may improve public perception of benefits of signs.

Improved partnership with park and forest service may help in other transportation initiatives (transportation planning, regional air quality monitoring, etc.).

Visitors

Receiving better information will help visitors have a better experience. The benefits of visitor information conveyed on the CMS will depend on the type of information being transmitted; Table 1 lists some possible CMS uses and the benefits that might result.

Estimated Costs

Installation

The estimated cost for putting together this document is $5,000. This would include facilitating meetings with key stakeholders, developing messages sets, and producing, circulating and revising agreements.

Operations and Maintenance

No operations and maintenance costs would be anticipated over the duration of Phase 2. Operations (i.e. staffing, utilities, communications) and maintenance (i.e. preventative and repair) costs of the signs would continue to be borne by Caltrans District 6. Any cost increases in operations and maintenance could be borne by the park or forest service. In the long term, there should be periodic reviews of the guidelines to ensure that these continue to work with Caltrans policy and meet park needs.

Table 2: Schedule for Shared-use CMS.

Date	Tasks
September 2003	• Project kickoff
October 2003	• Stakeholder discussions • Complete tentative agreements
November 2003	• Develop message sets
December 2003	• Finalize agreements; start shared-use

Schedule

See Table 2.

Measures of Effectiveness

A first question is whether Caltrans District 6 has any measures of effectiveness for this particular CMS or for the district's CMS system as a whole. These measures should be used as a starting point, because any benefits or disbenefits as a result of the shared-use agreement should be considered in assessing overall benefits.

Some potential measures to consider:

- Number of uses of CMS by park / forest service – a higher number indicates increased usage of the CMS
- Visitor surveys – do visitors notice information on CMS? Does this information help them in planning their trip to the park? Do visitors adjust their travel as a result of a CMS message? Do visitors believe CMS messages are accurate and current? Does usage of the sign enhance the visitor experience?
- Stakeholder surveys – do the agreements affect the perceived value of CMS to Caltrans District 6? Do the park and forest service use the CMS? Do they find the CMS beneficial to their operations?
- There may be some potential crash reduction benefits for some types of information, but these benefits would be difficult if not impossible to isolate
- Reduced delay for vehicles to get chains when chain information is posted on sign
- Benefits from information about road closures depend on the number and nature of road closures from one season to the next, so they may not provide much comparability

Estimated Cost-Benefit and Cost-Effectiveness

Cost-Benefit

The question with a cost-benefit analysis is the relative value of benefits from the project to the cost associated. A favorable cost-benefit ratio doesn't establish this project as the best project, but it simply conveys that funding invested in the project would yield more than equivalent value in return.

The primary benefit of this project would relate to visitor experience; however, the benefit of visitor satisfaction is difficult to quantify in economic terms. Does it mean additional visits to the park in the future? Does it mean additional spending on this visit to the park? There may be benefits of reduced travel time to park, for example if they did not have chains on way to park but learned chains were required well before the entrance and could turn around earlier. It is unclear what the magnitude of these benefits would be; therefore, the cost-benefit would be difficult to calculate.

Cost-Effectiveness

Cost-effectiveness examines how efficiently or effectively this project provides the intended benefits relative to other solutions. Alternative methods for providing en-route visitor information include the following:

- Addition of highway advisory radio (HAR) system at the same location. The average installation cost of a park-grade HAR system is around $10,000, with $500 annual operations and maintenance cost. The costs of the system on State Route 180 might be greater because of potential difficulties with providing power. A radio system has the advantage that it can provide more information than CMS. However, studies have shown that drivers show greater awareness of CMS than HAR (ex. 2, 3).

- Installation of a park-owned portable CMS. The CMS could be located to the highway as circumstances warrant. Usage of right-of-way would require, at a minimum, a permitting agreement with Caltrans. The average cost of a portable CMS is about $23,500, with $1,600 annual operations and maintenance costs (4). The portable CMS would have greater flexibility regarding the location at which information is provided. However, the matrix size would limit the portable CMS to less content than can be conveyed with the permanent overhead CMS.

Because neither of these solutions is directly interchangeable with this project, it is difficult to define the exact cost-effectiveness of a shared-use CMS agreement. However, the agreement would be significantly less expensive than the alternatives. The park could implement this project as a low-cost method of improving visitor information. Based on visitor response, the park could then invest more funding in pursuing the other solutions in combination (for example, the shared-use CMS would direct visitors to listen to the highway advisory radio).

Outstanding Issues

Technical

No technical issues would be anticipated.

Operational

As the owner of the CMS, Caltrans District 6 support is mandatory. It is not clear what their level of interest in this specific project is, or how departmental or district policies may affect their ability to participate in this project.

Maintenance

The shared-use CMS agreement would need some maintenance over time, to ensure that it is consistent with Caltrans priorities and purposes and meets park needs.

Strengths and Weaknesses

Strengths

- This project is a low-cost target of opportunity with significant potential benefits.
- This project could have positive political value in the local community.
- This project could provide a model for helping to support a CMS on SR 198 into the park through Three Rivers.
- The agreements could provide models transferable to other national parks and public lands.

Weaknesses

- Institutional issues regarding conflicting message priorities between stakeholders could be difficult to resolve.
- It will be difficult to quantify benefits on this project.

UPGRADE PARK-WIDE RADIO SYSTEM

Project Description

The park currently has two radio towers which may be used to provide recorded park information to visitors. One tower is located near the Ash Mountain entrance to the park (its sign is shown in Figure 2); the other tower is located near Giant Forest. The radio broadcasts are flexible enough to support a variety of information types, but the recordings are currently done manually by park staff.

This project would upgrade the park's radio system. This would improve the ease of recording messages on the system, provide automated recording capabilities which can provide more detailed, real-time information while reducing staffing requirements, and provide real-time indications to motorists of when information is available.

Figure 2: Sign for Park-owned Highway Advisory Radio on CA 198 near Three Rivers.

Relationship to Phase 1

Problems

Limited Parking. Parking lots at popular destinations (e.g., Grant Grove, Giant Forest, and Sherman Tree) fill quickly and become congested. Park 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.

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. 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.).

Weather Forecasts and Road Conditions. See description under "Shared-use CMS" project.

Queues at Entrance Stations. See description under "Shared-use CMS" project.

Safety Challenges due to Incidents. See description under "Shared-use CMS" project.

Work Zone Information. See description under "Shared-use CMS" project.

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 campground information needs to be provided in systems that tourists will use and at locations that enable them to make the proper decision.

Degradation of Air Quality. See description under "Shared-use CMS" project.

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 and 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.

Objectives

1.1.2 Provide visitors with appropriate information at major transportation decision points

1.1.3 Provide information to help visitors avoid congestion locations and times

1.1.4 Provide weather, road condition, and chain requirement information to visitors

1.1.5 Provide construction and work zone information to visitors

1.1.6 Provide information on parking availability to visitors

1.1.7 Provide visitors with information at various park sites about transit arrivals and schedules

1.1.8 Provide air quality information to visitors

1.2.1 Improve the safety of vehicles at or approaching congested entrance stations

1.4.2 Decrease the difficulty in finding available campsites

2.1.3 Promote information about non-automobile alternatives

Themes

Parking Management and Information. 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.

Transit Service and Transit Traveler Information. This ITS theme involves the deployment of a park wide transit service and 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 and 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.

Weather and Road Condition Information. See description under "Shared-use CMS" project.

Road Construction Information and Coordination. See description under "Shared-use CMS" project.

Campground Reservations and Information. 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 in late 2003). 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.

Emissions Monitoring. See description under "Shared-use CMS" project.

Stakeholders

- Caltrans District 6 (if signs are located on roadside)
- Federal Communications Commission (if their approval is needed for an upgrade)
- National Park Service Western Service Center
- Sequoia and Kings Canyon National Parks
- Sequoia National Forest (USDA Forest Service)

Draft Operational Concept

Current system (5)

The current visitor radio system includes two traveler information system (TIS) sites: one at the Ash Mountain entrance, and the other in Giant Forest at Beetle Rock, just before the museum. The systems are independent. While they share a common frequency (1610 AM), they are sufficiently separated that there is no interference in broadcasts.

Ash Mountain

The Ash Mountain system has a range of about two miles down State Route 198. The antenna sits on a knoll just inside the park entrance. This system is relatively old, but does allow digital messages to be recorded by telephone. Messages are updated by staff working in the visitor center. The site has both power and telephone service. It gets its telephone service off of PBX.

Giant Forest

This system is located across the highway from the Giant Forest Museum, and is west of the museum by about 500 yards. It has a low-powered antenna with a range of one to two miles. The system was relocated from Grant Grove because of expressed need for TIS at Giant Forest. It is believed that there are no signs advertising the system to visitors in Giant Forest, and the system almost always broadcasts dead air. Power is available. Telephone service is available nearby and service could be provided at approximately $40/month. This system uses a ground-mounted antenna (about 4 ft tall). It has a weather-tight box to house supporting equipment. The transmitter is about 20 years old and the voice recorder is also old. Messages cannot be recorded by telephone; personnel must go to the voice recorder and manually record messages. It is believed that the components are black box type technologies that could be swapped out with newer components if needed.

Concept

There are two phases possible with this implementation – one with the existing data collection infrastructure and a second phase with a more centralized park database system. While both phases include the capability of automated message recording, only the second phase actually utilizes this.

Under the first phase implementation, flashing beacons are added atop the static signs to indicate when a message is being broadcast. The static signs will be re-done to indicate that a broadcast is active only when the lights are flashing. The sign text may be changed to provide more detailed information about message content (e.g. “Campground Information / Dial 1610 AM / When Flashing”). The lights will be automatically activated whenever any message is placed on the TIS, and will be de-activated when the message is turned off. This may be necessary to help correct for the historical perception that TIS information is dated (6). An alternative is to not install a flashing beacon and to have the system always broadcasting a message.

Two recording options would be available in this system. One option would have park staff record the message in their own voice, and have it transmitted onto the TIS. This is how TIS messages are currently recorded, and it would limit the frequency at which messages can be updated to park staff availability. A second option would be to have park staff type the message, and voice annunciation software convert the text message into an audio recording suitable for broadcast. According to one vendor, current text-to-voice conversion applications could cost as much as a separate TIS installation, and the voice quality and emphasis would likely not be effective in a park setting (7).

Under the second phase implementation, the real-time park database would provide a wide variety of information that may be of note to visitors. Software could be developed that would select the most important information types for the given season (e.g. chain requirements in winter, campground information in summer), day of the week (e.g. construction information on weekdays, congestion information on weekends), and related to current conditions (e.g. road closures). The software could have a variety of standard message sets that could be combined with each other to form the overall broadcast message. This could then be provided to park staff to manually record it, although from an efficiency perspective it would be better to have this information posted automatically using text-to-voice conversion software.

Needs

The major question with the current TIS installations at the park is what would be needed in terms of upgrading. For the existing towers that the park has, the following questions should be answered:

- *Are the two towers located in areas that best serve visitor information needs?* This question needs to be answered by park staff. Initially, it is believed that the answer to this question is yes. If the answer is no, the park should identify appropriate locations.

- *Within those areas, are the towers located optimally?* Location studies would be recommended to determine specific sites within each area where coverage is best.

- *Do tower components need to be upgraded and/or replaced?* The recorder at the Giant Forest does not allow for real-time remote updating of messages. Hooking up telephone service and replacing the recorder would be necessary. Reports of limited coverage of the towers could be a result of a misaligned or damaged ground plane, or of poor antenna location relative to the topography.

- *Are HAR systems adequately promoted to visitors?* Roadside signage would need to be added for the Giant Forest system.

Anticipated Benefits

Sequoia and Kings Canyon National Parks and Sequoia National Forest

The system could provide better information to visitors, approaching the Ash Mountain entrance and within Giant Forest.

This may help to reduce visitor frustration, which could improve ranger interactions at entrance gates.

Upgrading the radio system may help to shorten processing time at ranger stations because some visitor questions will be answered, thus reducing visitor delay.

Improved automation of the system could help to enhance efficiency of staff utilization.

Caltrans District 6

The system could have an indirect benefit of possibly improving traffic flow (e.g. fewer U-turns) on roads leading to the park.

Visitors

The upgraded radio system provides visitors with improved real-time information.

Estimated Costs

Installation

Location studies could cost $2,500 per site (7).

A full National Park-type installation would cost around $10,000, so replacing a recorder would be less.

Replacing the TIS static sign with a sign that has a flashing beacon would cost $5,000 (4).

Developing an operations guide for the TIS towers would cost about $5,000.

Operations and Maintenance

There should be no additional operations and maintenance expenses for the system. Maintenance requirements for TIS are understood to be pretty minimal provided that the antenna is not relocated.

Estimated annual operations and maintenance costs of a flashing beacon TIS sign are $250 (4).

Schedule

See Table 3.

Measures of Effectiveness

- The number of messages recorded by park / forest service before and after system upgrade – a higher number indicates increased usage of the TIS.
- The number of hours of broadcast messages before and after upgrade.
- Visitor surveys – Do visitors use TIS? Do they consider the information to be real-time? Do they respond to the information? Does TIS change how visitors get information? Does TIS enhance visitor satisfaction/experience? A before/after survey would be best, but a survey could be done after the upgrade to ask visitors if they have used it previously.

Table 3: Schedule for Radio System Upgrade.

Date	Tasks
September 2003	• Project kickoff • Start request-for-information from vendors
October 2003	• Stakeholder discussions regarding message information • Complete request-for-information from vendors
November 2003	• Develop phase 1 (no centralized database) requirements for radio towers and sign upgrades • Develop protocol for phase 1 (no centralized database) message sets • Start contracting (w/ NPS?) for sign upgrades
December 2003	• Develop phase 2 (includes centralized database) requirements • Develop test plan for phase 1
January 2004	• Test phase 1
February 2004	• Initiate phase 1

- Park staff surveys – Do they like the upgrade? Do they perceive time/efficiency savings, and if so, how much?

- Reduced maintenance costs with upgraded system

- Improved throughput at entrance gates based on reduced processing times – requires before/after analysis

Estimated Cost-Benefit and Cost-Effectiveness

Cost-Benefit

As was true for the shared-use CMS project, the benefits of this project would be difficult to define. Utilization of the Ash Mountain TIS might increase slightly as information improves. Because the Giant Forest TIS has not been utilized, it is uncertain to what extent visitors would look for information while there. This could prove beneficial to visitors if the information is kept current and visitors are made aware of the system through roadside signage.

The economic benefit of visitor satisfaction is unknown. If the system automates some procedures, this could potentially reduce staffing requirements based on the number of reduced hours multiplied by an average wage rate. The upgrade may also help to reduce maintenance costs.

Cost-Effectiveness

Alternative traveler information methods to this upgrade include the following:

- Portable CMS at Giant Forest. This would have several disadvantages compared to the TIS upgrade, including aesthetics, limited content capabilities and higher cost.

- Rangers or Volunteers at Giant Forest. Rangers could be stationed at strategic locations in Giant Forest to help provide real-time information and guidance to visitors. Aside from the cost of maintaining staff support for this, there would still be communication requirements to ensure that the rangers are providing accurate information.

- CMS on State Route 198. This could be used to provide information to visitors entering the park through Three Rivers. The cost of a new CMS is substantial, however – up to $200,000 including the supporting tower – and it would provide less information than the TIS.

In terms of providing information to visitors at Ash Mountain and Giant Forest, this project appears to be more cost-effective than the alternatives.

Outstanding Issues

Technical

Relocation of either TIS site may be advised based on the results of the location study.

Automated messaging capabilities would help to improve the real-time nature of information; however, it does not appear that the state of the art for TIS allows automated, real-time message development to have an audio quality consistent with NPS desires. Moreover, significant effort would be required in database and message set development.

Operational

It is recommended that an operations guide be developed for each TIS, describing when messages should be provided, what types of messages are appropriate, how message content is to be collected, how message content should be developed, how frequently messages should be updated, who is responsible for updating messages, and similar questions. This will be especially critical as the park moves closer to real-time information, since apart from unified or automated messaging the potential exists for one tower's message to reflect less current information than the other.

Flashing beacons help to indicate that the radio system is actively broadcasting; however, there may be concern about how to install beacons in an area like Giant Forest in an aesthetically acceptable manner.

Maintenance

The upgraded system may have different maintenance requirements than the existing system, requiring different skill sets and testing equipment. Nevertheless, maintenance of the systems should be a minor concern.

Strengths and Weaknesses

Strengths

- This would be an important enhancement to an existing system to increase its utilization.
- There should be minimal permits and construction effort required because it would be able to use existing frequencies and broadcast towers.

Weaknesses

- It would not increase geographic area of coverage, so it would not address areas in the park where information is difficult to get.
- If text-to-voice translation is used, there may be concern over synthesized voice broadcasts being consistent with the intended visitor experience.
- If messages are recorded manually, there will need to be some commitment of staff time to ensure that content is current. There would also need to be a commitment of staff to adhere to consistent operational policies.
- The efficiency benefits of this system will be marginal at best until automated messaging is fully implemented and accepted.
- The flashing beacon may be expensive to implement; conversely, without some indication that the broadcast information is current, there may be less usage of the radio system by visitors.

EXPAND PARK-WIDE RADIO SYSTEM

Project Description

The park currently has two radio towers which may be used to provide recorded park information to visitors. One tower is located near the Ash Mountain entrance to the park (its sign was shown in Figure 2); the other tower is located in Giant Forest. These towers provide a limited geographic area of coverage, as approximated in Figure 3.

This project would look to expand the park's radio system by adding one or two towers, with potential locations including the Big Stump and Grant Grove within the park, and Squaw Valley and Lake Kaweah Dam outside the park. The expanded service area would allow the park to reach visitors earlier.

To ensure the maximum capabilities of the new towers, it is recommended that this system expansion would also include the upgrades of the park-wide radio system described earlier, so that there are common interfaces, standards, and maintenance requirements for each of the towers.

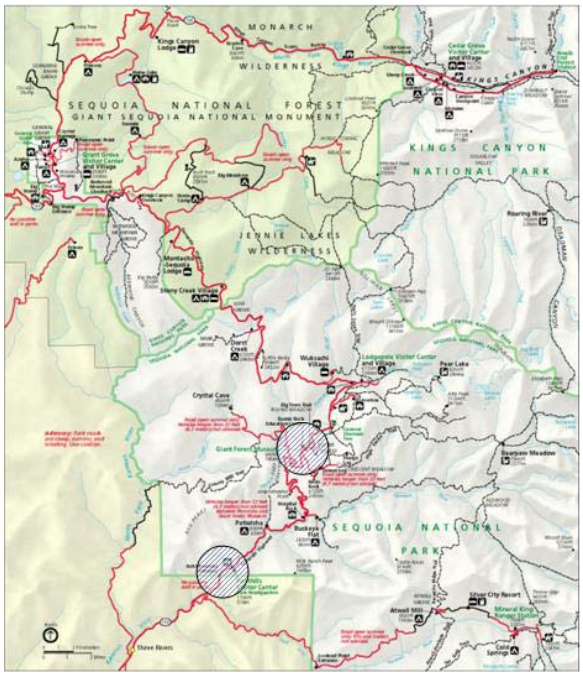

Figure 3: Approximate Radio Coverage within Sequoia/Kings Canyon National Parks.

(Base map source: http://www.nps.gov/carto)

Relationship to Phase 1

Problems

Limited Parking. See description under "Upgrade Park-wide Radio System" project.

Transit Service. See description under "Upgrade Park-wide Radio System" project.

Weather Forecasts and Road Conditions. See description under "Shared-use CMS" project.

Queues at Entrance Stations. See description under "Shared-use CMS" project.

Safety Challenges due to Incidents. See description under "Shared-use CMS" project.

Work Zone Information. See description under "Shared-use CMS" project.

Campground Information and Reservations. See description under "Upgrade Park-wide Radio System" project.

Degradation of Air Quality. See description under "Shared-use CMS" project.

Roadway Congestion. See description under "Upgrade Park-wide Radio System" project.

Objectives

1.1.2 Provide visitors with appropriate information at major transportation decision points

1.1.3 Provide information to help visitors avoid congestion locations and times

1.1.4 Provide weather, road condition, and chain requirement information to visitors

1.1.5 Provide construction and work zone information to visitors

1.1.6 Provide information on parking availability to visitors

1.1.7 Provide visitors with information at various park sites about transit arrivals and schedules

1.1.8 Provide air quality information to visitors

1.2.1 Improve the safety of vehicles at or approaching congested entrance stations

1.4.2 Decrease the difficulty in finding available campsites

2.1.3 Promote information about non-automobile alternatives

Themes

Parking Management and Information. See description under "Upgrade Park-wide Radio System" project.

Transit Service and Transit Traveler Information. See description under "Upgrade Park-wide Radio System" project.

Weather and Road Condition Information. See description under "Shared-use CMS" project.

Road Construction Information and Coordination. See description under "Shared-use CMS" project.

Campground Reservations and Information. See description under "Upgrade Park-wide Radio System" project.

Emissions Monitoring. See description under "Shared-use CMS" project.

Stakeholders

- Caltrans District 6 (if signs are located on roadside)
- Federal Communications Commission
- National Park Service Headquarters
- Sequoia and Kings Canyon National Parks
- Sequoia National Forest (USDA Forest Service)

Draft Operational Concept

The park has installed several TIS to help with visitor information needs. Together, they comprise a system in that they are the primary means for the park to communicate real-time information to visitors. However, the towers' messages are developed independently to provide customized information based on the location of the tower with respect to the park.

To ensure consistency in information content and delivery, the park adopted an operations guide for their TIS installations. The operations guide spells out clearly who is responsible for keeping TIS messages current, what type of content should be recorded, when content should be updated, and similar questions. This is critical since park rangers who record messages are located at scattered areas throughout the park. Each TIS is configured to allow for messages to be digitally recorded and updated via telephone.

Certain types of information, such as road closures in the park, are important enough to broadcast on all stations that park staff use two-way radios to communicate current status; messages are then updated by the ranger responsible for each TIS' content. Each message also includes a time stamp so visitors know when it was last updated.

As one concept, the park adds one TIS in Grant Grove and one on SR 180 approaching the park at Squaw Valley. Each TIS has its own unique content characteristics. The TISs at Squaw Valley and Ash Mountain provide fairly general information regarding current park conditions and how to use the park. For example, the Ash Mountain message would highlight Foothills Visitor Center being located just inside park; the Squaw Valley message could discuss access to Kings Canyon. For TIS inside the park, they could focus more on current availability of parking and how to access transit within the park. These messages are generally updated first thing in the morning, based on forecast weather conditions and expected park usage levels. When conditions change suddenly – for example, in the winter months when chains might be required during part of the day – park rangers who are responsible for this decision would communicate it to all staff responsible for recording TIS messages at that time. The TIS messages would be updated to reflect this information, and would include a time stamp.

Anticipated Benefits

Sequoia and Kings Canyon National Parks and Sequoia National Forest

The radio system allows the park to provide better information to visitors at key decision points, both inside and outside the park.

The system provides greater geographic coverage of information to visitors than would be possible through the existing system.

The radio system may help to reduce frustration of uninformed visitors, which would improve ranger interactions at entrance gates.

This system may help to shorten processing time at ranger stations because some visitor questions will be answered, thus reducing visitor delay.

The system's automation capabilities would help to make staff utilization more efficient.

Caltrans District 6

The system may provide an indirect benefit of possibly improving traffic flow (e.g. fewer U-turns) on roads leading to park.

Visitors

The system would provide enhanced real-time visitor information.

Estimated Costs

Installation

Replacing the HAR static sign with a sign that has a flashing beacon would cost $5,000 (4).

Location studies – to pinpoint a tower location once the general area at which information should be presented has been identified by park staff – would cost about $2,500 each (7).

A new park-type TIS would cost about $10,000. Frequency studies are recommended prior to installation; these studies help the park to identify appropriate frequencies that are available and that are acceptable for the park to use. Including permit processing with the appropriate Federal agency, these studies would cost about $500 per site (7).

Operations and Maintenance

Estimated annual operations and maintenance costs of a flashing beacon HAR sign are $250 (4).

Table 4: Schedule for Park-wide Radio System.

Date	Tasks
September 2003	• Project kickoff
October 2003	• Stakeholder discussions regarding message information • Develop concept of operations for how tower system should work (e.g. who has access, centralized vs. decentralized control) • Start request-for-information from vendors
November 2003	• Complete request-for-information from vendors • Develop requirements for new radio towers • Identify potential locations for new radio towers • Develop requirements for upgrades of existing towers, software and signage • Develop message requirements for phase 1 (no centralized database)
December 2003	• Start request-for-proposals for new towers and upgrades with two options: one new tower or two, with a couple of location options • Start request-for-bids for contractors for installation of new towers • Start contracting (w/ NPS?) for sign upgrades • Select radio system vendor
January 2004	• Select contractor; start tower installation • Develop message requirements for phase 2 (includes centralized database) requirements
February 2004	• Testing of upgraded system
March 2004	• System activated

Estimated annual operations and maintenance costs associated with a new tower would be approximately $500. This does not include the staff time necessary to update messages and keep information current.

Schedule

See Table 4.

Measures of Effectiveness

- The number of messages recorded by park / forest service before and after upgrade – a higher number indicates increased usage of the HAR.

- The number of hours of broadcast messages before and after upgrade

- Visitor surveys – do they use HAR? Do they consider information real-time? Do they respond to information? Does HAR change how visitors get information? Does HAR enhance visitor satisfaction/experience? A before/after survey would be best, but a survey could be done after the upgrade to ask visitors if they've used the system previously.

- Park staff surveys – do they like the upgrade? Do they perceive time/efficiency savings, and if so, how much?

- Reduced maintenance costs with upgraded system

- Improved throughput at entrance gates based on reduced processing times – requires before/after analysis

- Measures based on specific information provided (for example, less overflow parking with similar visitation levels, improved utilization of campgrounds)

Estimated Cost-Benefit and Cost-Effectiveness

Cost-Benefit

The system's primary benefit would be to provide more and better real-time information to visitors in more locations in the park and surrounding communities. It is unclear how the economic benefit of enhancing the visitor experience could be measured. There would be calculable benefits in reduced staffing requirements and maintenance costs. However, there may be additional system cost associated with database / radio system management.

Cost-Effectiveness

In terms of providing expanded geographic coverage of en-route visitor information, the following are potential alternatives.

- Addition of permanent CMS. The cost of a new CMS is substantial – up to $200,000 – and CMS are far more limited in the volume of content they can provide. However, as was described earlier, CMS tend to have greater motorist awareness than HAR.

- Addition of portable CMS. The cost of portable CMS is comparable to the cost of a new HAR installation. They have the benefit of locational flexibility – a portable CMS can be moved to different locations depending upon current information needs. However, a portable CMS is very limited in terms of the amount of content that can be provided. Moreover, there may be limits on where they can be deployed based on power, communications and aesthetic considerations.

- Use of portable HAR. Highway advisory radio may also be deployed using portable installations. This offers a potential alternative to a permanent HAR, provided that portable stations can be integrated just as easily into the overall system. There are no special permitting requirements, and the range is reported to be comparable to permanent HAR. However, there is no special advantage to portable HAR unless the park anticipates

regularly moving these systems (for example, a system could be devoted exclusively to in-park road construction work). Portable HAR typically rely on analog cellular or digital wireless communications, and operate primarily on solar power. Both of these may be challenges in SEKI. Moreover, portable HAR cost more than twice as much as a traditional park HAR deployment (8).

An expanded permanent HAR system appears to be more cost-effective than alternative solutions.

Outstanding Issues

Technical

How easily will new towers integrate with existing towers, software, interfaces, especially if a different radio system vendor is chosen?

How easy will it be to establish locations to install towers? How easy will it be to install towers within park boundaries?

How easy will it be to install towers outside of park boundaries, on either Forest Service land or Caltrans right-of-way? In many parts of the country the DOT is resistant to allowing TIS signage or TIS towers within its right-of-way.

Operational

It is recommended that an operations guide be developed for each TIS, describing when messages should be provided, what types of messages are appropriate, how message content is to be collected, how message content should be developed, how frequently messages should be updated, who is responsible for updating messages, and similar questions. This will be especially critical as the park moves closer to real-time information, since apart from unified or automated messaging the potential exists for one tower's message to reflect less current information than the other.

Flashing beacons help to indicate that the radio system is actively broadcasting; however, there may be concern about how to install beacons in an area like Giant Forest in an aesthetically acceptable manner.

Maintenance

The upgraded system may have different maintenance requirements than the existing system, requiring different skill sets and testing equipment. Nevertheless, maintenance of the systems should be a minor concern.

Strengths and Weaknesses

Strengths

- This would be an important enhancement to an existing system that could increase its utilization.

- This would provide greater geographic coverage for park information, reaching more visitors with more detailed information, than would be possible using other information delivery methods.

Weaknesses

- It may be difficult to build permanent tower infrastructure on park or forest service land, especially in a short time frame.

- System expansion, apart from automated capabilities, will require an investment of staff time to ensure message content is current.

- If messages are recorded manually, there will need to be some commitment of staff time to ensure that content is current. There would also need to be a commitment of staff to adhere to consistent operational policies.

- The efficiency benefits of this system will be marginal at best until automated messaging is fully implemented and accepted.

- The flashing beacon may be expensive to implement; conversely, without some indication that the broadcast information is current, there may be less usage of the radio system by visitors.

MILK RANCH CAMERA

Project Description

A communications tower at Milk Ranch provides a convenient observation point for looking over most of Generals Highway. This project would involve installation of a remotely controlled (pan-tilt-zoom) camera on this tower to provide roadway monitoring along Generals Highway. Images collected by the camera would be available exclusively to park staff.

Relationship to Phase 1

Problems

Safety Challenges due to Incidents. See description under "Shared-use CMS" project.

Roadway Congestion. See description under "Upgrade Park-wide Radio System" project.

Objectives

1.2.2 Improve the safety of vehicle travel by visitors on park roadways

3.1.2 Monitor transportation operations and congested areas

3.1.3 Reduce congestion on park roadways

3.2.1 Improve the response time to incidents on park roadways

Themes

Road Monitoring and Incident Management. 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.

Stakeholders

- Sequoia and Kings Canyon National Parks

Draft Operational Concept

The camera is positioned to overlook a large section of the southern section of Generals Highway, where tight switchbacks and limited shoulders make monitoring and response to incidents challenging. The camera is controlled by park staff at park headquarters. Snapshot

images are transmitted every second, with the camera panning and zooming on a pre-set pattern to focus on specific areas of Generals Highway. A collage of new images is posted every five minutes on monitors at headquarters to minimize data transfer time. When staff notice unusual activity at any part of the highway (e.g. an incident), they can stop the pre-set zoom pattern and remotely direct the camera to focus on a specific spot. They can look at the images long enough to develop and coordinate an appropriate response. Images are kept in a short-term data storage archive for a week and are destroyed after to save on video storage requirements.

Anticipated Benefits

Sequoia and Kings Canyon National Parks and Sequoia National Forest

The camera could help to reduce notification and response time for incidents on Generals Highway.

By allowing for remote monitoring, the camera could reduce time and inconvenience of monitoring activities on Generals Highway.

Visitors

The camera could help to improves safety on Generals Highway by identifying slowdowns and incidents more quickly.

By assisting in incident detection, the camera could reduce visitor delay on Generals Highway.

Estimated Costs

Installation

The cost of the camera installation would be approximately $12,000 (4). There may be additional cost requirements depending upon the need for video archiving and storage.

Operations and Maintenance

Estimated operations and maintenance costs would be $2,000 per year (4). Operations cost would consist of additional power and communications costs associated with the camera; these would need to be borne by the park. The most common maintenance need is preventative maintenance to clean the camera lens and inspect the cabling and cabinetry for corrosion. Problems may occur with communication between the camera and the operations center, depending upon the quality of power supply and environmental effects. Many solid-state devices, such as modems, routers and monitors, may be used in the image transmission and delivery process; these should need little maintenance.

Schedule

See Table 5.

Table 5: Schedule for Milk Ranch Camera.

Date	Tasks
September 2003	• Project kickoff • Identify power and communications availability at tower
October 2003	• Identify who would control cameras and where images should go • Start request-for-information from vendors • Start obtaining agreements, permits to use tower
November 2003	• Complete request-for-information from vendors • Develop requirements for cameras • Start request-for-bids for contractors for purchase and installation of camera
December 2003	• Evaluate request-for-bids and select contractor • Start camera installation • Develop test plan
January 2004	• Complete camera installation • Testing of camera
February 2004	• System activated

Measures of Effectiveness

- Reduced visitor delay and congestion on Generals Highway (number of incidents for which camera was first notification, average time savings, number of vehicles queued)
- Reduced notification and response time for incidents on Generals Highway

Estimated Cost-Benefit and Cost-Effectiveness

Cost-Benefit

Notification/response time savings can translate into benefits in reduced delay. The key question in estimating the economic benefit of this project is estimating value of time for recreational travel – it's not clear what the literature says about this.

Notification/response time savings could also improve the outcomes for emergency response activities. This will be more speculative, and requires estimate of economic costs involved in delaying emergency response.

Cost-Effectiveness

This project is intended to improve incident identification along Generals Highway. Other alternatives that might be used are as follows.

- Automated detection on highway. A variety of technologies – e.g. in-pavement loops, video detection – could be used to detect when traffic has stopped on the roadway. These technologies have varying costs, but would require the availability of power. Moreover, these technologies generally do not allow for verification of incidents. This could lead to many false alarms, for example, if a bear is adjacent to the roadway and is causing traffic to stop.

- Additional ranger patrols. In many parts of the country, patrols are used to enhance incident detection. In SEKI, there is neither sufficient road capacity on Generals Highway nor alternative routes that would make this feasible.

- Enhanced cellular phone coverage. Increasingly cell phone subscribers are among the first to report incidents. As an increasing percentage of visitors have cell phones, this becomes a more viable method of incident detection in the park overall. However, cell phone coverage in the park is largely nonexistent and would not be expected to change in the foreseeable future.

- Callboxes. Callboxes are used in some rural areas to allow motorists to call, identifying incidents or requesting roadside assistance. These increasingly rely on wireless coverage, which would not be possible in SEKI. However, wireline infrastructure is largely nonexistent along Generals Highway. In addition, there are few strategic shoulder locations where callboxes may be placed, and the callboxes may degrade park aesthetics.

It appears that the Milk Ranch Camera represents the most cost-effective method of enhancing incident identification, detection and verification.

Outstanding Issues

Technical

Can camera provide adequate resolution to be of use?

How effective would the camera location be during low-visibility weather (low clouds, fog, smog, etc.)?

Is the microwave link between the tower and park headquarters adequate for transmitting video?

Operational

How will viewing camera images be integrated into park staff's normal activities so as to not introduce an additional time burden? (One possibility is to have images go to park rangers, who could radio headquarters when unusual events are seen; headquarters could control cameras to focus on specific spots.)

Maintenance

How will camera maintenance be performed on the tower? What time costs might be involved?

Strengths and Weaknesses

Strengths

- This is a low-cost target of opportunity that could help improve emergency notification and response on Generals Highway.

- It could use existing infrastructure (the tower and line-of-sight communications availability).

Weaknesses

- It is unclear how viewing camera images would be integrated into standard park operations so as to improve roadway monitoring without consuming unnecessary staff time.

- The benefits of this system would be largely "invisible" to visitors, so it may not generate support for future ITS investment.

- There is concern about the quality of images of pictures taken from a camera that is 3 or 4 miles away from Generals Highway. This is exacerbated by concerns about the level of possible visibility during poor air quality days.

PARK INFORMATION DATABASE

Project Description

Improving information dissemination to park visitors requires not only an infrastructure to get information out (i.e. kiosks, changeable message signs, Internet sites, highway advisory radio, telephone number), but also accurate real-time information. To get information out efficiently, the time required to collect, analyze and re-package data should be minimized. One effective way to do this is to develop a common database for all traveler information that may be useful to park visitors. The database can serve as a source of information for a variety of information outlets, and can provide capabilities for automation that can help to reduce the time that park staff spend in collecting and analyzing data on a real-time basis.

Relationship to Phase 1

Problems

Limited Parking. See description under "Upgrade Park-wide Radio System" project.

Transit Service. See description under "Upgrade Park-wide Radio System" project.

Weather Forecasts and Road Conditions. See description under "Shared-use CMS" project.

Work Zone Information. See description under "Shared-use CMS" project.

Campground Information and Reservations. See description under "Upgrade Park-wide Radio System" project.

Degradation of Air Quality. See description under "Shared-use CMS" project.

Objectives

1.1.2 Provide visitors with appropriate information at major transportation decision points

1.1.3 Provide information to help visitors avoid congestion locations and times

1.1.4 Provide weather, road condition, and chain requirement information to visitors

1.1.5 Provide construction and work zone information to visitors

1.1.6 Provide information on parking availability to visitors

1.1.7 Provide visitors with information at various park sites about transit arrivals and schedules

1.1.8 Provide air quality information to visitors

1.4.2 Decrease the difficulty in finding available campsites

1.4.3 Allow visitors to make reservations for experiencing certain park activities

2.1.3 Promote information about non-automobile alternatives

2.2.3 Improve the monitoring of air quality in the park

Themes

Parking Management and Information. See description under "Upgrade Park-wide Radio System" project.

Transit Service and Transit Traveler Information. See description under "Upgrade Park-wide Radio System" project.

Weather and Road Condition Information. See description under "Shared-use CMS" project.

Road Construction Information and Coordination. See description under "Shared-use CMS" project.

Campground Reservations and Information. See description under "Upgrade Park-wide Radio System" project.

Emissions Monitoring. See description under "Shared-use CMS" project.

Stakeholders

- National Park Service Headquarters (if their permission is needed)
- Sequoia and Kings Canyon National Parks
- Other parties who own key data (National Weather Service? San Joaquin Valley Air Pollution Control District? Caltrans District 6?)

Draft Operational Concept

Park staff understand that providing accurate information to visitors on a real-time basis is integral to the quality of the visitor's experience at SEKI. They have developed a good understanding of the types of information that visitors require, where they require it, and what are the consequences (both to themselves and park operations) if they fail to receive that information. Park staff are continually looking for ways to get new types of information to visitors. Unfortunately, information collection and dissemination has not been developed in a systematic fashion. There is no consistency in how information is collected and stored, which makes it difficult for the park to take full advantage of new information dissemination opportunities (for example, the Internet and automated telephone traveler information systems).

The park information database fills in a gap by unifying data collection and storage throughout the park. The database supports all real-time information functions that park staff provides.

Weather conditions information is provided by direct data feeds from Caltrans District 6 (with nearby road weather information systems [RWIS] sites), the Forest Service and National Weather Service. Campground reservations and availability, recorded by park rangers at the entrance gates, are entered into this database. Even schedule and arrival information for the new in-park transit system is in the database, which has proved useful to visitors using kiosks at the Foothills Visitor Center. The database was also created with fields to permit real-time parking information to be provided as lots are instrumented with equipment to detect occupancy. For now, park rangers use personal digital assistants using radio communications to transmit parking lot status information into the database. The software provides an automatic time-stamp so visitors can know how current the information is.

The database provides the content for the park's two most popular information delivery media: the Internet and telephone information. Previously, the Internet was manually updated each morning by park staff based on current conditions; this information would become dated throughout the day. Now, the park's web site has automatic querying processes to collect the most current information regarding parking availability, road weather conditions, campground availability, along with schedules of interpretive activities. The park's telephone number formerly had a similar manual updating process. The database has not only allowed the park to rely entirely on automation for this aspect of information delivery, but it has also allowed the information to be presented in a menu format, which can conserve time for visitors wishing to obtain only certain pieces of park information.

Anticipated Benefits

Sequoia and Kings Canyon National Parks

The database would provide a more efficient way of storing and transmitting data for visitor information purposes.

The database would provide a structure that would make it easier to disseminate real-time information in new ways.

Visitors

The database would enhance the timeliness and quality of visitor information, resulting in an enhanced park visit.

Estimated Costs

Installation

The precise cost for database development and associated hardware will be impossible to determine until a detailed requirements analysis is developed. The requirements analysis would consist of meetings with park stakeholders who would provide information into the database or would need to query the database for visitor information needs and/or NPS reporting requirements. The estimated cost of conducting this requirements analysis would be $30,000.

The results of the requirements analysis would be sufficiently detailed for the park to know how the database would be laid out and what types of information would be used by which stakeholders and in what formats. This would provide information suitable for in-house or contracted development of the software and hardware necessary.

Operations and Maintenance

No operations and maintenance costs are necessary for the initial requirements analysis. It is anticipated that another round of requirements analysis would need to be pursued once database design is underway, to ensure that new requirements will be addressed.

Schedule

See Table 6.

Measures of Effectiveness

The database, when complete, would not provide direct benefits to park visitors and staff; however, the effects of the database should be measurable in several secondary measures:

- Increased usage of park telephone number
- Increased usage of park web site

Table 6: Schedule for Park Information Database.

Date	Tasks
September 2003	• Project kickoff • Survey park staff regarding current data availability, data needs
October 2003	• Develop draft data structure • Develop computer/hardware architecture
November 2003	• With park staff, prioritize data needs • Develop phased implementation plan
December 2003	• Database development for phase 1 • Procure necessary supporting hardware • Develop test plan
January 2004	• Beta test of database phase 1 • Database development for phase 2 • Procure necessary supporting hardware
February 2004	• Modify phase 1
March 2004	• Beta test of database phase 2 • System activated for phase 1

- Visitor perceptions of park information sources – usefulness, timeliness, reliability, etc.
- Increased visitor satisfaction with park experience
- Anecdotal evidence regarding secondary effects of improved park information (e.g. fewer visitors needing to return to town to get chains, more efficient utilization of parking lots, increased transit usage, less dissatisfaction regarding campgrounds being full, etc.)
- Anecdotal evidence regarding secondary effects of satisfied visitors (e.g. increased park visitation, increased economic benefits to gateway communities, increased support of park foundation, etc.)

These benefits would be realized only on completion of the database, and not upon completion of a requirements analysis.

Estimated Cost-Benefit and Cost-Effectiveness

Cost-Benefit

It will be difficult to estimate benefits specifically related to improved information, since there may be other factors that would increase visitors' willingness to return to the park and/or spend more money on their visits.

Cost-Effectiveness

This project focuses on re-structuring data collection and management to improve the timeliness and relevance of visitor information. Since this project encompasses the gamut of technology alternatives that may be used to this end, there are no technology alternatives. The other alternative to provide improved data management would be to increase staffing levels to support improved data collection and management; this is not a viable alternative.

Outstanding Issues

Technical

What computer and technology infrastructure – communications, networked terminals and servers, handheld devices, etc. – is available to support data collection, management and transmission?

What databases are currently in use by the park? How would this database need to integrate with those?

Are there other databases outside of SEKI that would be affected by this database (for example, data needed to meet NPS headquarters requirements)?

Operational

How would the database we used, and by whom?

Are there information dissemination outlets that can use the information generated by the database?

Maintenance

Does the park have access to staff skill sets to support long-term operation, maintenance and upgrading of the database as available park data increases or visitor information needs evolve?

Strengths and Weaknesses

Strengths

- This project provides an important foundation piece to support a variety of visitor information outlets.
- Upon completion of the requirements analysis, the database can be developed in a phased fashion based on available resources.
- This project can help to guide and direct future investments in data collection equipment to ensure that park-related information is provided in a systems perspective.

Weaknesses

- The current lack of automation in many data collection processes may mean that a significant hardware investment would be required for this project to be feasible.
- The requirements analysis alone will not provide an interesting product to the public.
- This will have visitor benefits only once it can be tied in to improving the web site and the telephone number; therefore, there needs to be a commitment to funnel the database into those (and potentially other) information dissemination outlets.

VISITOR CENTER KIOSKS

Project Description

With real-time information available, park visitors can make more informed choices about how to best enjoy their visit to the park. A variety of static or quasi-real-time information is available to visitors through the park newspaper, park rangers and visitor center staff. This information may be more efficiently provided to visitors using automated, interactive means, such as kiosks. The kiosks could use a web interface and may in fact use the park's web site. They could provide a variety of information related to the park, including static information regarding park activities and attractions, and real-time information regarding campground availability, parking lot status, transit arrival times, weather conditions, air quality information, and other types of information that may be useful to visitors.

Relationship to Phase 1

Problems

Limited Parking. See description under "Upgrade Park-wide Radio System" project.

Transit Service. See description under "Upgrade Park-wide Radio System" project.

Weather Forecasts and Road Conditions. See description under "Shared-use CMS" project.

Work Zone Information. See description under "Shared-use CMS" project.

Campground Information and Reservations. See description under "Upgrade Park-wide Radio System" project.

Degradation of Air Quality. See description under "Shared-use CMS" project.

Objectives

1.1.2 Provide visitors with appropriate information at major transportation decision points

1.1.3 Provide information to help visitors avoid congestion locations and times

1.1.4 Provide weather, road condition, and chain requirement information to visitors

1.1.5 Provide construction and work zone information to visitors

1.1.6 Provide information on parking availability to visitors

1.1.7 Provide visitors with information at various park sites about transit arrivals and schedules

1.1.8 Provide air quality information to visitors

1.4.2 Decrease the difficulty in finding available campsites

1.4.3 Allow visitors to make reservations for experiencing certain park activities

2.1.3 Promote information about non-automobile alternatives

Themes

Parking Management and Information. See description under "Upgrade Park-wide Radio System" project.

Transit Service and Transit Traveler Information. See description under "Upgrade Park-wide Radio System" project.

Weather and Road Condition Information. See description under "Shared-use CMS" project.

Road Construction Information and Coordination. See description under "Shared-use CMS" project.

Campground Reservations and Information. See description under "Upgrade Park-wide Radio System" project.

Emissions Monitoring. See description under "Shared-use CMS" project.

Stakeholders

- Park concessionaires (for contracted maintenance?)
- Sequoia and Kings Canyon National Parks

Draft Operational Concept

The kiosk would act as a permanent web interface, continually pulling in real-time information from a variety of data sources (or a centralized database, if it exists). It would be located within a visitor center which would provide a climate-controlled environment in addition to power and communications. In addition, visitors would be able to interact with rangers to get additional information. Kiosks may be set up with a common web interface and supporting data at numerous locations in the park, based on visitor needs.

Anticipated Benefits

Sequoia and Kings Canyon National Parks

The kiosks may increase traffic in visitor centers, which may increase visitor interactions with rangers.

The kiosks can augment park interpretation, providing for an improved visitor experience of park resources.

Visitors

The kiosks can enhance the timeliness and quality of visitor information, resulting in an enhanced park visit.

Estimated Costs

Installation

The estimated cost of a kiosk terminal is $15,000. Significant additional costs could include software and content development, depending upon the level of customization desired.

Operations and Maintenance

Cost estimate: $1,500 per year per terminal. This includes additional power and communications costs.

Schedule

See Table 7.

Table 7: Schedule for Visitor Center Kiosks.

Date	Tasks
June 2003	• Project kickoff • Identify models for SEKI to copy
July 2003	• Identify key information needs (current and future) • Start request-for-proposals on kiosk including software (note, this should be scalable so park could pursue similar units in the future and they would be able to work together)
August 2003	• Evaluate request-for-proposals • Initiate contract
September 2003	• Develop test plan
November 2003	• Deploy kiosk for beta testing
December 2003	• Finish beta testing • System activation

Measures of Effectiveness

- Increased traffic in visitors center
- Potential reduction in delay or interaction time at entrance gates (visitors would be instructed to get additional information at kiosk in visitors center)
- Number of kiosk users
- Visitor surveys regarding usage of kiosks – are they useful, timely, reliable, etc.
- Increased visitor satisfaction with park experience
- Anecdotal evidence regarding secondary effects of improved park information (e.g. fewer visitors needing to return to town to get chains, more efficient utilization of parking lots, increased transit usage, less dissatisfaction regarding campgrounds being full, etc.)
- Anecdotal evidence regarding secondary effects of satisfied visitors (e.g. increased park visitation, increased economic benefits to gateway communities, increased support of park foundation, etc.)

Estimated Cost-Benefit and Cost-Effectiveness

Cost-Benefit

It will be difficult to estimate benefits specifically related to improved information, since there may be other factors that would increase visitors' willingness to return to the park and/or spend more money on their visits.

Cost-Effectiveness

Kiosks represent one way of providing customized visitor information; alternatives include the following:

- Increased staffing (volunteer or ranger) at visitor centers. Expansion of visitor center staffing would increase the opportunity for visitors to receive personalized information. This alternative would require significantly more funding to pay for staff, along with the need to redesign visitor centers to accommodate additional staff.
- Enhanced telephone information service. The park's visitor information telephone number could be transformed into a menu-based structure that allows visitors greater flexibility in selecting information customized for their visit. This service could be developed to pull information from a real-time database so that the maintenance requirements and type of contact would be similar to a web-based kiosk. This alternative has several disadvantages that would limit its effectiveness. First, it would likely require more time from the visitor to get the information they seek. Second, a telephone cannot convey graphical information, such as maps and pictures of attractions. Third, the menu

system would likely be more difficult to adapt as seasonal information needs change. Fourth, using a kiosk may be more consistent with a park experience than a telephone number.

- Reliance on personal digital assistants. Some visitors will have access to PDAs, so one alternative would be to have a PDA portal developed that would provide customized interpretation. This has the advantage of geographic flexibility, as a visitor can obtain information anywhere within the park. The most significant concern with this alternative is that most visitors will not have PDAs, and those who do have PDAs may not wish to use those in a national park setting. There are also technical issues regarding timeliness of data and communications requirements for real-time data updates that would need to be addressed.

Clearly, kiosks are the most cost-effective method for providing customized visitor information.

Outstanding Issues

Technical

Does the park have adequate real-time, automated information to support the kiosk?

How many kiosks would be required to be effective?

What computer and communications infrastructure is available to support this system?

Operational

Would outdoor, sheltered locations make more sense, since they would allow visitors access to information when the visitor centers are closed?

Maintenance

The need for kiosk maintenance is often underestimated.

Strengths and Weaknesses

Strengths

- This is a product that is easily visible to visitors and provides tangible evidence to visitors about what ITS can do.
- The kiosk may help to increase traffic to the visitor centers, encouraging a better visitor experience from an interpretation perspective.
- The presence of the kiosks may have auxiliary benefits of reducing some delay at the entrance gates, as visitors can get more real-time information at the visitor center.

- Kiosk capabilities could easily adapt to new information as it is made available.

Weaknesses

- Kiosks may be maintenance-intensive.
- Without adequate real-time data, the kiosks will probably not be heavily used.

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