

VISITOR PERCEPTIONS OF INTELLIGENT TRANSPORTATION SYSTEMS IN A NATIONAL PARK

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Abstract

Congestion in national parks is an issue of concern for both visitors and managers. Increased visitation has resulted in a need to plan and manage for a balance between the visitor experience and resource protection. Understanding access issues, in particular as a way to ease congestion, improve the quality of the visitor experience, and maintain the integrity of the resource is integral to this process.

In 1991 Congress created the Intelligent Transportation Systems (ITS) program to address the needs of the transportation network in the United States. ITS solutions include technologies such as electronic toll collection and electronic message signs.

This study examined visitor attitudes toward and intent to use ITS in two of the national park units in California. The findings suggest a positive relationship exists between attitude and intention in regard to ITS tools in national parks, and between technology experience and intent to use technology at the study parks.

1.0 Introduction

The dual purpose of the National Park Service calls for preservation of resources as well as visitor enjoyment. The current use level of many of the parks is relevant to both aspects of the park mission; higher numbers of visitors can lead to resource damage and can also lower visitor enjoyment of the resource (Gramann 1982). Congestion, or crowding, in the parks has been the subject of many studies over the last thirty years, although the focus has been largely on the backcountry or primitive use areas rather than the frontcountry or developed areas of the parks (Ditton et al. 1983; Patterson & Hammitt, 1990; Lewis et al. 1996). While the number of visitors to the parks has fallen somewhat in the past few years (2000 and 2001 visitation was approximately 285 million and

280 million respectively), there have been increases at individual park units (e.g. Sequoia and Kings Canyon National Parks) (Public Use Statistics Office 2002). The continued demand for national park experiences draws attention to the need to study access to the parks, particularly the developed or frontcountry areas. The National Park Service (NPS) has utilized a series of development strategies over the years. One such strategy was Mission 66, a 10-year program created in 1956 to increase the number of facilities in the parks in response to ever increasing numbers of visitors. However, a more recent emphasis on preservation over use calls for the development of lower impact solutions that address impacts from congestion and crowding. As stated by Robert Stanton, then Director of the National Park Service, "As visitation to the parks continues to increase dramatically, so too does the challenge of ensuring resource protection while accommodating visitors and providing enjoyable experiences for them. We cannot simply build and widen roads and parking lots" (1999).

One approach to managing access is intelligent transportation systems. This approach uses information technology to improve transportation services for the public (U.S. Department of Transportation 1998). More specifically, ITS is used to address access and congestion concerns such as bottlenecks and safety. As noted by Roggenbuck (1992), visitors with better information may have more realistic expectations and, therefore, may be better able to reduce or avoid negative evaluations of their experience. The national park experience includes the journey to and through the parks. Thus, this study examined visitor attitudes towards ITS tools and their intentions to use them in two national parks in California.

2.0 Literature Review

2.1 Intelligent Transportation Systems

A 1997 Memorandum of Understanding (MOU) between the Departments of Transportation and The Interior set in place an agreement to examine a variety of joint transportation projects, including ITS in national parks. ITS tools include vehicle detection technologies, closed-circuit television cameras, electronic message signs, global positioning systems (GPS) to track vehicles such as shuttles, and use of the Internet to provide up-to-date

information to visitors. At a workshop in June 2002, transportation and national park experts agreed that the four most important issues with possible ITS solutions are: 1) provide driver information about roadway conditions to alleviate congestion; 2) provide information that allows visitors to make informed decisions about transit; 3) provide accurate, real-time information such as traffic, weather, and park conditions (e.g. openings and closings); and 4) use information systems to direct visitors to less congested areas (Volpe National Transportation Systems Center 2001). Furthermore, in addition to improving transportation safety and efficiency, ITS is intended to “enhance the visitor experience and contribute to the preservation of park resources” (Plosky et al. 2001).

A study examining tourists’ use of ITS in the Branson, Missouri area and in northern Arizona (i.e. the Grand Canyon region) found several factors that affect the use of ITS (Clark 2000). The first factor, distance traveled, determined the type of information sought; general area information was obtained by those further away (often via the Internet) while detailed information (e.g. hotel and restaurant information) was more important to visitors once in the area. A second factor, previous experience in the area, had a varied effect. Repeat visitors to Branson had more knowledge of how to get around the area and avoid the congested times of day, while experienced northern Arizona visitors wanted information on new secondary sites. Both groups also expressed a need for information on the third factor, season and weather. Harsh winter weather in northern Arizona created the need for weather advisory and road condition updates, while peak season use (e.g. Christmas shopping) was a concern in the Branson area.

Changes in access to an area through route changes, changes in information available to the public or changes in the type of access allowed, may affect visitor behavior. An understanding of the types of visitors that travel to certain parks, as well as the way in which they plan their trips, is key to management’s ability to determine the most effective way to provide traveler information in order to manage access. Furthermore, a summary of the National Workshop to Develop an Intelligent Transportation Systems Strategy for the National Park Service identified differing needs for various park types. Urban park representatives emphasized the need for in-park transit information, rural park representatives

cited the need for initial trip planning information (e.g. is the park closed), and parkways representatives believed that their goal of fast, efficient travel could be best met by a travel information system that focused on roadway incidents and congestion (Volpe National Transportation Systems Center 2001).

2.2 Attitude Based Theories

Attitudes have long been considered to influence behavior. Early definitions of attitude include “the affect for or against a psychological object” (Thurstone 1931), and “an implicit, drive producing response considered socially significant in the individual’s society” (Doob 1967). Critical to the early literature was the belief that attitudes were learned; therefore, motivation and perception must be considered relevant to the concept (Doob 1967). The expectancy-value models expanded on this, stating that attitude toward an object is drawn from an individual’s salient beliefs, which are a function of the tendency to form beliefs about and evaluate the object’s attributes (Ajzen & Fishbein 1980). These models also emphasized that two individuals can share the same attitude about an object, but behave differently as a result of differing evaluations of the consequences of performing the behavior. Alternatively, two individuals may share the same evaluation of behavioral consequences, but not share the same attitude toward that behavior (p. 67). Lawler (1973) stated that there are two things that must be known in order to predict possible behavioral choices: 1) the general classes or groups of outcomes that people find desirable or undesirable; and 2) the factors that influence the desirability of outcomes. He also maintained that some of the variables that may influence expectations are past experience, communication with others, the situation at hand, and personality. Understanding attitudes can provide a dual use for managers: a source of information to help guide managers and a social control tool that provides managers the ability to target attitudes that cause undesirable behaviors (Heberlein 1973).

The theory of planned behavior has also been utilized in studies regarding the adoption of technology. Klobas and Clyde (2000) attempted to determine what factors were important when measuring intent to use the Internet. Attitudes were an important factor, particularly as the acceptance of the Internet “as part of the future” outweighed perceived barriers to use (p. 32). A study that focused on the acceptance of technology by physicians

found that attitudes and perceived behavioral control were important determinants (Hu & Chau 1999). In this study, attitudes were measured as “positive or preferential attitudes toward use of telemedicine technology” (p. 29). Perceived behavioral control was measured as the perceived availability of training and access to telemedicine technology.

3.0 Methodology

The research team included the Western Transportation Institute, Texas Transportation Institute, California Department of Transportation, and the Recreation, Park & Tourism Administration Department at Texas A&M University. The research team held several meetings with stakeholder groups in California, including representatives from the National Park Service, USDA Forest Service, chambers of commerce, city transportation and safety experts, and park users in the San Francisco Area. As a result of these meetings, Golden Gate National Recreation Area (GOGA) and Sequoia and Kings Canyon National Parks (SEKI) were chosen by the research team as the study parks. Golden Gate National Recreation Area is one of the largest urban parks in the world and, with nearly 14 million visitors per year, is the most popular park within the national park system. The park is located on two peninsulas between the Pacific Ocean and San Francisco Bay in western California, and is linked by the Golden Gate Bridge.

Sequoia and Kings Canyon National Parks are located in central California on the eastern side of the San Joaquin Valley in the Sierra Nevada Mountains. Fresno and Visalia are the two principal cities located nearest the Park entrances, with Squaw Valley and Three Rivers serving as the gateway communities. Encompassing nearly 900,000 acres, SEKI contains a variety of natural features including sequoia groves, glacial canyons, rugged mountain terrain, and numerous caverns.

Visitors were surveyed at each park during the weeks of March 10-16, May 19-25, and July 14-20, 2002. The March survey was used as a pilot study to check the validity of the questionnaire. The survey team intercepted every *n*th visitor at various locations in the parks to obtain a random sample of park visitors. Contact locations (i.e. visitor centers, parking lots, museums) were rotated in an attempt to reach a random, yet widespread, population. A brief on-site survey was completed by each contact, who was then given a mail-back survey to

return after their visit to the park. Nonresponse bias was checked by comparing the on-site survey items between the respondents and non-respondents. A modified Dillman approach was employed for each survey round. This approach endorses repeated follow-up with the contacted park visitors. First, a postcard reminder was mailed two weeks after the end of each survey distribution period. Secondly, a follow-up letter with a copy of the survey was mailed 2 weeks following the mailing of the postcard reminder.

The comprehensive study addressed traditional (e.g. tour books), alternative (e.g. shuttles) and intelligent transportation and travel planning tools. Visitors were asked a wide range of questions that addressed their experience with national parks, the study parks, and technology. Their attitudes towards and intent to use traditional, alternative and intelligent travel planning tools were also addressed. As stated earlier, the focus of this paper is on intelligent transportation tools. Attitudes toward transportation and travel planning tools in national parks were measured using an appropriateness scale. This was a five-point Likert scale ranging from inappropriate to appropriate. Respondents were asked to indicate how appropriate they believed each transportation and travel planning tool was for use in national parks (e.g. optional shuttle in park, tour book, PDA). Next, behavioral intent was addressed by asking respondents to rate how likely they were to use each of the media forms (e.g. tour book, GPS) and transportation modes (e.g. public bus, free shuttle) before arriving at the study parks (either before leaving home or en-route), and while at the study parks. This scale ranged from “not at all likely” to “very likely.”

Multiple regression analysis was utilized to determine which predictor variables best explain the dependent variables: attitude and intention (Stevens 1996). The predictor items included external (e.g. past and current behavior) and internal (e.g. perceived conditions) antecedent variables. This type of analysis has been used to discern the strongest predictor variables in previous studies regarding attitudes (Ajzen & Driver 1992) and motivations (Lee et al. 2002).

4.0 Results

A total of 687 fully deliverable surveys were distributed at SEKI in May and July; 454 were returned for a response rate of 66.1 percent. At GOGA, a total of

Table 1.—Factor Analysis of Appropriateness in National Park Items Used to Measure Attitude

	Factor Loading	Eigen-value	Variance Explained	Alpha
Traditional Electronic Media ($M^1 = 3.9$)	----	4.46	27.90	.86
Commercial Radio	.844			
Information Radio	.771			
Commercial TV	.766			
Park video	.765			
NPS radio	.733			
Electronic Signs ($M^1 = 3.3$)	----	1.75	10.96	.88
EMS on parks roads	.915			
EMS in parking lots	.903			
Traditional ($M^1 = 4.7$)	----	1.45	9.07	.53
Talk to ranger at park	.676			
Visitor center info kiosks	.674			
Tour book	.616			
Optional shuttle in park	.542			
Alternative Transportation ($M^1 = 3.3$)	----	1.40	8.74	.61
Park and Bike	.793			
Mandatory shuttle in park	.769			
Public bus to park	.587			
Technology ($M^1 = 3.0$)	----	1.14	7.10	.57
Internet terminal in park	.856			
PDA	.770			

¹Mean scores based on scale of 1 -5 with 1 equaling inappropriate and 5 equaling appropriate.

368 fully deliverable surveys were distributed; 206 were returned for a response rate of 56.0 %. Overall, 48.7% of respondents were males and 51.3% were female. The overwhelming majority (90.6%) was white, and most respondents (69.4%) were between 35 and 64 years of age. Additionally, the majority was employed full-time (53.5%), although the next largest group was the retirees (21.4%). While 26.5% of SEKI respondents were retired, only 10.7% of GOGA respondents were retired. The majority of respondents (68.5%) also had at least a college degree. Most respondents earned over \$40,000 per year; only 12.6% earned less. The respondents also included a large percentage of repeat visitors; over 38% had made one or more additional visits to the respective study parks during the previous year. Moreover, while 40.0% of respondents had visited three or fewer national parks during the preceding five years, 37.4% had visited seven or more national parks during that time.

A principal components factor analysis with Varimax rotation was conducted on the items included in

the appropriateness scale to reduce the variables into underlying factors (Gall et al. 1999). A Varimax rotation with Kaiser Normalization is the extraction method recommended by Stevens (1996). This method ensures that the resulting factors are uncorrelated and better enables interpretation of the factors. The result factors explained 65.39 percent of the variance (Table 1). These factors were traditional electronic media, electronic signs, traditional tools, alternative transportation, and technology. For the purposes of this paper, only the ITS items (e.g. technology, electronic signs) will be discussed.

Intent to behave was operationalized in a “likely to” scale. This five-point scale (1 = not at all likely, 5 = very likely) asked respondents to rate how likely they were to use each item while they were at the study parks. The principal components factor analysis with Varimax rotation revealed six factors that explained 70.85% of the variance. These six factors represented alternative transportation, kiosks, technology, TV and radio, EMS/HAR and traditional travel planning tools. As the focus

in this paper is on ITS, there are two factors of concern here, technology and EMS/HAR (electronic message signs and highway advisory radio).

There were several key findings derived from this study. The first was that attitudes regarding the appropriateness of ITS tools were predictive of the two ITS intention domains, technology and EMS/HAR. The technology intent factor included likelihood of using a park web site, other web site, current Internet, and PDA devices at the study parks. The EMS/HAR factor included electronic message signs and highway advisory radio at the study parks. Second, past experience with technology (as an individual independent variable) was related to attitudes toward technology in national parks. This supports the hypothesis that those with higher levels of experience with technology will assign a higher level of appropriateness to technology in national parks. Moreover, technology experience was also predictive of visitors' intentions to use technology (e.g. the Internet) at the study parks. Third, park type was predictive of the intent to use EMS/HAR tools at the study parks; furthermore, it was more likely at the rural park (SEKI) than the urban park (GOGA). Finally, one demographic, age, was predictive of the likelihood of using technology (e.g. the Internet) at the parks. There was an inverse relationship between intent to use the Internet and age.

5.0 Discussion

The strength of the relationship between attitudes and intentions, particularly in regard to technology, supports the literature and provides an insight to the potential use of these tools in the study parks. The relationship between experience with technology and both attitude toward and intent to use this technology at the study parks adds weight to this potential of these tools, particularly in the long term. Those with the highest level of experience with technology tended to be younger; 67% of "high tech" respondents were under 50 years of age. Alternatively, 69% of "low tech" respondents were over 50. As the population continues to age, the portion of the population that is not technologically savvy will continue to decline; technology such as PDAs, cell phones and the Internet are pervasive in society, particularly among the younger generation many of whom do not remember a world without these tools.

The greater likelihood that electronic signs and highway advisory radio would be used at the rural park (SEKI)

rather than the urban park (GOGA) may have been related to external variables such as weather. While these two tools are more common in urban areas, snowstorms and road closings in Sequoia and Kings Canyon National Parks during the study may have influenced visitors' responses. Additionally, there is a highway advisory radio notice sign near the south entrance of SEKI. However, several respondents noted that the radio signal was not effective in the mountains, and, therefore, not particularly useful. While highway advisory radio has been in use much longer than most ITS tools, it is part of an integrated ITS system. Further study is needed to determine the potential effectiveness of this tool as part of this system.

Given the rapidly increasing uses of technology in society in general (e.g. cell phones with cameras and text messaging), it is likely that these tools will find their way into the national parks. The greater acceptance of these tools by the younger generations indicates that the use of these tools will become increasingly common over time. The way that these tools are used in the parks is dependent on both the ITS systems provided by park management and continued developments in technology. The use of electronic signs to advise visitors of open parking areas, road closures and other transportation access issues can improve the visitor experience by reducing time spent searching for a parking space and providing more up-to-date information regarding weather conditions. As stated above, directing visitors to less congested areas, the ability of the visitor to make informed decisions and the provision of accurate, real-time information are some of the most important issues that ITS is intended to address. Therefore, use of these tools by visitors is necessary to have a successfully integrated system. The visitor attitudes toward and willingness to use these tools as demonstrated in this study suggest that these tools have the potential to provide low impact solutions to congestion and crowding in the study parks.

6.0 Citations

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