5-2012

From Automobiles to Alternatives: Applying Attitude Theory and Information Technologies to Increase Shuttle Use at Rocky Mountain National Park

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FROM AUTOMOBILES TO ALTERNATIVES: APPLYING ATTITUDE THEORY AND INFORMATION TECHNOLOGIES TO INCREASE SHUTTLE USE AT ROCKY MOUNTAIN NATIONAL PARK

By

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B.S. Western Michigan University, 2009

A THESIS

Submitted in Partial Fulfillment of the

Requirements for the Degree of

Master of Science

(in Forest Resources)

The Graduate School

The University of Maine

May, 2012

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THESIS ACCEPTANCE STATEMENT

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Dr. John Daigle, Associate Professor of Forest Resources, April 17, 2012

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By Kourtney Kristen Collum

Thesis Advisor: Dr. John Daigle

An Abstract of the Thesis Presented
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This thesis examines potential strategies for increasing voluntary shuttle use at Rocky Mountain National Park (ROMO) and the gateway community of Estes Park, Colorado. The first chapter of this two-part study evaluates the impact of a pilot intelligent transportation system (ITS) on visitor awareness and use of shuttles during the summer of 2011. Two forms of ITS, dynamic message signs (DMS) and highway advisory radio (HAR), were evaluated. Specifically, the ITS was meant to influence day-visitors to park at a new park-and-ride lot just east of Estes Park where they could then board a connector shuttle and transfer to any of four shuttle routes servicing the town and park. Surveys were administered onboard the park-and-ride shuttle (N = 68) and at two locations in downtown Estes Park (N = 490). Our analysis revealed that the DMS contributed to increased awareness of the shuttles. However, the HAR did not contribute substantially to awareness or use of the visitor shuttles. Our analysis offers additional recommendations for increasing voluntary shuttle use, such as providing direct routes

between the park-and-ride and popular park attractions. The results of this study demonstrate the utility of ITS as a transportation management tool in a national park setting, but also highlight the importance of selecting appropriate technologies that meet the needs of park visitors.

The second chapter explores strategies for optimizing the use of ITS by applying the theory of planned behavior (Ajzen, 1991) to identify the beliefs that inform choice of travel mode among ROMO and Estes Park visitors. Using results of a mail survey (N = 222), the theory of planned behavior was applied to the prediction of intention and use of visitor shuttles. Perceived behavioral control was found to have a significant influence on intention to use shuttles. Past experience with park shuttles was tested as an additional predictor of behavior and shown to significantly improve the prediction of shuttle use. Past experience with public transit was also added to the model, but with no significant contribution, thereby demonstrating the inherent difference between travel behaviors in everyday settings as opposed to recreation settings. These results were then coupled with segmentation analysis to identify unique segments of visitors. The segments were statistically similar in terms of demographic characteristics, yet heterogeneous in their attitudes, subjective norms, and perceived control regarding shuttle use. Of the three segments identified, *Bus Backers* were found to hold the most positive beliefs about shuttles and *Potential Mode-shifters* were identified as the segment offering the most potential for mode change due to their neutral attitudes and beliefs. Strategies were identified to maintain and improve use of shuttles among these segments. Our study broadens the application of segmentation analysis to transportation in a park setting and demonstrates its important contribution.

ACKNOWLEDGMENTS

I would like to thank my advisor, Dr. John Daigle, for guiding me in my graduate studies and for empowering me to grow from a student to a colleague. His encouragement and faith in my ability afforded me an exceptional level of professional involvement while at UMaine. I would like to thank my other committee members, Dr. Laura Lindenfeld and Dr. Mario Teisl, for offering me their knowledge, insight and advocacy. Their optimism never failed to give me a renewed sense of confidence in my abilities. Additional thanks to Dr. Jessica Leahy for her advice throughout my studies and for helping me with analysis for my second chapter. Also, thank you to Dr. Robert Wagner for writing me countless letters of recommendation.

I must also thank the staff at the Paul S. Sarbanes Transit in Parks Technical Assistance Center (TRIPTAC) for giving me the opportunity to work with federal land management agencies throughout the country, particularly Natalie Villwock-Witte for her leadership on the ROMO ITS pilot study. Also, thank you to the great people at ROMO and the Town of Estes Park and to all the volunteers who helped with the project.

I would like to thank the graduate students of Nutting Hall for offering their eyes, ears and hands on numerous projects, as well as their friendship.

Most of all, I want to thank my family. They have taught me to live with passion and purpose. Their love and support continually gives me the strength to pursue my goals. And finally, I must thank Patrick, my unanticipated reward of graduate school. Your friendship and humor keep me happy and healthy. You are my best love.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

ATS	Alternative Transportation System
CVB	Estes Park Convention and Visitor's Bureau
DMS	Dynamic Message Sign
HAR	Highway Advisory Radio
ITS	Intelligent Transportation System
NPS	National Park Service
ROMO	Rocky Mountain National Park

CHAPTER 1

EXPLORING THE UTILITY OF AN INTELLIGENT TRANSPORTATION SYSTEM TO ENCOURAGE SHUTTLE USE AT ROCKY MOUNTAIN NATIONAL PARK

Introduction

> "Transportation is an integral, defining feature of the national park experience, and a means by which the park mission of protecting resources for the enjoyment of future generations can be realized." – The National Park Service Transportation Planning Guidebook (1999)

Transportation management has emerged as a premier issue facing land managers in America's national parks, wildlife refuges, national forests, and other public lands (Daigle, 2008; Dilsaver & Wyckoff, 1999; White, 2007). Public lands are experiencing substantial increases in visitation which has led to increased traffic congestion, wildlife habitat degradation and air and noise pollution. Traffic congestion and continual infrastructural development for automobile traffic are two of the most critical issues presently challenging federal land managers. (Dilsaver & Wyckoff, 1999).

Without transportation systems sufficient to support a growing user population, many recreation areas are experiencing not only diminished resources, but declining visitor satisfaction. Included in the mission of the National Park Service (NPS) is the directive to manage resources so as to provide enjoyment while meeting the needs of

future generations of Americans. This directive is not only a key component of the agency's mission, but vital to the survival of federal lands, as it is the passion of Americans and their connections to these areas that creates a national incentive to manage and protect them (Louter, 2006).

Over the last four decades several parks, wildlife refuges and national forests have attempted to address crowding, congestion and resource degradation by implementing **alternative transportation systems** (ATS) which combine various travel modes such as bicycles, buses and hiking trails in order to reduce visitor reliance on private automobiles. ATS have been successfully implemented at parks across the nation, but there is a need to promote these systems and convince visitors to switch from the car to other available modes. An emerging strategy is to employ **intelligent transportation systems** (ITS), an approach to transportation management that uses information technologies to provide visitors with relevant and real-time traffic information.

This study explores the utility of two forms of ITS, **dynamic message signs** and **highway advisory radio**, as tools for encouraging shuttle use at Rocky Mountain National Park and the gateway community of Estes Park, Colorado. The objectives of this study are to:

1. Examine the individual utility of DMS and HAR as components of an ITS at Rocky Mountain National Park and Estes Park.
2. Determine the extent to which the combined ITS influenced visitors' choice of travel mode at Rocky Mountain National Park and Estes Park during the summer of 2011.

The United States has seen a shift in both public and private sector transportation over the last century, from infrastructure growth to infrastructure management. ITS that provide real-time traveler information will help bring transit specific to federal lands one step further, moving it into the realm of management that focuses on visitor satisfaction. Transit systems that are designed with visitor needs and preferences in mind will not only provide for more enjoyable recreation experiences, but will offer a competitive product in the global economy and ensure that federally managed tourism remains a viable industry.

Literature Review

Historical Context of Automobiles in Parks

The modern day national park, and particularly the national park 'experience,' is inextricably linked to the automobile (Louter, 2006; Sutter, 2002). In 1908, Mount Rainier National Park became the first park in the United States to officially admit automobiles (Louter, 2006). This event occurred eight years before the National Park Service (NPS) was officially established by congress (Dilsaver & Wyckoff, 1999).

As nature tourism began to flourish in the United States in the early part of the twentieth century, visitors flooded to parks such as Yellowstone, Yosemite and Mount Rainier by way of railroad, wagons, and travel by horse and foot (Louter, 2006; Youngs, White, & Wodrich, 2008). But these modes of transportation were relatively short lived. The construction of the interstate highway system and the growing affordability of the automobile moved auto tourism from the realm of the wealthy to the realm of the middle

class (Shaffer, 2001). The freedom and control afforded by the automobile had powerful implications for nature tourism; specifically, it gave strength to grassroots movements dedicated to establishing more national parks and protected lands, initiated the rise of auto tourism and the joining of government and private industry to meet public demand for recreation opportunities, and launched the rapid movement of highways into the heart of America's most sublime landscapes (Louter, 2006; Shaffer, 2001; Sutter, 2002).

Several researchers have examined the impact of the automobile on the national park experience, emphasizing the influence on park design and infrastructure (Colten & Dilsaver, 2005; Dilsaver & Wyckoff, 1999; Hallo & Manning, 2009; Louter, 2006; Youngs, et al., 2008). Dilsaver and Wyckoff (1999) exposed the deleterious ramifications of automobile infrastructure, describing the NPS approach to transportation management as a "process of cumulative causation," a type of positive feedback loop where each infrastructural addition encourages additional use which in turn requires additional infrastructure. Louter (2006) documented the changing aesthetics of national parks since the beginning of the twentieth century as a result of shifting attitudes toward automobiles. Using case studies of Mt. Rainier, Olympic, and North Cascades National Parks, he highlighted three distinct phases of landscape design employed by the National Park Service; roads running through, roads designed to travel around, and roads built completely outside of designated wilderness areas.

Currently, we are seeing a further shift in transportation management from infrastructure growth to infrastructure management. This current approach places emphasis on providing alternatives to travel by private automobile. The goal of this new

paradigm is to reduce the harmful effects of automobiles on park resources while maintaining or improving the level of visitor satisfaction.

Legislation in Support of Alternatives

Several pieces of legislation have been enacted to address transportation issues in and around public lands beginning in 1991 with the Intermodal Surface Transportation Efficiency Act (ISTEA; 1991) which served as a catalyst for transportation research, planning, and implementation (Daigle, 2008). In 1997, the Departments of Transportation and Interior (the parent organization of the NPS) signed a Memorandum of Understanding, a formal agreement to jointly assess and address transportation needs in parks and other public lands (Daigle & Zimmerman, 2004a; G. Dilworth & Shafer, 2004). The following year, the Transportation Equity Act for the 21st Century (TEA-21) was passed which called for the formation of the Alternative Transportation Program within the NPS (Daigle, 2008).

More recently, the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU; 2005) was introduced. This legislation promotes more efficient and effective federal surface transportation programs and addresses transportation challenges such as improving safety, reducing traffic congestion, increasing intermodal connectivity and protecting natural resources (Daigle, 2008).

As demonstrated by the increase in legislation, the study of transportation within recreation and leisure settings is growing exponentially, with 1.2 billion federal dollars

dedicated to federal transit research and implementation via the SAFETEA-LU legislation in the first five years alone (Daigle, 2008). Moreover, included in the SAFETEA-LU legislation was the formation of the Paul S. Sarbanes Transit in Parks program (formerly the Alternative Transportation in Parks and Public Lands Program) (Turnbull, 2010). The Transit in Parks program provides technical assistance and funding for transportation planning and implementation projects in parks, wilderness areas, wildlife reserves and historic sites. In January of 2012, the Federal Transit Administration secured an additional 40.8 million dollars for 58 planning and implementation projects to be awarded by way of the Transit in Parks program (U.S. Department of Transportation, 2012). An implementation grant was awarded by the Transit in Parks program to fund the 2011 ITS pilot project at Rocky Mountain National Park, on which this study focuses.

Research on Alternative Transportation Systems

Alternative transportation refers to all modes of travel other than the private automobile, including bicycles, buses, trains, trams and hiking (White, 2007). For the purpose of this study, ATS refers to systems of transportation to, in and around public lands that combine alternatives in order to reduce visitor reliance on private automobiles.

The 2001-2005 NPS Strategic Plan lists ATS as a key strategy for protecting park resources while maintaining positive visitor experiences (National Park Service, 2000). This and other guidelines and legislation, as outlined above, have prompted federal land management agencies to design and implement ATS and subsequently researchers have

begun to explore the various components of the recreation experience that are affected by these transportation systems.

The majority of these studies have focused on visitor attitudes towards changes in existing transportation systems. Harrison (1975) was one of the first to do this by surveying visitors at Denali National Park regarding newly implemented restrictions on private automobiles. Cars were banned in certain areas within the park and a fare free shuttle bus was introduced. Contrary to expectations, 84% of those surveyed approved of the new policy. Though support for the new policy was relatively high across the board, respondents who utilized the bus service indicated stronger support of the policy than those who used a private automobile (Harrison, 1975). This suggests that if visitors can be influenced to try a shuttle, they may find it less of an inconvenience than previously anticipated and therefore show more support for such systems. Harrison stresses, however, that shuttles must offer amenities equal to those available via a private automobile or offer a unique service if they are to succeed as a competitive alternative.

By modeling visitor acceptance of a proposed shuttle system at Cades Cove in Great Smoky Mountains National Park, Sims et al. (2005) were able to explore the assumption that based on a historic perception of automobiles as the primary and best way to experience national parks, "the establishment of shuttle systems could potentially result in greater impact on visitor experience than that resulting from the increase in traffic congestion." The results of the study, however, revealed higher support for a mandatory shuttle system than managers had anticipated and showed that the value of

reduced traffic congestion to visitors was significant (Sims, Hodges, Fly, & Stephens, 2005).

White (2007) conducted an interpretive study of visitor attitudes towards the shuttle system at Yosemite National Park and concluded that visitors primarily value convenience and freedom when considering travel modes. White also observed that visitors using private automobiles at Yosemite used rationalization as a cognitive coping mechanism when confronted by congestion and crowding. In contrast, visitors using alternative transportation praised the alternatives for allowing them to "take their time, focus on their immediate surroundings, move at their own pace, and connect with the park and its natural and cultural surroundings in an environmentally-friendly way". These results suggest that visitors have similar values, such as freedom and convenience, though often disagree on what travel modes best suit these values (White, 2007).

A recent study used qualitative and quantitative methods to determine incentives and disincentives for day visitors to use a new park-and-ride facility at Acadia National Park (Holly, Hallo, Baldwin, & Mainella, 2010). The study found that the most important factors influencing visitors' use of shuttles were the length of wait for and frequency of shuttles. A management focus on increasing the frequency of shuttles was recommended, as well as focusing promotional efforts on first-time, out-of-state visitors. Advertisement of the environmental benefits of shuttle use was also suggested as a strategy for increasing ridership.

Given the complexity of the study of transportation systems as related to outdoor recreation, numerous information gaps exist (Daigle, 2008; Chris Strong, 1999; Turnbull,

2010). Researchers and managers generally agree that visitor experience is affected negatively by congestion, however, Young et al. (2008) suggests that "rather than being seen as an intrusion, visitors and park managers have come to view transportation systems as embedded components of the landscape that allow visitors to view wilderness while driving." Many studies corroborate this observation (Bishop, 1996; Featherstone, 2004; Louter, 2006; Waitt & Lane, 2007). This research suggests that motorized transportation is an essential component of the recreation experience, but it does not provide solutions for the crowding, congestion and resource degradation caused by excessive automobile use.

The current trend in the field is towards exploring the utility of information technologies to improve transit systems, thereby providing sustainable transportation options that enhance, rather than detract from, the park experience. It is widely understood that this shift to alternative transportation requires a "reorientation" of the way visitor's access and experience national parks (Dilsaver & Wyckoff, 1999; Sims, et al., 2005; White, 2007). While this is no easy task, the key to the solution may lie in intelligent transportation systems.

Emergence of Intelligent Transportation Systems

It has been argued that our mass cultural acceptance of automobiles in parks is rooted in the belief that technology and nature can be mutually beneficial (Louter, 2006), though until recently this belief has not often come to fruition. Intelligent transportation systems (ITS) are an attempt to make this belief a reality, by using information

technologies to reduce the negative impact of automobiles through dissemination of traveler information. Technology is an ever-growing part of society and it is likely that technological tools such as ITS will continue to gain popularity in national parks and public land settings (Dilworth & Shafer, 2004).

ITS technologies are designed to provide traveler information to visitors by applying information technologies to transportation management (Sheldon, 1997). There are a wide array of information technologies now associated with ITS. The most common technologies used for discretionary tourism purposes include route guidance systems, highway advisory radio, electronic message signs, global positioning systems, automated onboard annunciators, and two-way voice communication (Daigle & Zimmerman, 2004b; Sheldon, 1997).

Transportation experts and national park managers have identified four ITS applications that offer the most valuable solutions to auto-related problems: 1) provide traveler information about road conditions so as to reduce congestion; 2) provide relevant information about transit options so that visitors can make informed decisions; 3) provide real-time information on weather, traffic and parking lot conditions; and 4) direct visitors to areas with less congestion (G. Dilworth & Shafer, 2004).

Technologies designed to address these key areas have been tested at Acadia, Kings Canyon, Sequoia, Grand Canyon and Arches National Parks, among others (Daigle & Zimmerman, 2004a, 2004b; G. Dilworth & Shafer, 2004; Lawson, Manning, Valliere, & Wang, 2003; Christopher Strong, Eidswick, & Turner, 2007). A study of two park units in California showed that visitors reported willingness to use two ITS technologies,

electronic message signs (EMS) and highway advisory radio (HAR), to access information about road closures and parking and weather conditions (G. Dilworth & Shafer, 2004). At Grand Canyon National Park, EMS and HAR were also evaluated. Support vector regression analysis suggested that the two ITS technologies were responsible for a 30% increase in shuttle ridership (Ye, Albert, Eidswick, & Law, 2010).

ITS have also been tested in urban park settings. In an effort to improve visitor safety and inform motorists' decision-making, portable changeable message signs (PCMS) were installed at Golden Gate National Recreation Area in California. Using a combination of qualitative and quantitative methods, researchers were able to evaluate the influence of the signs. While visitor surveys indicated only small influences, traffic counts indicated a 12-14% reduction in traffic volumes on weekdays, and up to 19% on weekends. Overall, the PCMS appeared to have some positive influence on shuttle ridership, notwithstanding operations and maintenance challenges (Western Transportation Institute, 2007).

Despite these studies, park and recreation researchers have stated the need for additional transportation focused research (Daigle, 2008; Daigle & Zimmerman, 2004a; Dilsaver & Wyckoff, 1999; Sims, et al., 2005; White, 2007). While preliminary research reveals that ITS technologies are viable, further research is needed to determine what specific technologies are most effective for shifting visitors from private automobiles to alternatives. Research is also needed to identify the effectiveness of ITS given specific geographic areas, user groups, levels-of-use, and capital and resource constraints. The best technologies must be identified so that a switch in travel mode does not necessitate a

decrease in visitor experience. In a survey conducted at Acadia National Park, visitors reported that maintaining or improving the visitor experience should be seen "as the most important gauge of success for travel information technologies (Daigle & Zimmerman, 2004a)." Our research explores the utility of an ITS to increase shuttle ridership between and within Rocky Mountain National Park and seeks to identify potential strategies for increasing awareness and use of shuttles.

Methodology

Study Site

Rocky Mountain National Park (ROMO) is the most visited park in Colorado and is challenged by consistently high visitation concentrated within the peak summer season. The months of June, July and August alone see more than half of ROMO's three million annual visitors (National Park Service). In the 1970's a fare-free visitor transportation system was established to help manage the influx of visitors. The shuttle service has since grown, with nearly half a million rides provided in 2010 (Villwock-Witte & Collum, 2012). Despite this, private automobiles remain the preferred mode choice by the majority of visitors. Symptoms of this high visitation rate include parking lots filled to capacity early in the day, traffic congestion within the park and pressure on natural and managerial resources. The issue is further exacerbated by bottlenecking at the parks primary access point, where two US highways and one state highway converge at one major intersection in downtown Estes Park (Rocky Mountain National Park, 2008).

The majority of the visitors that access ROMO via Estes Park are drawn to the Glacier Gorge and Bear Lake Trailheads. On the weekends during the peak summer season, the parking lots at these trailheads reach capacity by 8am and 10am respectively. Additional parking is located at the Bear Lake park-and-ride lot, where visitors can leave their car and take a free shuttle to Glacier Gorge or Bear Lake; however, this lot also reaches capacity on summer weekends by as early as 11:30am (Villwock-Witte, Ye, Eidswick, & Albert, 2011).

To address these issues, a planning study was funded through a 2010 Paul S. Sarbanes Transit in Parks Program grant to explore potential mitigation strategies. The proposed solution was to implement a pilot ITS to direct day visitors to a new park-and-ride lot located just east of downtown Estes Park by the community fairgrounds, where visitors then boarded a shuttle (the Silver Route) which provided a five minute ride to the Estes Park Convention and Visitors Bureau (CVB). Once at the CVB, visitors could gather information for their trip and transfer to any of four shuttle routes servicing Estes Park and ROMO. The Silver Route made the trip between the park-and-ride and the CVB every 15 minutes from 10am until 10pm daily from June 25th through September 11th.

The ITS

The ITS was comprised of highway advisory radio (HAR) and dynamic message signs (DMS) and was pilot tested from July 15th until August 30th, 2011. DMS are meant to display short, concise messages to passing motorists, while the HAR can broadcast longer messages on a continuous loop. Four DMS were strategically positioned along

U.S. Highway 36 on the approach to Estes Park. Preapproved messages were developed by the Transit in Parks technical liaison staff and appeared on the DMS to warn approaching visitors of the status of parking within ROMO. On a daily basis, once parking lots reached capacity, messages were displayed to inform visitors that the Bear Lake lot was full and to recommend use of the eastern park-and-ride lot and the Silver Route shuttle. The DMS also displayed the station number for the HAR, which contained a recorded message about travel conditions, parking, and shuttle services. The messages that were presented on the DMS are provided in Table 1.1. The full HAR message is provided in the Appendix.

Table 1.1. Dynamic Message Sign Message Sets

BEAR LK PARKING LIMITED	PARK AND RIDE IN ESTES	TUNE TO AM 1630
BEAR LK PARKING LIMITED	FREE VISITORS SHUTTLE	TUNE TO AM 1630
PARK AND RIDE IN ESTES	SHUTTLE TO RKY MTN	TUNE TO AM 1630
PARK AND RIDE AT FAIRGRDS	FREE VISITORS SHUTTLE	TUNE TO AM 1630
RKY MTN ESTES PK INFO	FREE VISITORS SHUTTLE	TUNE TO AM 1630
PARK AND RIDE IN ESTES	NEXT LEFT	
PARK AND RIDE AT FAIRGRDS	FREE VISITORS SHUTTLE	NEXT LEFT

Study Design and Sampling Procedures

On-site surveys were conducted on fourteen consecutive days between July and August 2011. These dates were selected to overlap with peak visitation and ITS operations. It is customary in recreation research to use multi-stage cluster sampling to assign the day of week and time of day for data collection. However, due to the nature of the pilot study and given time and resource constraints, data were collected for the entirety of the fourteen day period so as to obtain as much data as possible.

Two questionnaires were developed for this study in collaboration with the Paul S. Sarbanes Transit in Parks Technical Assistance Center (TRIPTAC) and project stakeholders provided iterative feedback during the design process. The two questionnaire versions included a *shuttle* survey and an intercept *visitor* survey. The *shuttle survey* was distributed onboard the Silver Route shuttle as it returned to the park-and-ride lot from the CVB. Several people rode the shuttles on multiple days but were only allowed to complete the survey once during the survey period.

The *visitor survey* was used to capture visitors who did not use the Silver Route shuttle, including non-riders and visitors who were influenced by the ITS to use visitor shuttles but who chose to board at the CVB rather than the park-and-ride lot. The visitor survey was distributed at two locations: the CVB and Bond Park, a small community park located in downtown Estes Park. Random assignment was used to determine where surveying would occur on each day of the surveying period, with the intention of collecting surveys from each location equally. However, due to weather conditions,

surveying had to be moved to the CVB mid-day on five occasions because Bond Park lacked rain cover.

For both the *shuttle* and *visitor* survey, data collection personnel followed a script approved by the University of Maine Institutional Review Board for the Protection of Human Subjects. Data collection personnel approached every n^{th} group at the CVB and Bond Park, and every group onboard the shuttle, and briefly introduced the study. Groups were told that participation was voluntary and all responses confidential. One adult (18 or older) from each party was then invited to complete a survey and return it to the data collection team member when finished. Data collection personnel recorded observational information for parties that refused to participate including gender, party size, and presence of children.

The surveys were designed to be completed in 5 minutes or less so as to limit the burden on visitors. All respondents were provided with a laminated photograph of the DMS, as well as a map of the locations of the DMS and HAR, to ensure that they understood all questions pertaining to the ITS.

Questionnaires

The *shuttle* and *visitor survey* questionnaires consisted of fourteen fixed scale and close-ended questions, many of which were multi-part. These two surveys were identical with the exception of one question. For the *shuttle survey*, this question asked respondents to evaluate twelve positive and negative statements related to the shuttle

service, including ‘the shuttle is easy to use’ and ‘the shuttle does not have sufficient room for my gear.’ For the *visitor survey*, this question asked visitors to evaluate nine statements which represented possible reasons why they did not use the Silver Route shuttle, such as ‘I was not aware of the shuttle’ and ‘the shuttle does not run frequently enough for my needs.’ These questions were derived from a review of previous transportation studies (Daigle & Zimmerman, 2004b; Holly, et al., 2010) and measured on a 5-point bipolar Likert scale from *strongly agree* to *strongly disagree*.

The other thirteen questions on the surveys pertained to overall experience, travel experience, route used to arrive to the area, awareness and use of the DMS and HAR, evaluation of the HAR, and information about other shuttles used and sources of information about those shuttles. Demographic information including gender, zip code, country of origin and number of people in party was gathered to help determine the representativeness of those sampled.

The questionnaires were pilot tested in Estes Park on one day in June of 2011, both on-board the Silver Route shuttle and at the CVB. Based on feedback and observations from the pilot test, it was determined that far more local residents and seasonal employees were using the Silver Route than anticipated. Therefore, a question was added to the shuttle survey questionnaire which asked respondents to indicate whether they were *visitors*, *seasonal residents*, or *fulltime residents*.

Data Analysis

Survey data were entered into Excel 2010 and then analyzed using SPSS 16.0. Descriptive statistics were examined, including mean, standard deviation, frequency and variance. Differences between shuttle-users and non-users were analyzed with Pearson's chi-square test of independence. The critical *p*-value used for all statistical tests was .05 (Vaske, 2008).

Results

Response Rate and Bias

A total of 68 *shuttle* surveys were collected, for a response rate of 81.9 percent. This small sample size can be attributed to the low ridership of the Silver Route shuttle in its first year of operation. A total of 490 *visitor* surveys were collected, for a 61.1 percent response rate.

To measure on-site nonresponse bias, Pearson chi-square (X^2) was used to compare non-respondents to respondents on gender, party size and presence of children (whether the party interviewed included any children under the age of five). For the *shuttle* survey, respondents did not differ significantly from non-respondents on gender (X^2=1.022, 1 df, p=.312), party size (X^2=6.732, 7 df, p=.457), or presence of children (X^2=1.017, 1 df, p=.313).

For *visitor* survey respondents, no significant differences were found between respondents and non-respondents on gender (X^2=.679, 1 df, p=.410). However, in terms

of group size, a significantly higher proportion of non-respondents were traveling alone or as a couple (X^2=33.271, 20 df, p =.032). Also, individuals traveling with children under the age of five were less likely to participate in the study (X^2=27.347, 1 df, p <.01). Non-response bias was also considered by sample location, as the visitor survey was administered in two different locations in Estes Park (the CVB and Bond Park). Location was found to have no significant impact on visitors willingness to participate in the study (X^2=3.587, 1 df, p=.058).

Characteristics of Respondents

Shuttle survey respondents were predominately return visitors (62%). Day visitors and overnight visitors accounted for 38% and 27% respectively, while 13% were seasonal residents (staying more than 45 days) and 22% were fulltime residents. The percentage of seasonal and fulltime residents was much higher than anticipated, as it was assumed that primarily day visitors would use the Silver Route shuttle. However, a number of local employees utilized the shuttle to get to work. For day visitors, the mean length of stay was 6.4 hours, while overnight visitors stayed an average of 6.4 days. Approximately half (49%) of the respondents were visiting from in-state, while 34% were out-of-state visitors and 16% were international visitors. The higher percentage of international visitors can be attributed to use of the shuttle by international students who were working in the area for the summer. A slightly higher proportion of males (54%) responded than females (46%), and the mean group size was 2.4 people (Table 1.2).

Table 1.2. Characteristics of Shuttle Survey Respondents

Characteristics	*N*	*%*
Gender		
Male	37	54.4
Female	31	45.6
Experience		
First time visitor	26	38.2
Return visitor	42	61.8
Number of people in party		
Mean	2.4	
Origin		
In-state	33	49.3
Out-of-state	23	34.3
International	11	16.4
Length of stay		
Day visitor	26	38.2
Overnight visitor	18	26.5
Seasonal resident	9	13.2
Fulltime resident	15	22.1

Among *visitor* survey respondents, 57% were return visitors and 51% were males. Respondents were predominately overnight visitors (62%) and less than five percent were seasonal residents (1%) or fulltime residents (2%). The mean length of stay for day visitors was 5.9 hours. For overnight visitors, the mean length of stay was 4.5 days. Out-of-state visitors (64%) accounted for a higher proportion of respondents than among shuttle survey respondents, while the proportion of in-state (32%) and international (4%) visitors was much lower. The mean group size was 3.7 (Table 1.3).

Table 1.3. Characteristics of Visitor Survey Respondents

Characteristics	*N*	*%*
Gender		
Male	247	51.2
Female	235	48.8
Experience		
First time visitor	212	43.4
Return visitor	276	56.6
Number of people in party		
Mean	3.7	
Origin		
In-state	151	31.5
Out-of-state	308	64.1
International	21	4.4
Length of stay		
Day visitor	166	34.9
Overnight visitor	292	61.5
Seasonal resident	6	1.3
Fulltime resident	11	2.3

Awareness and Use of ITS Components

Two U.S. highways and one state highway approach Estes Park from the east, however, for the purpose of the pilot study, the dynamic message signs (DMS) and highway advisory radio (HAR) were only placed on one highway: U.S. Highway 36. The project partners selected this highway for the pilot study because of its accessibility to the newly constructed park-and-ride lot. To ensure that our evaluation of the ITS considers only those respondents who had the opportunity to see the DMS and tune-in to the HAR, all respondents were asked to indicate which route they used to arrive to the area at the time they completed the survey. In total, 73% of *shuttle* survey respondents and 61% of *visitor* survey respondents reported that they arrived to the area via U.S. Highway 36 (Table 1.4).

Table 1.4. Route Used to Arrive in Estes Park/ROMO

	Shuttle Survey Respondents		*Visitor Survey Respondents*	
Route	*N*	*%*	*N*	*%*
U.S. Highway 36	46	73.0	295	60.6
U.S. Highway 34	7	11.1	143	29.4
Colorado State Highway 7	1	1.6	21	4.3
Other	9	14.3	28	5.7

Note: Respondents who listed "other" indicated that they accessed ROMO from the west entrance or lived near the shuttle stop.

Of the *shuttle* survey respondents who arrived to the area via U.S. Highway 36, 80% (N=35) indicated that they saw a DMS. Of those who saw a DMS, the majority (86%, N=30) reported that the DMS displayed a message prompting them to tune to the HAR, and 67% (N=20) of those prompted indicated that they did tune to the HAR (44% of those who approached on U.S. Highway 36).

In contrast, among the *visitor* survey respondents who arrived to the area by way of U.S. Highway 36, 65% (N=189) stated that they saw a DMS, and of those, 68% (N=120) reported that the DMS displayed a message prompting them to tune to the HAR. Of those who reported seeing a prompt for the HAR, 28% (N=34) indicated that they actually tuned to the HAR (12% of those who approached on U.S. Highway 36).

To evaluate the effect of the HAR on use of the park-and-ride and subsequently the Silver Route shuttle, respondents were asked to indicate their level of agreement with the statements "the information influenced me to use the park-and-ride". Among *shuttle* survey respondents who tuned to the HAR, 95% *somewhat agreed* or *strongly agreed* that the information influenced them to use the park-and-ride. Slightly more than half (57%) of the *visitor* survey respondents who tuned to the HAR agreed with this statement (Table

1.5). Caution should be used when interpreting these results, as such a small proportion of *visitor* survey respondents actually tuned to the HAR.

Table 1.5. Influence of the Highway Advisory Radio

	Shuttle Survey Respondents				*Visitor Survey Respondents*			
	Mean	*SD*	*Agree (N)*	*Agree (%)*	*Mean*	*SD*	*Agree (N)*	*Agree (%)*
The information on the HAR influenced me to use the park-and-ride	4.65	0.93	19	95.0	3.50	1.41	17	56.6

Note: Mean based on 5-point Likert scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). Responses of 4 and 5 were collapsed into the category "agree."

Evaluation of the Highway Advisory Radio

Visitors rated the HAR on a number of criteria, such as how accurate and useful the information was, whether the information saved them time and helped them get around or avoid traffic congestion, and whether they would use the information again. Overall, *shuttle* survey respondents indicated high levels of satisfaction with the HAR. All respondents (100%) who used and evaluated the highway advisory radio *strongly agreed or somewhat agreed* that the information was accurate. When asked if the information saved them time, 65% agreed, and 72% indicated that they were able to get around easier with the information. Similarly, 75% agreed that the information helped them avoid traffic congestion. A high proportion of users (89%) agreed that the information was useful to them, and 85% agreed that they planned to use the information if visiting again. Interestingly, 79% agreed that they needed more information, despite the

high levels of satisfaction with the information. Unfortunately, respondents provided little to no information in regards to the type of information they needed (Table 1.6).

Table 1.6. Evaluation of the Highway Advisory Radio

	Shuttle Survey Respondents				*Visitor Survey Respondents*			
	Mean	*SD*	*Agree (N)*	*Agree (%)*	*Mean*	*SD*	*Agree (N)*	*Agree (%)*
The information was accurate	4.74	0.45	19	100	4.34	0.72	25	86.2
The information saved me time	3.90	1.33	13	65.0	3.56	0.80	12	44.4
I was able to get around easier with the information	4.11	1.08	13	72.2	3.86	0.85	18	64.3
I would plan to use the information if visiting again	4.20	1.11	17	85.0	4.25	0.84	23	82.1
The information was useful to me	4.32	1.00	17	89.4	3.96	1.17	21	75.0
The information helped me avoid traffic congestion	4.00	1.21	15	75.0	3.52	0.85	12	44.4
I needed more information	3.93	1.21	11	78.6	3.76	1.26	11	52.4

Note: Mean based on 5-point Likert scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). Responses of 4 and 5 were collapsed into the category "agree."

Satisfaction with the HAR among *visitor* survey respondents was much lower. Though a high proportion of respondents (86%) agreed that the information was accurate, less than half (44%) agreed that the information saved them time and helped them avoid traffic congestion. A slightly high proportion (64%) agreed that they were able to get around easier with the information, and 75% agreed that the information was useful to them. Despite the lower satisfaction among respondents in some areas, 82% agreed that they would plan to use the information again. Just over half (52%) agreed that they needed more information (Table 1.6).

Evaluation of the Silver Route Shuttle

Shuttle survey respondents were asked to evaluate various components of the Silver Route shuttle. Overall, the respondents indicated high levels of satisfaction with the shuttle. When asked if they enjoyed their experience using the shuttle, 92% *strongly agreed or somewhat agreed*. In addition, 92% agreed that they would use the shuttle again. More than ninety percent of respondents agreed that the shuttle was convenient (95%) and easy to use (97%). Additionally, 79% agreed that the shuttle saved them time. Only 5% felt that the shuttle was confusing, and less than five percent felt that it was physically challenging for them or someone in their group to get on/off the shuttle (3%), that the shuttle did not have sufficient room for their gear (3%), and that it seemed difficult to travel with children on the shuttle (2%). However, 20% of respondents felt that they had to switch shuttles too many times to get to their desired destination, 14% said the shuttle does not run frequently enough for their needs, and 10% had trouble finding the shuttle schedule (Table 1.7).

Table 1.7. Evaluation of the Silver Route Shuttle

	Shuttle Survey Respondents			
	Mean	*SD*	*Agree (N)*	*Agree (%)*
The shuttle is convenient	4.71	0.62	55	94.8
I would use the shuttle again	4.68	0.91	58	91.9
The shuttle is easy to use	4.66	0.80	57	96.6
I enjoyed my experience using the shuttle	4.63	0.86	55	91.6
The shuttle saved me time	4.33	1.03	50	79.4
I had to switch shuttles too many times to get to my desired destination	2.14	1.21	12	20.3
The shuttle does not run frequently enough for my needs	2.05	1.18	8	13.7
It seems difficult to travel with children on the shuttle	1.76	0.95	1	2.0
I had trouble finding the shuttle schedule	1.74	1.16	6	10.4
The shuttle does not have sufficient room for my gear	1.66	0.93	2	3.4
The shuttle schedule is confusing	1.56	0.93	3	5.3
Getting on/off the shuttle is physically challenging for me or someone in my group	1.29	0.73	2	3.4

Note: Mean based on 5-point Likert scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). Responses of 4 and 5 were collapsed into the category "agree."

To gain further insight, *visitor* survey respondents were asked to indicate their level of agreement with a number of statements which presented possible reasons why they did not use the Silver Route shuttle. Seventy one percent (N=215) of respondents who provided a reason (or 44% of total *visitor* survey respondents) indicated that they were not aware of the Silver Route shuttle. Furthermore, because the park-and-ride was designed to provide an alternative for day visitors, the 62% of visitor survey respondents who were overnight visitors had no reason to use the Silver Route shuttle, as they could leave their vehicles at their lodging and board a shuttle from there. For those who were aware of the shuttle, written comments indicate that the majority were staying overnight and did not need the shuttle or were simply "not interested."

Sources of Information about Shuttles

Although the primary goal of the ITS was to encourage day visitors to use the new park-and-ride lot and subsequently the Silver Route shuttle, it was also expected that the ITS would increase awareness of all shuttle options among day visitors and overnight visitors alike. To evaluate this, respondents were asked to indicate how they learned about the shuttles. The most frequent source of information cited by *shuttle* survey respondents was the DMS; 41% indicated that they learned about the shuttles from this source. At 22%, the HAR was cited the second most frequently. Four information sources were used by less than five percent of *shuttle* survey respondents: hotel/lodge/campsite staff (5%), the Town of Estes Park website (3%), through employment with ROMO (2%) and through employment with a business in Estes Park (3%). No *shuttle* survey respondents reported that they learned about the shuttles from the ROMO website (Table 1.8).

Table 1.8. Sources of Information about Shuttles

	Shuttle Survey Respondents		*Visitor Survey Respondents*	
Information source	*N*	*%*	*N*	*%*
Dynamic message signs	27	41.5	85	20.1
Highway advisory radio	14	21.5	14	4.0
Family or friends	9	13.8	54	12.8
Visitor center staff	8	12.3	103	24.4
A newspaper articles	7	10.8	15	3.5
Previous visits	4	6.2	72	17.0
Hotel/lodge/campsite staff	3	4.6	35	8.3
The Town of Estes park website	2	3.1	16	3.8
Through employment with a business in Estes Park	2	3.1	6	1.4
Through my employment with ROMO	1	1.5	4	0.9
The ROMO website	0	0.0	43	10.2

Note: Totals amount to more than 100% as respondents were instructed to indicate all sources of information used.

Among visitor survey respondents, the most frequently cited source of information was visitor center staff, with 24% indicating that they learned about the shuttles for this source. The second most cited information source was the DMS (20%), followed closely by "previous visits" (17%). Less than five percent of *visitor* survey respondents indicated that they learned about the shuttles from the HAR (4%), a newspaper article (4%), the Town of Estes Park website (4%), through employment with ROMO (1%), and through employment with a business in Estes Park (1%) (Table 1.8).

Effect of Shuttle Use on Visitor Experience

Respondents of both the *shuttle* and *visitor* survey were asked to rate their overall experience visiting Estes Park and ROMO, as well as their overall travel experience (i.e. driving, navigating, and parking). Overall experience and travel experience were rated quite high by both survey groups.

Among *shuttle* survey respondents, 96% rated their overall experience *good* or *very good*, and 85% rated their travel experience *good* or *very good*. Similarly, 97% of *visitor* survey respondents rated their overall experience as *good* or *very good*, and 82% gave a *good* or *very good* rating for their travel experience.

In all, 32% (N=154) of *visitor* survey respondents used one or more of the seven shuttles routes within Estes Park and ROMO, and 42% used the ITS (defined here as all respondents who, at a minimum, saw a DMS). Pearson's chi-square was used to measure the effect of shuttle use and ITS use on overall experience visiting Estes Park and

ROMO, and on overall travel experience. Shuttle-users did not rate their overall experience (X^2=.832, 1 df, p=.362) or travel experience (X^2=.600, 1 df, p=.439) significantly higher than respondents who did not use shuttles. Furthermore, respondents who used ITS did not rate their overall experience (X^2=.564, 1 df, p=.453) or travel experience (X^2=.243, 1 df, p=.622) significantly higher than respondents who did not use ITS.

Effect of Past Use on Future Use of Shuttles

Pearson's chi-square was used to determine if past use of shuttles at Estes Park and ROMO had an effect on visitors use or planned use of shuttles on their most recent visit. Due to the nature of our survey, this analysis could only be performed for *visitor* survey respondents. The proportion of *visitor* survey respondents who indicated that they had used or planned to use shuttles on their current visit was significantly higher for visitors that had previous experience using shuttles at Estes Park/ROMO, as compared to respondents who had no experience using the shuttles (X^2=98.732, 1 df, p <.01). In percentages, 92% of respondents who indicated that they had prior experience using the Estes Park/ROMO shuttles also indicated that they had already used or planned to use shuttles on their current visit. In contrast, only 29% of respondents who lacked prior experience had already used or planned to use shuttles on their trip. In Chapter 2, we explore the influence of past shuttle use on future shuttle use in depth.

Discussion

As alternative transportation becomes more common in park and recreation settings, ITS is gaining recognition as a tool for promoting and enhancing alternative travel modes, thereby decreasing reliance on automobiles. Especially in the face of economic uncertainty and tightening federal budgets, it is important to find innovative solutions to the myriad challenges public lands face. Our study sought to evaluate the utility of an ITS at Rocky Mountain National Park and Estes Park as a means for increasing awareness and use of visitor shuttles. Moreover, we aimed to determine additional ways to reach visitors and promote alternative modes of travel. Although the findings of this study are based solely on a one season pilot study, they nonetheless provide insight into the benefits of ITS for the areas visitors, managers, and local residents.

Our first objective was to examine the individual utility of DMS and HAR as components of an ITS at Rocky Mountain National Park and Estes Park. The results indicate that 80% of *shuttle* survey respondents who approached the area from U.S. Highway 36 saw one or more DMS. Additionally, 42% of *shuttle* survey respondents reported that they learned about the Silver Route shuttle from the DMS. It was originally anticipated that the DMS would simply encourage visitors to tune to the HAR, and the HAR would then influence visitors to use the park-and-ride and Silver Route shuttle. However, 43% of the visitors who used the Silver Route shuttle saw a DMS but did not tune to the HAR. This suggests that the information on the DMS was enough for many

visitors to decide to use the park-and-ride, without needing to tune to the HAR for additional information.

In addition, 65% of *visitor* survey respondents who approached the area from U.S. Highway 36 reported seeing a DMS, and 20% indicated that they learned about the town and park shuttles from this source. This shows that the DMS also contributed substantially to shuttle awareness among *visitor* survey respondents. Thus, the DMS appears to have successfully increased awareness of the various town and park shuttles.

The utility of the HAR is not as evident. Only 12% of *visitor* survey respondents who approached from U.S. Highway 36 reported using the HAR, and less than half of those visitors felt that the information saved them time or helped them avoid traffic congestion. However, use of the HAR was much higher (44%) among *shuttle* survey respondents, and the effect of the information on visitor mobility much greater. Sixty five percent or more of those who used the HAR felt it saved them time and helped them avoid traffic congestion and nearly 90% found the information useful. With more than 80% of *shuttle* and *visitor* survey respondents indicating that they would use the information again, it is clear that for this segment of visitors, the HAR provided a much desired service.

Though satisfaction was fairly high among users of the HAR, the fact remains that few people chose to use it. When choosing appropriate technologies for an ITS, managers must not only consider visitor satisfaction with the technologies, but also the appeal of these technologies to a broad user base, as well as the cost of operating and maintaining the devices. Our results show that while the HAR did contribute to awareness and use of

the park-and-ride and Silver Route shuttle, it was not widely used by other visitors. Additionally, the HAR failed to transmit as far as had been anticipated, and several visitors indicated that the channel was overpowered by static at times and difficult to hear. The geography of the area presented considerable challenges for transmission of the radio signal. Further research is necessary to determine whether the DMS alone can increase awareness and use of shuttles, or if the HAR is a vital component for a significant number of visitors.

We also explored the impact of the combined ITS on visitor experience. While use of the ITS technologies did not result in a significant increase in visitor experience, visitor evaluations of the ITS were nonetheless positive. It appears that the ITS provided a desired service to many visitors. Although the ITS did not significantly improve visitors travel experience, it may prove crucial to maintaining current levels of satisfaction as visitation continues to increase. Furthermore, previous studies have shown that global measures of experience in recreation settings tend to be consistently high (Manning, 1999), thus, it is difficult to measure a significant increase. Qualitative research could be useful to determine the specific ways ITS impact the experience of park visitors.

The second objective of our study was to determine the extent to which the pilot ITS influenced visitors' choice of travel mode. Examining the two survey groups individually, we find that 95% of *shuttle* survey respondents who tuned to the HAR, or 41% of total *shuttle* survey respondents who approached the area from U.S. Highway 36, indicated that the information on the HAR influenced them to use the park-and-ride. This is substantial, especially considering that such a large proportion (35%) of *shuttle* survey

respondents were seasonal and fulltime residents who had no occasion to use the ITS. Despite this, it is important to remember that due to low ridership on the Silver Route shuttle, only 68 people participated in the shuttle survey. Although the HAR appears to have been of great value to this segment of visitors, it terms of sheer numbers, the affect is negligible. Furthermore, the HAR had a small impact on *visitor* survey respondents. Only 57% of those who tuned to the HAR, or less than 6% of total *visitor* survey respondents who approached from U.S. Highway 36, agreed that the information influenced their mode choice.

It is not clear, however, how the DMS alone influenced mode choice. Findings from a 2012 technical report which evaluated additional aspects of the ROMO pilot study reported large increases in Hiker Shuttle ridership. The Hiker Shuttle transports visitors from the CVB directly into ROMO, and is one of the most important routes in terms of reducing crowding and congestion. The Hiker Shuttle saw increases in ridership in June, July and August 2011 ranging from 50-68%, as compared to the same months in 2010 (Villwock-Witte & Collum, 2012). While there is no direct causal link between the increase in ridership and the application of the ITS, it seems that the ITS was at least partially responsible for this increase, as such a large percentage of visitors indicated that they learned about the shuttles from the DMS and HAR. Future research should explore the direct effect of the DMS on shuttle use.

Overall, our results show the ITS had a substantial effect on awareness of travel alternatives, and for some visitors this translated to actual use of shuttles. In terms of broad impact, the DMS was very effective. Although those who used the HAR were

satisfied and indicated that they would plan to use it again, the HAR failed to appeal to a broad user base during the pilot study.

Although the HAR failed to have broad impact, the DMS cannot be expected to serve as the sole technology of an ITS. These technologies are meant to work in tandem, especially considering the limited text which can be communicated via the DMS. If managers determine that the HAR is not worth the cost to ROMO, other technologies must be implemented or expanded in order to provide visitors with enough information to make informed travel decisions. Electronic signs that display real-time departure time for shuttles have been successfully demonstrated at other parks (Daigle & Zimmerman, 2004b) and could be tested as a component of an ITS at ROMO and Estes Park. Our study findings reveal other information sources that can be used to increase awareness and use of shuttles.

The results show that visitor center staff is currently serving as one of the primary sources of information about shuttles. Park and town managers should take full advantage of this already existing information source and work with visitor center staff to ensure that they are promoting a consistent message about the benefits associated with shuttle use. Staff should use specific talking points, for example, that the shuttles are free, convenient and easy to use, help alleviate the stress related to finding parking, and offer full access to a number of popular recreation areas. Based on our findings, staff should not promote the shuttles as a way to save time or avoid congestion. Staff should only promote benefits that are sure to be realized, as satisfaction is determined by the congruence between visitors expectations and actual experience (Manning, 1999). The

promotion of desirable but realistic expectations will help visitors build trust in the system, which ideally will lead to continued use of shuttles.

Although visitor center staff is a great source of information, many return visitors are comfortable enough with the area that they bypass the visitor center. Additional sources of information must be available for this segment of visitors, as they account for 57% to 62% of the visitor population, according to our results. The 2012 technical report associated with the pilot study presented results from a mail survey of area visitors, which showed that visitors found the internet and the ROMO website to be the two most useful travel information sources (Villwock-Witte & Collum, 2012). This is an interesting finding, as results from the *shuttle* and *visitor* surveys show that 10% or less of survey respondents listed the Estes Park and ROMO websites as their source of information about shuttles. These websites should provide direct links to shuttle information and schedules, as the data show that visitors prefer to use these information sources, but are not currently finding adequate information about the shuttles.

Other findings from our study are worth additional discussion. Although we had not anticipated that such a large portion of Silver Route users would be seasonal and fulltime residents, this finding nonetheless reveals an area that requires further attention. The crowding and congestion occurring in downtown Estes Park is intensified by concentrated visitation in the summer months, but the problem encompasses more than just visitors. Traffic congestion is largely caused by people slowing and circling to find one of the limited parking spaces in downtown Estes Park, and these spaces are largely filled by employees of the local shops and restaurants. This also causes delays for visitors

who are trying to get to the park but must pass through downtown en route (Villwock-Witte & Collum, 2012). The fact that employees and residents are beginning to use the shuttles is of great value to the community as a whole, as this has potential to keep many cars out of downtown, thereby opening up more parking spaces. Furthermore, while employees might stay parked for up to eight hours or more based on the length of their shift, visitors tend to stay parked for only a couple of hours. By encouraging local employees and residents to park at the eastern park-and-ride, or access a shuttle from another part of town closer to their home, the turnover of parking spots in town can be greatly increased, helping to assuage congestion. Acadia National Park has experienced similar unanticipated benefits from their shuttle system, where many youth and employees have been found to use the system (Zimmerman, Coleman, & Daigle, 2003).

Although ridership onboard the Silver Route shuttle was low during the pilot season, the shuttle did receive high evaluative marks. Users found the shuttle to be easy to use and convenient, indicated high levels of enjoyment, and expressed that they would use the shuttle again. We also asked if the shuttle provided enough room for gear or made it difficult to travel with children, as previous studies have found that automobile users often cite space and ease with children as advantages of cars over shuttles (White, 2007; Youngs, et al., 2008). Our results show that the Silver Route shuttle offered these amenities. Less than 4% of *shuttle* survey respondents felt they did not have sufficient room for their gear or that it seemed difficult to travel with children on the shuttles. Thus, the Silver Route appears to be performing at a high level. This level of performance must be maintained, especially as ITS and other travel information sources are expanded to help increase shuttle use.

It is worth noting that 20% of *shuttle* survey respondents agreed with the statement "I had to switch shuttles too many times to get to my desired destination." If a day visitor wished to visit Bear Lake and decided to use the eastern park-and-ride, they would have had to transfer shuttles twice to make it from the park-and-ride lot to Bear Lake. This is an unacceptable number of transfers, especially for a user population that has little to no experience using public transportation at home (Villwock-Witte & Collum, 2012). Researchers have stressed that for park transit systems to be competitive, they must offer a service that is equal or better than that provided by private automobile (Harrison, 1975). Therefore, we recommend that a stop be added at the eastern park-and-ride lot along the Hiker Shuttle route, offering a direct route for visitors from the park-and-ride to ROMO.

The findings from our study reveal the initial impact of the ITS, as well as the potential of such technologies to contribute to effective management of transportation at ROMO and Estes Park. It is particularly encouraging that past shuttle use was found to have such a significant influence on future use of shuttles. By designing and implementing a truly "intelligent" ITS that offers frequent and direct routes, and by maintaining and improving the high levels of current shuttle service, visitors can be influenced to switch travel modes. With the strong correlation between past and future shuttle use, visitors need only be convinced to give shuttles a chance and these auto-addicts can be converted to shuttle supporters. Our findings have implications for other parks that are exploring potential ITS technologies, as well as units that are incorporating park-and-ride lots into their transportation systems, such as at Acadia National Park in Maine.

Conclusions

Alternative travel modes must account for a larger percentage of visitor transportation at parks and other public lands that are experiencing increasing crowding and congestion. ITS offer a valuable tool for travel management in that they can provide relevant information to help visitors make informed travel decisions. This study demonstrated the utility of an ITS to increase awareness and use of shuttles at ROMO and Estes Park. DMS were found to be particularly effective, while the usefulness of the HAR was less notable. Other findings revealed the potential of the town and park websites as valuable conduits for travel information, although these tools have yet to be fully realized. The study also identified the need for direct routes between parking and popular park attractions in order to make shuttles more attractive to visitors. These findings and recommendations encompass a number of incentives that can be used to improve the appeal of shuttles. It remains uncertain, however, if these incentives will be enough to result in a significant mode shift. In a growing number of parks, shuttles have been made compulsory at the most popular and congested areas (Harrison, 1975; Sims, et al., 2005). Without a combination of ITS and other powerful incentives, mandatory shuttle use may be necessary for certain parts of ROMO.

Despite the utility of the information gleaned from our analysis, our study was limited in a number of ways. First, because the DMS and HAR were only placed on one highway for the pilot study, we were only able to measure the influence of the ITS on a limited portion of the visitor population. Additionally, ridership on the Silver Route shuttle was very low in its first year of operation and we could therefore only reach a small number of visitors via the *shuttle* survey. Based on our results and on anecdotal

information from our data collectors, we believe that many people may have been influenced by the ITS to park at the CVB and access shuttles, or to drive into ROMO and use the Bear Lake park-and-ride. Unfortunately, our survey design did not enable us to measure the impact of the ITS on these visitors. Future research should involve surveying on the Hiker Shuttle which connects to the Bear Lake park-and-ride, as well as on the other shuttles located within ROMO.

There is also a need to understand who is likely to use shuttles in park and recreation settings, and how these visitors can be influenced to shift travel modes (Holly, et al., 2010). Attitude theory, specifically the theory of planned behavior (Ajzen, 1991), provides an ideal framework for examining the beliefs that influence travel behavior. The theory may be used to identify interventions for improving visitors' attitudes towards and perceptions of alternative transportation, as well as improve the prediction of shuttle use (Daigle & Zimmerman, 2004b; Fishbein & Ajzen, 2010). In the next chapter, we apply the theory of planned behavior in an attempt to explore its potential contribution to transportation research in recreation settings.

CHAPTER 2

INTELLIGENT TRANSPORTATION AND THE THEORY OF PLANNED BEHAVIOR: TARGETING POTENTIAL MODE-SHIFTERS TO INCREASE VOLUNTARY SHUTTLE USE WHILE RECREATING

Introduction

"As parks and protected areas continue to implement alternative transportation strategies, it is important to understand both who is likely to use public transportation in parks and why visitors are making these decisions." – Holly et al. (2010)

It is widely acknowledged that excessive use of private automobiles is one of the most critical threats to the natural and cultural wellbeing of America's parks and public lands. Since as early as 1908, automobiles have been linked to the park experience (Louter, 2006) and have required ever expanding infrastructure to accommodate their presence (Dilsaver & Wyckoff, 1999). Consequences of this car-dominant transportation culture include congestion and crowding at popular park attractions, air and noise pollution, erosion caused by cars parked outside of designated areas, and threats to the safety of visitors and wildlife alike (Hallo & Manning, 2009; Sims, et al., 2005; Youngs, et al., 2008).

In an effort to alleviate some of these transportation issues, several parks and public lands have implemented alternative transportation systems (ATS). The National Park Service (NPS) in particular has made the choice not to build new roads, but rather to

invest in ATS. Alternative transportation includes any alternative to the private automobile, such as buses, trains, trams, ferries and hiking and biking trails (White, 2007). ATS refers to systems of transportation to, in and around public lands that combine alternatives in order to reduce visitor reliance on private automobiles. The NPS now has 110 alternative transportation systems in 81 park units throughout the United States (National Park Service).

Visitor shuttles are the most popular alternative and shuttle systems can now be found at parks, wildlife refuges and national forests throughout the country. Some parks, such as Denali, Great Smoky Mountains and Zion National Parks, have implemented mandatory shuttle systems at the most popular areas within the parks. Studies of these mandatory shuttles have revealed higher support for these systems than anticipated (Harrison, 1975; Sims, et al., 2005). Despite this, researchers have stressed visitors' preferences for incentives, such as free shuttles, over disincentives, like policies restricting automobile access (Anable, 2005; Holly, et al., 2010). Owing to the strong influence of public opinion in park management, the majority of ATS are optional to visitors. This makes it all the more important that visitors are aware of ATS and that the services provided by shuttles are comparable to those afforded by private automobiles. Thus, many researchers have applied qualitative and quantitative methods to identify the most effective ways of promoting alternatives and encouraging voluntary use of ATS (Holly, et al., 2010; Shiftan, Vary, & Geyer, 2006; White, 2007).

Presently, managers are looking to intelligent transportation systems (ITS) as a tool for increasing shuttle awareness. ITS are an approach to transportation management

that use information technologies to provide pertinent travel information to visitors (Sheldon, 1997). This information serves to attract potential ATS users. Various ITS technologies exist and can be combined according to specific needs and preferences. For example, route guidance systems are used to keep shuttles on schedule, highway advisory radio is used to provide shuttle information as well as traffic and weather conditions, and electronic message signs can be placed along approach roads to display short, concise messages informing motorists of parking conditions and alternate travel modes. Other technologies include global positioning systems, electronic signs that display real-time arrival and departure of shuttles, and two-way voice communication which allows drivers to communicate between buses (Daigle & Zimmerman, 2004a; Sheldon, 1997).

ITS technologies have been tested at Acadia, Arches, Grand Canyon, and Sequoia and Kings Canyon National Parks, among others (Daigle & Zimmerman, 2004a, 2004b; G. Dilworth & Shafer, 2004; Lawson, et al., 2003; Christopher Strong, et al., 2007). These studies have made a strong case for ITS as an effective tool for travel management. Nevertheless, a better understanding of visitor attitudes towards alternative transportation is necessary to reap the full benefits of ITS. By understanding the factors that influence mode choice, appropriate technologies can be implemented and smart messaging can be employed to attract more users to ATS.

Study Context

More than three million visitors a year travel to Rocky Mountain National Park (ROMO) and the majority accesses the park via the eastern gateway community of Estes

Park, Colorado. Over half of the annual visitation is concentrated within the summer months of June, July and August, resulting in bottlenecking in downtown Estes Park (National Park Service).

In the 1970's, a visitor transportation system was implemented inside ROMO to help mitigate the crowding and congestion caused by the profusion of private automobiles. The transit system has since gained popularity, evolving into a regional transportation system. Seven routes now exist to provide visitors with free, frequent access to lodging, shops and restaurants within Estes Park, and many of the most popular areas within ROMO. Overnight visitors can leave their cars at their lodging and day-visitors can park at one of several park-and-ride lots located in town and within the park. Nearly half a million rides were provided by the transit system in 2010 (Villwock-Witte & Collum, 2012), but even with the shuttles' growing popularity, cars remain the preferred mode by the overwhelming majority.

The parking lots of two of the most popular recreation areas within the park, Glacier Gorge and Bear Lake, reach capacity as early as 8am and 10am respectively (Villwock-Witte, et al., 2011). Congestion within Estes Park causes traffic delays, and shuttle drivers struggle to stay on schedule. ROMO and Estes Park managers have recognized that the status quo is not sustainable and are taking strides to improve the transportation system, thereby increasing ridership and improving the overall visitor experience.

In the summer of 2011, a pilot study was conducted to explore the potential of an ITS consisting of dynamic message signs (DMS) and highway advisory radio (HAR) to

increase awareness and use of the shuttle system. The DMS were placed along a major route on the approach to Estes Park from the east. Messages were displayed on the signs informing motorists of parking conditions within the park and recommending the use of a newly constructed park-and-ride located just before downtown Estes Park. The DMS also displayed the station number for the HAR, where motorists could tune-in and listen to a recorded message detailing parking and transportation options, as well as directions to the park-and-ride. Once at the lot, visitors could board a free shuttle to the Estes Park Convention and Visitors Bureau, where they could then connect to any of various shuttle routes servicing the town and the park.

This chapter details the results of a survey that applied the theory of planned behavior in an attempt to understand the motivations behind mode-choice at ROMO and Estes Park. By understanding the factors that influence mode choice, we can determine who is likely to use shuttles and how those people can best be motivated. This knowledge will enable managers to maximize the value of ITS technologies. The objectives of this study are to:

1. Examine the utility of the theory of planned behavior to predict choice of travel mode in a recreation setting.
2. Determine if past behavior can be added to our model to improve the predictive power of the theory of planned behavior.

3. Apply the theory of planned behavior to determine distinct segments of visitors in regard to their beliefs about transportation, so as to determine the best methods for promoting shuttles in Estes Park and ROMO.

Conceptual Framework

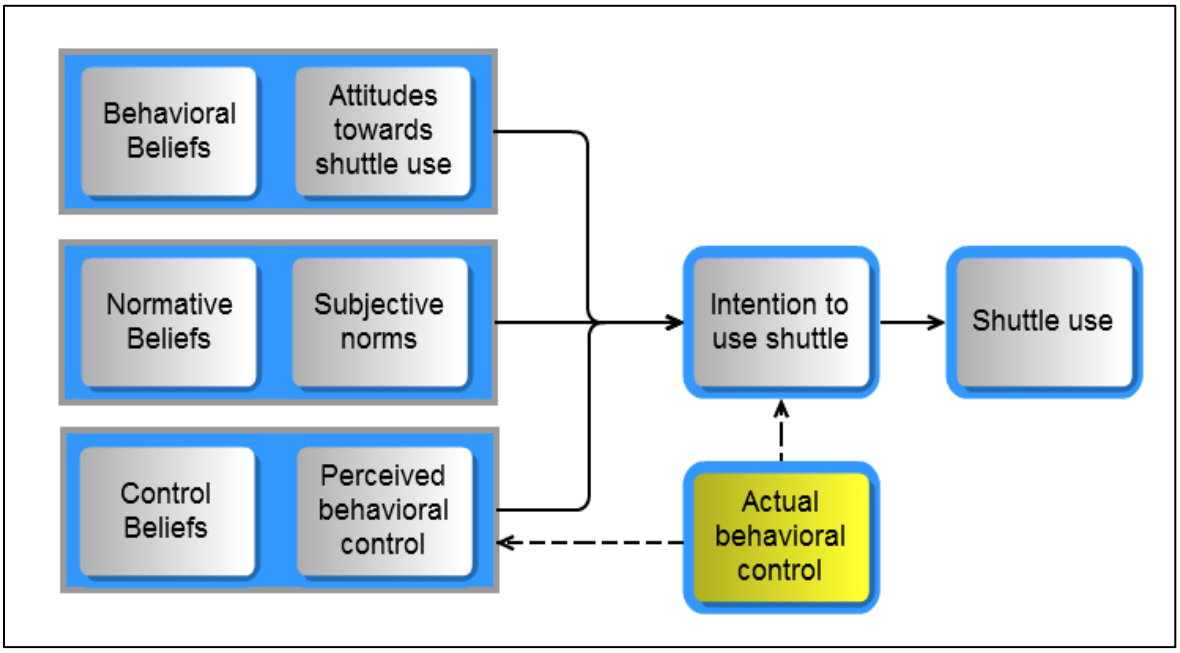
Mode Choice and the Theory of Planned Behavior

ATS can now be found at public lands across the United States, but the issue remains of how to encourage visitors to leave their private automobiles behind and opt for alternative transportation instead. Historically, the most commonly used predictors of public transit use have been sociodemographic variables such as age, gender and income (Heath & Gifford, 2002). However, a number of studies have shown that psychological variables are often more powerful predictors of behavior, and consequently attitude theory is commonly used in transportation studies.

The theory of planned behavior (Ajzen, 1991; Fishbein & Ajzen, 2010) is perhaps the most commonly used theory for exploring the factors that influence mode choice. According to the theory, human behavior, so long as it is under a person's volitional control, is guided by reason, and people reason using three kinds of beliefs. First, people hold beliefs about the positive and negative outcomes associated with performing a behavior. These beliefs are referred to as *behavior beliefs*, and they are assumed to influence people's *attitudes* towards a given behavior. Second, people form *normative beliefs*, which are beliefs about whether important individuals and groups in their life will

approve or disapprove of their performing the behavior in question, and whether those important individuals/groups would perform the behavior themselves. Normative beliefs produce *subjective norms*, which are the perceived social pressures to perform or not perform a behavior. Finally, people form *control beliefs* about the internal and external factors that will aid or inhibit them from performing a behavior. This results in *perceived behavioral control (PBC),* or the perceived ease or difficulty of performing the behavior. Once formed, attitude, subjective norm, and PBC influence people's intention to perform a behavior. The more favorable the attitude, subjective norm and PBC, the stronger the intention to perform the behavior. Intention is therefore the immediate antecedent of behavior. Given a strong degree of actual control, intention serves as a strong predictor of behavior. According to the theory, it is then possible to influence intention and thereby behavior by introducing a structural intervention designed to effect attitude, subjective norm, and/or PBC toward a given behavior (Fishbein & Ajzen, 2010).

Figure 2.1: Theory of Planned Behavior Conceptual Model.



There is strong support for the theory of planned behavior among social scientists and it has been broadly used in studies of transportation (Bamberg, Ajzen, & Schmidt, 2003; Bamberg & Schmidt, 2001; Heath & Gifford, 2002). Bamberg and Schmidt (2001) used the theory to test the effect of an intervention in the form of a free bus ticket on car use among German university students. The intervention significantly decreased students' car use, from 44 percent of reported mode use before the intervention to 30 percent after the intervention. Additionally, use of public transportation significantly increased from 15 percent to 31 percent after the introduction of the pre-paid bus ticket. In a similar longitudinal study, Bamberg et al. (2003) found that a prepaid bus ticket was able to effectively influence participants' attitude, subjective norm and PBC towards bus use at another German university, thus increasing intention and performance of the

behavior. The intervention resulted in an impressive mode shift, more than doubling the number of students who rode the bus to campus. Similar results were found in a study at a Canadian university, where the introduction of an unlimited regional transit pass was used as a structural intervention (Heath & Gifford, 2002).

Building on the Theory of Planned Behavior

Fishbein and Ajzen (2010) have invited research that proposes additional constructs to the theory of planned behavior in order to increase its predictive power. Several transportation studies have attempted to do so, such as Heath and Gifford (2002), who proposed the addition of descriptive norms, moral (or personal) norms, environmental values, perceived responsibility for and awareness of problems caused by car use, and an interaction effect between PBC and intention. Of these constructs, the addition of descriptive norm (i.e. what most people would do in a given situation) and an interaction effect between PBC and intention significantly improved the prediction of mode choice. The existence of an interaction effect was acknowledged in earlier studies (Ajzen, 1991; Terry & Oleary, 1995), which recognized that if a person perceives strong control over a behavior, intention should serve as a more powerful predictor of behavior, while if PBC is weak, performance of the behavior is unlikely regardless of intention.

Past behavior has been suggested as an additional predictor by several researchers. Though Fishbein and Ajzen (2010) have argued that past behavior cannot be used in casual models of human behavior, Ouellette and Wood (1998) rebutted that no theory has attained enough success at predicting behavior as to dismiss past behavior as

simply "error variance." In a meta-analysis of 64 studies, the authors examined other predictors of intention and behavior in order to surmise the independent effects of past behavior after controlling for attitudes, subjective norms and PBC (Ouellette & Wood, 1998). Of the 13 studies that included past behavior in the regression models predicting behavior, 11 revealed a statistically significant relationship between past and future behavior. The authors concluded that there is a strong correlation between the performance of a behavior and the stability of the context within which it is performed. Past behavior was a weaker predictor in unstable contexts and for behaviors which are performed only once or twice annually, while it was a strong predictor for behaviors that are performed on a daily or weekly basis.

Despite this and other research, Fishbein and Ajzen (2010) argue that only attitude, subjective norm, PBC and intention meet the criterion of causality and can be used to explain later action. While past behavior has been found to explain up to ten percent of additional variance when added with the four main constructs of the theory, the authors hold that past behavior overlaps with the existing constructs and is not conceptually independent. Instead, the authors contend that past behavior can be used as a measure of habit strength. Bamberg et al. (2003) tested the frequency of past behavior as an independent measure of habit strength using a fast-response index adapted from a previous study (Verplanken, Aarts, Vanknippenberg, & Vanknippenberg, 1994). Participants were presented with a set of alternative transportation choices (car, bus, train or bike) and asked to select their preferred travel mode as quickly as possible for a number of hypothetical situations. In the context of habit strength, past behavior was found to have a significant impact on later behavior, though following the intervention

past behavior declined in predictive ability. The authors concluded that as long as conditions remain stable, past experience retains predicative power, but once conditions change, as with the introduction of an intervention, past behavior and habit become less powerful predictors and behavior is based primarily on reason.

In an urban study of mode preference in the United Kingdom, additional constructs were proposed: environmental concern and control, descriptive and personal norms concerning mode choice, and attitudes, norms and PBC concerning non-car transportation modes. Environmental concern and control proved weak predictors, while descriptive and personal norms accounted for a significant increase in explained variance (Gardner & Abraham, 2010). This corroborates with the findings of Heath and Gifford (2002) and others (Devries, Backbier, Kok, & Dijkstra, 1995).

A recent study by Haustein and Hunecke (2007) added perceived mobility necessities (PMN) as a new predictor for the theory of planned behavior. PMN is defined as the perceived need to be flexible and spontaneous in one's mobility, and is defined by socioeconomic variables like employment and household structure. Using an initial survey of 1,545 participants and in-depth interviews with 82 participants, PMN was found to moderate the relationship between attitude and intention directly, though PBC had both a direct and indirect effect on intention (Haustein & Hunecke, 2007). Further research will be necessary to reveal the usefulness of PMN as a predictor of mode choice.

Though the theory of planned behavior has been applied to urban transit studies as well as recreation studies ranging from leisure choice (Ajzen & Driver, 1992) to hunting and wildlife viewing (Daigle, Hrubes, & Ajzen, 2002; Hrubes, Ajen, & Daigle, 2001),

few studies have applied the theory to a study of transportation within a recreation setting. Dilworth (2003) used the theory in a study of attitudes toward transportation at two national parks in California and found that attitudes regarding the appropriateness of ITS technologies were predictive of intentions to use the DMS and HAR. The author also found that higher prior experience with public transportation was a significant predictor of intention to use shuttles at the parks (V. A. Dilworth, 2003). However, these parks are located near urban areas where exposure to public transportation is much higher than in rural park settings. It still remains unclear if past experience with public transportation can serve as a good predictor of transit use in recreation settings. Our study adds to the literature by using the theory of planned behavior as a conceptual framework for predicting voluntary shuttle use at ROMO and Estes Park. Despite the debate among researchers, past behavior has been shown to significantly contribute to behavior prediction in stable settings. Therefore, previous experience with shuttles in urban and recreation settings is explored as an additional predictor of mode choice.

Segmentation Analysis

Segmentation, or the act of defining meaningful sub-groups of individuals, has been widely used in consumer studies to identify homogenous groups in order to tailor specific marketing campaigns and policies (Wedel & Kamakura, 2000). For a given behavior, individuals are grouped into specific segments using sociodemographic characteristics or by using multivariate statistical analysis to categorize unique clusters based on psychological factors (Anable, 2005). While a multitude of literature exists on

the psychological determinants of mode choice, few transportation studies have combined segmentation and attitude-theory.

Early studies almost exclusively used sociodemographic variables to assign segmentation, but over the last two decades researchers have demonstrated the value of segmenting based on attitude (Hunecke, Haustein, Bohler, & Grischkat, 2010; Jensen, 1999; Pas & Huber, 1992; Redmond, 2000). In a study of potential rail travelers in the United States, Pas and Huber (1992) identified five distinct groups from a sample of 333 survey participants based on attitudes towards various transport services. Jensen (1990) used qualitative interviews to determine segments and their differing attitudes and motivations for using cars, bicycles and other public transport. This research revealed the efficacy of segmentation for simplifying the complex structure of travel markets.

Redmond (2010) used cluster analysis to segment mobility behavior based on lifestyle and personality traits, and these variables were also found to be superior in predictive ability than sociodemographic variables such as age, gender, and income. More recently, Hunecke et al. (2010) used an expanded version of the theory of planned behavior to show that segmentation based on psychological variables has more predictive power than segmentation based on sociodemographic variables.

Few studies, however, have combined segmentation and attitude-theory in the context of recreation. In a study on National Trust lands in the United Kingdom, Anable (2005) used an expanded version of the theory of planned behavior to categorize 666 mail-survey participants into six distinct segments. The groups ranged from “Die Hard Drivers” to “Car-less Crusaders,” and the individual members varied widely in terms of

sociodemographic characteristics. One segment referred to as "Complacent Car Addicts" felt that they had the ability to switch from cars to alternative travel modes, but felt no moral obligation to do so. On the other hand, the segment "Aspiring Environmentalists" had already reduced their car use for environmental reasons, but were reluctant to give up their cars entirely. This study demonstrated the utility of cluster analysis for identifying specific groups for targeted marketing campaigns.

Our study builds on this research, combining the theory of planned behavior and segmentation analysis to identify unique segments of travelers so as to determine the factors effecting mode choice for these specific groups. By doing so, empirically sound strategies can be devised to effectively promote and encourage the use of alternative travel modes. Information technologies such as ITS are becoming common tools for encouraging mode shifting in parks, but only by determining the psychological factors behind mode choice will managers be able to implement the most effective and persuasive messaging via ITS.

Methodology

Sampling Procedure

The data used for this analysis were collected as part of a larger effort to evaluate the effectiveness of the pilot ITS at ROMO and Estes Park during the summer of 2011. Visitors to the area were asked to participate in an on-site survey designed to evaluate their awareness and use of the ITS. Sampling for this survey took place on-board a newly

designed shuttle route, as well as at a local visitor center and a small community park located in downtown Estes Park. After completing the on-site survey, all respondents were invited to participate in a mail survey which was designed to yield indepth information regarding visitor attitudes and beliefs about various travel modes and travel information sources. For the purpose of this evaluation, we focus only on the results of the mail survey.

Those who agreed to participate in the mail survey provided their name and mailing address on a card and a survey was sent to them within three weeks. The survey was administered using the Dillman Tailored Design Method (Dillman, Smyth, & Christian, 2008). A four-wave treatment was implemented over a seven week period, consisting of 1) an invitation letter, survey, and postage-paid return envelope to all participants, 2) a post-card reminder and thank you, 3) a replacement questionnaire for participants that had not yet completed surveys, and 4) a final appeal to non-respondent. In total, 558 people completed an on-site survey and of those, 233 people, or 41.8 percent, agreed to participate in the extended study.

Questionnaire

The questionnaire was divided into four sections: 1) About your use of visitor shuttles, 2) About your opinions towards shuttle use, 3) About how you plan for trips, and 4) About you. The questions in the first three sections were designed to measure the components of the theory of planned behavior (TPB): attitude, subjective norm, PBC, intention and behavioral beliefs. These questions were adapted from Bamberg (2003) and

the variables used to measure the components were developed using previous TPB studies (Bamberg, et al., 2003; Hrubes, et al., 2001). Questions were also asked regarding past experience using shuttles at home and in recreation settings. In the final section respondents provided demographic information including age, gender, education, number of previous visits, type of travel group, and accommodations used.

To explore potential interventions, respondents were asked to indicate how their future use of visitor shuttles would be influenced by eleven hypothetical scenarios. Respondents used a 4-point categorical scale (*not at all increase my use, somewhat increase my use, strongly increase my use, not sure*) to evaluate such scenarios as rising gas prices, vouchers for discounts at shops in downtown Estes Park, and extended hours on all shuttle routes. These data are used in our analysis to evaluate potential strategies for increasing shuttle use, as well as to recommend interventions that could be tested as part of a future study.

TPB Constructs

To measure the four TPB constructs, questions were adopted from Bamberg et al. (2003). Two questions were used to measure each construct on a 5-point Likert scale. For attitudes towards shuttle use, respondents were asked to evaluate whether taking the visitor shuttle on their next visit to Estes Park/ROMO would be *extremely pleasant-extremely unpleasant* and *extremely good-extremely bad*. For subjective norms, respondents indicated on a scale from *extremely likely-extremely unlikely* their agreement that most people who are important to them would support their decision to take a visitor

shuttle next time, and most people who are important to them think they should take the visitor shuttle next time. To measure PBC, respondents rated their ability to take the visitor shuttle next time (*extremely high-extremely low*) and the difficulty of taking the visitor shuttle next time (*extremely easy-extremely difficult*). In measuring behavioral intention, respondents indicated the strength of their intention to take the visitor shuttle next time (*extremely strong-extremely weak*) and the likelihood of their taking the visitor shuttle next time (*extremely likely-extremely unlikely*).

Behavioral Beliefs

Behavioral beliefs were measured by having respondents assess the likelihood of different outcomes that could potentially result from using visitor shuttles at Estes Park and ROMO. Ten outcomes, both positive and negative, were rated on a 5-point scale (*extremely likely-extremely unlikely*). Outcomes included reducing tension and stress caused by driving, feeling crowded and touristy, saving money by not using gas, and feeling rushed or short on time. Respondents also evaluated the ten outcomes by indicating the desirability of each on a 5-point scale (*extremely desirable-extremely undesirable*).

Behavior and Past Behavior

The following yes/no question was used to measure behavior: during your most recent visit to Estes Park/ROMO, did you use a visitor shuttle? As a measure of past behavior, two questions were asked using a 5-point bipolar response scale. The first asked respondents to indicate how often they used five various modes of transportation (car, visitor shuttle, bicycle, walking, group tour bus) when visiting parks and recreation areas (*never-always*). The second question asked how often they use public transportation at home (*never-almost every day*). For the regression analysis, past visitor shuttle use when visiting a park or recreation area is referred to as VS experience, and past public transportation use at home is referred to as PT experience.

Use of Travel Information Sources

Three questions were used to evaluate visitor use of travel information. First, respondents rated the usefulness of thirteen travel information sources on a 5-point bipolar scale (*very useful-not at all useful*). Information sources included various websites, printed material, electronic technologies, and human resources. Next, respondent were asked to indicate which mode(s) of transportation they planned to use and which mode(s) they actually used on their most recent visit to Estes Park/ROMO. Five transportation modes were evaluated: car, visitor shuttle, bicycle, walking and group tour bus. Respondents were given a score of 1 for each mode used and a score of 0 for each mode they did not use. We focus on planned and actual use of cars and visitor shuttles to evaluate the potential for ITS.

Data Analysis

The data from our survey were compiled into Excel 2010 and analyzed using SPSS 16.0. Descriptive statistics examined include mean, standard deviation, frequency and variance. K-means cluster analysis was used for segmentation analysis. Differences between visitor segments were analyzed with Pearson's chi-square test for categorical data and one- way ANOVA. For all analyses using ANOVA, post hoc comparisons were made using Tukey's *honestly significant difference* (HSD) test. Hierarchical logistic regression was used to measure the influence of the TPB constructs on the dichotomous dependent variables of behavior and intention in regards to shuttle use. The acceptable probability level for rejecting the null hypothesis for all statistical tests was set at $p < .05$ (Vaske, 2008).

Cronbach's alpha was used to estimate the internal consistency of the item-pairs used to measure attitude, subjective norm, PBC, and intention regarding shuttle use. The resulting alpha for each item-pair was quite high (.85, .80, .82, and .96 for attitude, subjective norm, PBC and intention, respectively). By convention, .80 or higher constitutes a "good scale" (Vaske, 2008). The item pairs for each of the four constructs were therefore summated to form an aggregate index which is used for the regression portion of our analysis.

As a measure of reliability, Pearson's chi-square (X^2) test of independence was used to measure non-response bias. It has been shown that later respondents have a tendency to be like non-respondents (Armstrong & Overton, 1977), therefore, survey respondents were divided between first and last wave respondents and comparisons were

made for five variables of interest. These comparisons revealed no significant difference between first and last wave respondents on age (X^2=49.1, 56 df, p=.731), gender (X^2=.371, 1 df, p=.543), education (X^2=.259, 3 df, p=.968) , first time or return visitors (X^2=.256, 1 df, p=.613), and use of shuttles at Estes Park/ROMO (X^2=.043, 1 df, p=.835).

Results

Survey Response Rate and Demographics

The survey was administered by mail to 222 ROMO and Estes Park visitors. The survey had a response rate of 72.4 percent (N=155), with 8 surveys returned as undeliverable. Eleven respondents requested to complete the survey on-site rather than have the survey mailed to their home, resulting in a total of 166 completed surveys.

Our sample was approximately evenly divided between males and females, with an average age of 48.1 years old. Respondents were predominately overnight visitors (67 percent) and highly educated, with more than 70 percent reporting a Bachelor's degree or higher and less than five percent reporting a high school diploma or less (Table 2.1). This high level of education is consistent with the findings of a previous study of ROMO visitors (Blotkamp, 2010).

Table 2.1. Demographic Characteristics of Survey Participants

Demographic Characteristics	*N*	*%*
Gender		
Male	83	50.6
Female	81	49.4
Age in years		
Mean	48.1	
Education		
High school or less	8	4.8
Some college	41	24.8
Bachelor's degree	58	35.2
Graduate degree	58	35.2
Length of stay		
Day-visitor	48	29.1
Overnight visitor	111	67.3
Local resident	6	3.6
Used Shuttles		
Yes	78	47.0

Approximately 30 percent (N=51) of respondents were first time visitors, while 15 percent (N=25) had visited the area once before, 15 percent (N=24) had visited two or three times, and 40 percent (N=66) had visited 4 times or more. The majority (65 percent, N=107) was traveling with family, 11 percent (N=19) were traveling with friends, 13 percent (N=21) were traveling in a mixed party of friends and family, and 5 percent (N=9) were traveling alone. Only 2 percent (N=3) of respondents were traveling as members of a group or club.

Forty seven percent (N=78) of respondents reported that they used a visitor shuttle on their most recent visit to Estes Park/ROMO. Respondents were then asked to indicate to what degree the price of gasoline influenced their decision to use a visitor shuttle. The idea was that if the price of gasoline had a noteworthy effect on visitors' decisions to use shuttles, the cost savings associated with shuttle versus automobile use could be used as an effective marketing tool. However, 78 percent (N=59) of those who used shuttles indicated that the price of gasoline did not influence their decision to use a shuttle.

Twenty-one percent (N=16) said that it somewhat influenced their decisions, and only 1% (N=1) indicated that it completely influenced their decision.

Preliminary Analysis

Before we move to the primary analyses of our study, it is important to have some indication that ITS can be successfully implemented at ROMO and Estes Park. ITS provide visitors with traveler information so that they can make informed travel decisions, but this often requires visitors to change plans that they have already made for their trip. Therefore, we wanted to compare planned and actual mode use to see if visitors were willing to change their plans when given useful travel information.

Respondents were instructed to indicate each mode of transportation they planned to use and each mode they actually used on their most recent visit to the area. Ninety four percent (N=156) of respondents reported that they planned to use a car, and 24 percent (N=39) planned to use a visitor shuttle. However, 91 percent (N=151) reported that they actually used a car, and 44 percent (N=73) reported that they ended up using a visitor shuttle. Although car use remained high, there was an 83 percent increase in actual shuttle use as compared to planned shuttle use. Respondents provided written explanations if their actual mode use differed from their planned use. The most common responses provided were a variation of "we did not know about the shuttle before we came," and "parking was limited." This shows that given relevant travel information, such as information about alternative travel options and updates on parking lot conditions, some segments of visitors are willing to switch travel modes.

Segmentation Analysis

To determine unique segments of respondents, K-means cluster analysis was run using the eight TPB questions addressing visitor attitudes, subjective norms, PBC and intentions towards shuttle use. Cluster analysis yields statistically significant and distinct segments of respondents in terms of the heterogeneity of responses toward the questions included in the analysis. The K-means clustering assigned the survey participants (N=164) to their respective groups based on their responses to the TPB questions on a 5-point Likert scale. Two-, three-, and four-cluster solutions were analyzed, ultimately settling on a three-cluster solution based on the effectiveness of the solution and ease of interpretation for our purposes. The three-cluster solution was then used with analysis of variance (ANOVA) and Pearson's chi-square to explore how segments differed in their demographics, use of various modes of transportation, perceptions of shuttles, and information source preferences.

Table 2.2. Visitor Segments

TPB Constructs	*Shuttle Shunners (N=24)*	*Potential Mode-shifters (N=47)*	*Bus Backers (N=93)*
Attitude 1	2.75	3.40	4.40
Attitude 2	2.58	3.53	4.56
Subjective norm 1	2.38	3.60	4.61
Subjective norm 2	1.96	2.96	3.86
PBC 1	1.75	3.38	4.55
PBC 2	2.42	3.33	4.51
Intention 1	1.57	2.93	4.37
Intention 2	1.48	3.11	4.46

Note: Items measured on a 5-point Likert scale with 5 indicating a more positive response.

Demographics	*Shuttle Shunners*	*Potential Mode-shifters*	*Bus Backers*
Female (%)	56.5	46.8	49.5
Age	51.1[a]	46.0[a]	48.4[a]
First visit (%)	25.0	23.4	35.5
Day visitor (%)	30.4	40.4	23.7
Bachelor's Degree or higher (%)	70.8	60.9	76.3
Used shuttles (%)	12.5	25.5	67.7*

*p-value >.05

[a]=statistically similar

Shuttle Shunners was the label chosen for the smallest segment. Members of this segment have the most negative attitudes towards shuttles, believe that it is unlikely that friends or loved ones feel they should use shuttles or would support their decision to use shuttles, and feel they have little control over their ability to use shuttles. Overall, members of this segment have the significantly lowest intent to use visitor shuttles on their next visit to Estes Park/ROMO.

In contrast, members of the group *Bus Backers* have the significantly highest intent to use visitor shuttles on their next trip. True to their name, members of this group have positive attitudes toward shuttles and find them to be pleasant. Members of this segment believed it likely that people who are important to them would support their decision to use shuttles, though they were slightly less confident that these important

people felt they should use shuttles. It is important to note that this group also reported the highest perceived behavioral control in regard to shuttle use, indicating that they have high ability to use shuttles and that engaging in the behavior would be easy.

The third segment, *Potential Mode-shifters*, contains respondents who are more neutral in their beliefs about and intentions to use shuttles. These respondents lack strong attitudes toward shuttles. Likewise, they are uncertain of how important people in their life would feel about their using shuttles, or believe those people lack an opinion about the matter. The *Potential Mode-shifters* appear to be indifferent to using shuttles on their next visit, either because they simply do not care to or perhaps because of their limited experience with shuttles. Whatever the reason, this group contains the best hope for mode change, as they lack strong opinions one way or the other. As this group is so neutral in their attitude, subjective norm and PBC concerning shuttle use, they are the most susceptible to interventions designed to encourage shuttle use.

As previously discussed, market segmentation has historically relied on sociodemographic traits, but recent research has shown that "attitudes and opinions largely cut uniformly across demographic characteristics (Anable, 2005)." Our analysis supports this conclusion. While all three segments were significantly unique, there were no significant differences in demographic characteristics including gender, age, education, whether they were first time visitors, or whether they were day visitors. The only significant difference between the segments was the use of shuttles at ROMO and Estes Park. A significantly higher percentage of *Bus Backers* reported that they used shuttles on their most recent visit (Table 2.2).

The questions pertaining to the TPB constructs were summated to create an aggregate measure for each construct, which is used later for the hierarchical regression analysis. Table 2.3 shows the aggregate measures by segment. The three segments are statistically different on all TPB measures. However, all three groups are statistically similar in that they all "never" or "hardly ever" use public transportation at home. *Bus Backers* are significantly different from *Shuttle Shunners* and *Potential Mode-shifters* in that they reported higher use of shuttles when visiting national parks or other recreation areas.

Table 2.3. Means and Standard Deviations for Aggregate TPB Constructs Related to Shuttle Use

	Shuttle Shunners		*Potential Mode-shifters*		*Bus Backers*	
Attitudes	2.67	(0.73)	3.47	(0.48)	4.48	(0.48)
Subjective norm	2.20	(0.73)	3.28	(0.62)	4.23	(0.53)
Perceived behavioral control	2.08	(0.65)	3.38	(0.45)	4.53	(0.45)
Intention	1.52	(0.49)	3.02	(0.65)	4.42	(0.53)
Use of public transportation at home	1.92	(1.21)	1.72	(0.85)	1.87	(1.01)
Use of shuttles when visiting a national park or recreation area	1.53	(0.74)	1.89	(0.89)	2.95	(0.99)

Note: Standard deviations in parentheses. All variables measured on a scale from 1 to 5 with higher numbers indicating more positive attitudes and norms, higher perceptions of control and intentions, and more frequent use of public transportation.

Next, we compared the mean desirability strength for outcomes associated with shuttle use to the mean belief strength for each of the outcomes, by segment. The three segments were statistically similar in their levels of desire for outcomes resulting from shuttle use, with only two exceptions. *Bus Backers* rated the desirability of reducing the tension and stress caused by driving and of alleviating the stress related to finding parking significantly higher than *Shuttle Shunners* and *Potential Mode-shifters* (Table 2.4).

Table 2.4. Desirability of Outcomes Associated with Shuttle Use

Outcome	*Shuttle Shunners*	*Potential Mode-shifters*	*Bus Backers*
Reducing my tension and stress caused by driving	4.00[a]	3.82[a]	4.42[b]
Reducing my environmental impact	4.23[a]	3.98[a]	4.24[a]
Experiencing infrequent buses with long lines	2.23[a]	2.34[a]	2.60[a]
Feeling crowded, touristy	2.10[a]	2.34[a]	2.43[a]
Alleviating my stress related to finding parking	3.82[a]	3.91[a]	4.41[b]
Feeling rushed or short on time	2.05[a]	2.55[a]	2.65[a]
Saving money by not using gas for my own vehicle	4.00[a]	3.70[a]	4.06[a]
Enhancing my sightseeing ability	3.91[a]	3.84[a]	4.05[a]
Exploring at my own pace	3.41[a]	3.77[a]	3.90[a]
Having enough space for my personal belongings	3.55[a]	3.64[a]	3.67[a]

Note: Outcomes were rated on a 5 point scale ranging from 1 (*extremely undesirable*) to 5 (*extremely desirable*). Superscripts indicate between-group differences significant at $p < .05$.

Interestingly, despite the lack of disparity in regards to desires, the segments were quite disparate in their beliefs about the likelihood of outcomes associated with shuttle use. *Bus Backers* believed it significantly more likely than the other two segments that using shuttles would reduce their tension and stress caused by driving, alleviate their stress related to finding parking, allow them to explore at their own pace, and provide enough space for their gear. *Shuttle Shunners* on the other hand believed it significantly more likely than *Bus Backers* and *Potential Mode-shifters* that using shuttles would make them feel crowded or touristy. *Shuttle Shunners* also believed it significantly less likely that using shuttles would enhance their sightseeing ability and more likely that it would make them feel rushed or short on time, as compared to *Bus Backers*. *Potential Mode-shifters* thought it significantly less likely than *Bus Backers* that shuttle use would allow them to save money on gas (Table 2.5).

Table 2.5. Belief Strength for Outcomes Associated with Shuttle Use

Outcome	*Shuttle Shunners*	*Potential Mode-shifters*	*Bus Backers*
Reduce my tension and stress caused by driving	3.22[a]	3.28[a]	4.21[b]
Allow me to reduce my environmental impact	3.83[a]	3.68[a]	4.15[a]
Make me experience infrequent buses with long lines	3.52[a]	3.47[a]	3.22[a]
Make me feel crowded, touristy	4.09[a]	3.32[b]	2.96[b]
Alleviate my stress related to finding parking	3.09[a]	3.48[a]	4.49[b]
Make me feel rushed or short on time	3.70[a]	3.21[a,b]	2.77[b]
Allow me to save money on gas	3.52[a,b]	3.28[a]	3.99[b]
Enhance my sightseeing ability	3.00[a]	3.34[a,b]	3.78[b]
Allow me to explore at my own pace	2.26[a]	2.68[a]	3.39[b]
Provide enough space for my personal belongings	2.65[a]	2.98[a]	3.56[b]

Note: Outcomes were rated on a 5 point scale ranging from 1 (*extremely unlikely*) to 5 (*extremely likely*). Superscripts indicate between-group differences significant at $p < .05$.

This shows that while the segments largely desire the same outcomes, they differ in their beliefs about whether using shuttles will allow them to realize these outcomes. The task then must be to convince visitors that shuttles can help them achieve their desired outcomes.

The three segments were statistically similar in their evaluations regarding the majority of travel information sources. "Online" and the "ROMO website" were given the highest usefulness ratings by all three segments. "Park brochure or map" was also rated as a *somewhat* to *very useful* information source by all segments, though this source was rated significantly higher by *Bus Backers*. *Bus Backers* also found the "park newspaper" to be significantly more useful than did *Shuttle Shunners*. The same is true for the highway advisory radio (HAR), though this information source was not rated as *very useful* by any of the three segments. The information sources given the lowest

usefulness rating by all three segments were "America's traveler information phone number (511)" and "text updated for cellular phones." Interestingly, *Potential Mode-shifters* and *Bus Backers* rated "other visitors" as a significantly more useful source of information than did *Shuttle Shunners* (Table 2.6).

Table 2.6. Mean Responses for Usefulness of Travel Information Sources

Source	*Shuttle Shunners*	*Potential Mode-shifters*	*Bus Backers*
ROMO website	4.21[a]	4.60[a]	4.63[a]
511	2.26[a]	2.74[a]	2.83[a]
Park brochure/map	4.21[a]	4.51[a,b]	4.68[b]
Park newspaper	3.29[a]	3.62[a,b]	3.96[b]
Host of campground/hotel/B&B	3.17[a]	3.64[a]	3.51[a]
Traveling guide/tour book	3.71[a]	3.80[a]	4.09[a]
Chamber of commerce or state visitors bureau	3.61[a]	3.70[a]	3.70[a]
Text updates for cellular phones	2.87[a]	2.78[a]	2.72[a]
Apps available for Smartphones	3.00[a]	2.96[a]	3.12[a]
Online	4.38[a]	4.62[a]	4.37[a]
HAR	2.43[a]	2.85[a,b]	3.21[b]
Family or friends	3.71[a]	3.74[a]	4.08[a]
Other visitors	3.04[a]	3.62[b]	3.96[b]

Note: Outcomes were rated on a 5 point scale ranging from 1 (*not at all useful*) to 5 (*very useful*). Superscripts indicate between-group differences significant at $p < .05$.

In exploring the influence of potential scenarios on the future use of visitor shuttles, several scenarios appear to have the potential to strongly increase use of shuttles. Due to the relative consistency in responses across the segments, influence is analyzed for the entire survey population rather than by segment. The scenario that was rated as having the potential to *strongly increase use* by the highest percentage of respondents (40 percent) was "special recreation opportunities, such as pick-ups and drop-offs for one way hikes." Thirty three percent of respondents indicated that direct shuttle routes between parking and park attractions would *strongly increase* their use, and 22 percent

said their use of shuttles would increase if electronic message signs showing real-time arrival and departure were available. Three scenarios were rated as having only negligible ability to increase future use among all three groups, particularly: an interpretive program played onboard the shuttles, information about the environmental benefits associated with shuttle use, and shuttles that operate on alternative fuels (Table 2.7).

Table 2.7. Influence of Potential Scenarios on Future Use of Shuttles

Scenario	*Strongly increase my use*		*Somewhat increase my use*		*Not at all increase my use*	
	N	*%*	*N*	*%*	*N*	*%*
Special recreation opportunities	61	39.6	71	46.1	22	14.3
Direct shuttle routes between parking and park attractions	50	33.1	74	49.0	27	17.9
Electronic signs showing real-time arrival/departure	34	22.2	78	51.0	41	26.8
Increased frequency of shuttle pick-ups and drop-offs	28	20.0	78	55.7	34	24.3
Vouchers for discounts at shops in Estes Park	27	18.0	75	50.0	48	32.0
Rising gas prices	27	17.6	74	48.4	52	34.0
Extended hours on all shuttle routes	25	18.5	71	52.6	39	28.9
Shuttles that operate on alternative fuels	24	16.7	46	31.9	74	51.4
Additional space for gear	20	13.7	53	36.3	73	50.0
Interpretive program onboard shuttles	14	9.9	55	38.7	73	51.4
Information about the environmental benefits of shuttle use	10	6.8	47	32.0	90	61.2

Regression Analysis

Hierarchical logistic regression was used to examine the influence of the TPB constructs on shuttle use and intentions, as well as the influence of two additional variables: prior visitor shuttle experience at recreation areas (VS experience) and prior

public transportation experience at home (PT experience). The first analysis examined the influence of the relevant constructs of the TPB on intention to use shuttles at Estes Park and ROMO. In the first step, the relevant TPB constructs were entered, followed by visitor shuttle experience in the second step, and public transit experience in the final step. The model had high accuracy in predicting intention in every step (between 92 and 94 percent), however, neither visitor shuttle experience nor public transport experience contributed significantly to the model. Interestingly, only perceived behavioral control contributed significantly to the prediction of intention, in all three steps (Table 2.8). A possible explanation for this is the level of experience using visitor shuttles among our sample. The segments with the least shuttle experience (*Shuttle Shunners* and *Potential Mode-shifters)* had the lowest mean scores for behavioral control. *Bus Backers* on the other hand, the segment with the most experience using visitor shuttles, had the highest mean score for behavioral control. The lack of experience using public transportation at home among all segments results in relatively infrequent use of shuttles across our entire population, as visits to national parks tend to occur on an annual as opposed to daily basis. This could explain why perceived control serves as such an important factor in deciding whether to use shuttles.

Table 2.8. Hierarchical Logistic Regression of Shuttle Behavior and Intention

Dependent variable	*Coefficient*	*Standard Error*	*Significance*	*Marginal Effect*	*LnL*	*% Correct*	*AIC*
Intention (N = 130)							
Step 1: Attitude	1.274	(0.743)	0.086	0.212			
Subjective norm	0.729	(0.541)	0.177	0.122			
Perceived control	3.270	(0.851)	0.001*	0.545	-27.38	93.8	0.483
Step 2: Attitude	1.093	(0.733)	0.136	0.168			
Subjective norm	0.762	(0.591)	0.197	0.117			
Perceived control	2.849	(0.859)	0.001*	0.437			
VS experience	0.791	(0.417)	0.058	0.121	-25.42	92.3	0.468
Step 3: Attitude	1.125	(0.758)	0.138	0.173			
Subjective norm	0.748	(0.595)	0.209	0.115			
Perceived control	2.854	(0.860)	0.001*	0.438			
VS experience	0.768	(0.433)	0.076	0.118			
PT experience	0.084	(0.472)	0.858	0.130	-25.40	92.3	0.483
Behavior (N = 132)							
Step 1: Intention	1.350	(0.261)	0.001*	0.337	-69.76	72.0	1.087
Step 2: Intention	0.869	(0.280)	0.002*	0.217			
VS experience	1.055	(0.268)	0.001*	0.264	-60.57	81.1	0.963
Step 3: Intention	0.874	(0.284)	0.002*	0.219			
VS experience	1.046	(0.278)	0.000*	0.262			
PT experience	0.028	(0.250)	0.911	0.007	-60.57	81.1	0.978

*p-value <.05

We now move to the second model in our analysis. In predicting behavior, the relevant TPB construct (intention) was added in the first step, followed by visitor shuttle experience in the second step, and public transit experience in the final step. Consistent with the literature, intention contributed significantly to the prediction of behavior, resulting in 72 percent accuracy in prediction when serving as the only predictor in the model. However, when visitor shuttle experience was added in the second step, the accuracy of the model in predicting behavior increased to 81 percent. Visitor shuttle experience contributed significantly to the prediction of behavior in both the second and third step, though public transit experience did not contribute significantly. An examination of the marginal effects listed in Table 8 provides insight into the contribution of the independent variables included in our analysis. When multiplied by 100, the marginal effects yield the percentage change in the probability of a visitor engaging in the behavior in question (in our case, shuttle use). For example, looking at the model for behavior, if a visitor has a one unit increase in visitor shuttle experience, it would increase their probability of using shuttles by 26 percent.

Discussion

Intelligent transportation technologies have the potential to significantly increase visitor awareness and use of alternative travel modes at parks and recreation areas (Daigle & Zimmerman, 2004b; Ye, et al., 2010). To realize the full potential of these technologies it is essential that we understand who is likely to use shuttles and what

factors influence their mode choice. Our study set out to explore the factors influencing mode choice at Estes Park and ROMO, so as to determine potential strategies for increasing voluntary shuttle use.

The first objective of our study was to examine the utility of the theory of planned behavior to predict choice of travel mode in a recreation setting. Based on a series of hierarchical logistic regression analyses, intention was found to be a significant predictor of shuttle use. Furthermore, in predicting intention the use of the theory constructs resulted in high accuracy in prediction, although only PBC contributed significantly to the model. It is logical that PBC plays such an important role in predicting shuttle use in recreation settings, as the infrequent nature of the activity reduces one's sense of control over the behavior. Several studies have shown that visitors believe they have more freedom and ability to travel where they choose in a private automobile as compared to a visitor shuttle (Hallo & Manning, 2009; Youngs, et al., 2008). This perceived lack of freedom can certainly contribute to one's sense of behavioral control.

Our second objective was to determine if past behavior can improve the predictive power of the theory of planned behavior. Previous visitor shuttle experience contributed significantly to the prediction of shuttle use, though not to the prediction of intention. However, if PBC were to increase it is possible that previous shuttle experience would be a significant predictor of intention as well. Previous experience using public transit at home did not contribute significantly to the prediction of intention or shuttle use. These results support the argument that transportation in recreations settings is inherently

different from public transportation in typical home and work environments (Hallo & Manning, 2009). Therefore, visitors may be unaccustomed to the use of public transportation, yet open to trying alternative travel modes in the context of a national park. This is an important finding as it reveals that despite a lack of experience with public transportation at home, if visitors can be convinced to simply try park transit, the probability of future use of visitor shuttles increases. The task is then to determine how to convince visitors to try visitor shuttles.

The third objective sought to do this, by applying the theory of planned behavior to determine distinct segments of visitors in regard to their beliefs about transportation. Using cluster analysis, we identified three distinct segments of Estes Park/ROMO visitors. Consistent with the literature (Anable, 2005; Hunecke, et al., 2010), these segments were statistically similar in regards to sociodemographic variables such as age, gender, and education, yet significantly different in terms of their attitudes, subjective norms, PBC and intentions to use shuttles. Therefore, comparisons were made between segments to inform management strategies.

A number of useful conclusions can be made based on the comparisons between segments on the likelihood and desirability of outcomes associated with shuttle use. Our analysis revealed that while visitors largely desire the same outcomes, such as reduced tension and stress and enhanced sightseeing ability, they differ in their beliefs about whether using shuttles will allow them to realize these outcomes. The group *Shuttle Shunners* holds the most negative views about shuttle use, thus it will be difficult to

convince them to try shuttles. However, *Potential Mode-shifters* are neutral in their evaluations and therefore steps can be taken to improve their attitudes about shuttles and perceptions of behavioral control. *Potential Mode-shifters* expressed strong desires to reduce their tension and stress caused by driving and to alleviate their stress related to finding parking. Thus, the messaging employed via the ITS should emphasis that by using the free shuttles, visitors can relax and not have to worry about finding a parking space or driving in congestion. *Potential Mode-shifters* also expressed strong desires to enhance their sightseeing ability. The Estes Park and ROMO shuttles can be promoted as a way for visitors to focus on the scenery and landscape while leaving the navigating to the shuttle operators. These messages will also work to encourage shuttle use among *Bus Backers*, who also strongly desired these outcomes. While the majority of *Bus Backers* reported that they are already using visitor shuttles, more than 30 percent reported that they did not use shuttles on their last visit to the area, despite their positive attitudes and high intentions to use shuttles. *Bus Backers* desired reduced tension and stress related to driving and parking above all other segments, therefore promoting those outcomes has strong potential to shift the remaining *Bus Backers* from autos to shuttles.

All three segments indicated that feeling rushed or short on time was undesirable, as well as feeling crowded or experiencing infrequent buses with long lines. Unfortunately, neither *Bus Backers* nor *Potential Mode-shifter* were confident that these outcomes were entirely unlikely. To assuage this concern, shuttle service must be frequent and reliable, giving visitors the ability to access the most popular park attractions without excessive wait times for shuttle pick-ups. The ITS must then

prominently advertise the frequency and hours of shuttle operation. In a park such as ROMO, avoiding crowds is often impossible in the front country, so this should not be advertised as a benefit of shuttle use. However, ITS can be used to inform visitors of off-peak hours when shuttles and park attractions are less crowded. This information must also be provided on the town and park websites, as well as through other trip planning modes such as park literature, as many visitors have itineraries in mind before that arrive to the area (Villwock-Witte & Collum, 2012).

Furthermore, based on the visitor evaluations, the ROMO website and other online sources are the most useful travel information resources. Shuttle information must be prominently displayed on these websites. Park brochures and maps were also rated as very useful travel resources. The HAR was not rated as a useful information source by any of the three segments, which suggests that the HAR may not be an appropriate ITS technology for ROMO and Estes Park.

Our analysis also identified a number of scenarios that have the potential to increase shuttle use. The scenario with the highest potential to increase shuttle use was the availability of special recreation opportunities, such as pick-ups and drop-offs for one-way hikes. Every year, thousands of visitors travel to ROMO to climb Longs Peak, a long and challenging climb which necessitates climbers hit the trail hours before sunrise in order to reach the peak before afternoon thunderstorms arrive (National Park Service, 2012). Currently, there is no shuttle route servicing Long's Peak. There are also other popular hikes within ROMO for which hikers must arrange pick-up and drop-off. The

survey results indicate that offering shuttle drop-off and pick-up for these popular hikes could improve shuttle ridership. Because of the length of time it takes to complete a hike such as Longs Peak, the shuttles could provide as few as two drop-offs and two pick-ups per day and still be successful.

Two other scenarios also ranked as having strong potential to increase shuttle ridership. The first was the availability of direct shuttle routes between parking and park attractions. A park-and-ride lot already exist in Estes Park; however, visitors must transfer at the Estes Park Convention and Visitors Bureau in order to connect to the shuttle route that accesses ROMO. A direct route from the park-and-ride to ROMO would increase the appeal of the park-and-ride lot, and based on our results, strongly influence many visitors to use shuttles. The second high-ranking scenario was the implementation of electronic signs that display the real-time arrival and departure of shuttle routes. Real-time arrival signs have tested well in other parking settings (Daigle & Zimmerman, 2004b) and could make a valuable addition to an ITS at ROMO and Estes Park.

While our study provides a number of recommendations concerning the promotion of park shuttles, it is not without limitations. Foremost, the theory of planned behavior offers the most utility when applied to a longitudinal study to evaluate the effect of an intervention on a specific behavior (Fishbein & Ajzen, 2010). Time and resource constraints made a longitudinal study impossible, therefore we were unable to properly evaluate the potential for ITS at ROMO by gathering data before and after the

implementation of the ITS. If another pilot study is conducted in the future to explore other ITS technologies, survey data should be gathered both pre- and post-implementation to properly predict shuttle use.

Our study was also limited by a small sample size. Our relatively small sample size was a result of combining this analysis with a larger data collection effort to evaluate the pilot ITS. The respondents of our survey had already made a time investment by filling out an onsite survey to evaluate the ITS, therefore, participating in the mail survey required an additional investment of time, thus adding additional burden to respondents. To minimize the time burden to respondents, the survey instrument was designed to be short and concise. However, much can be gained from knowing more about the factors that influence mode choice. Future research should evaluate the usefulness of other ITS technologies, such as real-time arrival signs. Additional lifestyle and personally traits should be considered in segmenting visitors, including reasons for visiting the area, preferred recreation activities, and willingness to change plans and try new travel modes. This information could further inform management strategies, making ITS a highly effective tool for travel management.

Conclusions

In the coming decades America's parks and public lands will continue to grapple with increasing visitation and growing pressure on natural and managerial resources. One of the foremost challenges for park managers will be transitioning from the auto-dominated park infrastructure of the past to the alternative transportation systems of the future. ITS have the potential to vastly improve transportation management, but only if the proper technologies are coupled with meaningful travel information.

Despite the unique character of park visitors, similarities exist between individuals that can help managers determine appropriate ITS technologies to invest in and effective messaging to be employed via these technologies. Our study demonstrates the utility of the theory of planned behavior as a conceptual framework for predicting shuttle use in park settings and segmenting visitors based on their beliefs with regard to shuttle use. Segmentation analysis proved valuable for exploring the divergent beliefs about shuttles held by park visitors. By combining theory and market segmentation, park managers can identify and implement empirically sound travel management strategies.

Although ITS are gaining popularity in park and recreation settings, there are inherent differences in travel for tourism purposes as opposed to traditional travel that must be considered when identifying appropriate technologies. By employing technologies that cater to the needs of park visitors and fit with the natural environment of national parks, there is potential for a new park culture to emerge that is dominated by smart, alternative transit options that lay lighter on the land.

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APPENDIX A. HIGHWAY ADVISORY RADIO MESSAGE SETS

Table A.1. HAR Messages without Insider's Tip

Message Number	Highway Advisory Radio Message – Without "Insider's Tip"
H-1	The following is traveler information for Rocky Mountain National Park. Rocky Mountain National Park and the Gateway Community of Estes Park invite you to use free shuttle services between the new park-and-ride lot in Estes Park and Rocky Mountain National Park. Riding the shuttle is a relaxed and convenient way to explore the Park; you will not have to wait in entrance lines, find a parking space at each attraction or navigate your own way through the Park. By using this service, you will also help the National Park Service reduce congestion and preserve natural resources. While the shuttle services are free, be sure to purchase your entrance pass at the Estes Park or Beaver Meadows Visitors Center. You can also pick up maps and information about shuttle services at either visitor center, so stop in and learn about these options for car-free travel within the Park. Here is an overview of the shuttle routes available. From the park-and-ride lot, take the Silver Route to the Estes Park Visitors Center, where you can connect to the four shuttle routes that travel to and within Rocky Mountain National Park and Estes Park: the Hiker, Brown, Red and Blue Routes. Shuttle schedules and maps are available at both Visitor Centers. We hope you will take advantage of the new park-and-ride lot, with its convenient access to Park shuttle services. As you travel west along US 36 into the Estes Park valley, turn left on Community Drive to access the park-and-ride lot. Watch for the electronic message sign just before the turn.
H-2	Rocky Mountain National Park and the gateway community of Estes Park invite you to use free shuttle services between the Fairgrounds park-and-ride lot, the Town of Estes Park, and Rocky Mountain National Park. By using the shuttles, you will help the National Park Service and the Town reduce congestion and preserve natural resources. Remember to purchase your entrance pass at the Estes Park or Beaver Meadows Visitor Center, and while you're there, pick up maps and helpful information about shuttle services at either visitor center. As you travel west along US 36 into the Estes Park valley, turn left on Community Drive and follow the green park-and-ride signs to the lot. Watch for the electronic message sign just before the turn onto Community Drive. Once at the park-and-ride lot, head to the shuttle shelter to board the Silver Route. This route will allow you to connect to the Hiker, Brown, Red, or Blue Route, running daily from 10am to 8pm. The Hiker shuttle connects you to Rocky Mountain National Park and the other shuttles provide service to attractions in and around Estes Park.

Figure A.2. HAR Messages with Insider's Tip

Message Number	Highway Advisory Radio Message – With "Insider's Tip"
H-IT-1	The following is traveler information for Rocky Mountain National Park. Rocky Mountain National Park and the Gateway Community of Estes Park invite you to use free shuttle services between the new park-and-ride lot in Estes Park and Rocky Mountain National Park. Riding the shuttle is a relaxed and convenient way to explore the Park; you will not have to wait in entrance lines, find a parking space at each attraction or navigate your own way through the Park. By using this service, you will also help the National Park Service reduce congestion and preserve natural resources. While the shuttle services are free, be sure to purchase your entrance pass at the Estes Park or Beaver Meadows Visitors Center. You can also pick up maps and information about shuttle services at either visitor center, so stop in and learn about these options for car-free travel within the Park. Here's an insider's tip that may help you enjoy area attractions even more. Most visitors come to the National Park in the morning. If your schedule permits, explore Estes Park in the morning and come to Rocky Mountain National Park in the afternoon. Here is an overview of the shuttle routes available. From the park-and-ride lot, take the Silver Route to the Estes Park Visitors Center, where you can connect to the four shuttle routes that travel to and within Rocky Mountain National Park and Estes Park: the Hiker, Brown, Red and Blue Routes. Shuttle schedules and maps are available at both Visitor Centers. We hope you will take advantage of the new park-and-ride lot, with its convenient access to Park shuttle services. As you travel west along US 36 into the Estes Park valley, turn left on Community Drive to access the park-and-ride lot. Watch for the electronic message sign just before the turn.
H-IT-2	Rocky Mountain National Park and the gateway community of Estes Park invite you to use free shuttle services between the Fairgrounds park-and-ride lot, the Town of Estes Park, and Rocky Mountain National Park. By using the shuttles, you will help the National Park Service and the Town reduce congestion and preserve natural resources. Here's an insider's tip: you may also want to consider exploring Estes Park in the morning and come to Rocky Mountain National Park in the afternoon when there are less visitors. Remember to purchase your entrance pass at the Estes Park or Beaver Meadows Visitor Center, and while you're there, pick up maps and helpful information about shuttle services at either visitor center. As you travel west along US 36 into the Estes Park valley, turn left on Community Drive and follow the green park-and-ride signs to the lot. Watch for the electronic message sign just before the turn onto Community Drive. Once at the park-and-ride lot, head to the shuttle shelter to board the Silver Route. This route will allow you to connect to the Hiker, Brown, Red, or Blue Route, running daily from 10am to 8pm. The Hiker shuttle connects you to Rocky Mountain National Park and the other shuttles provide service to attractions in and around Estes Park.

APPENDIX B. SHUTTLE ROUTES

Figure B.1. Hiker Shuttle Route

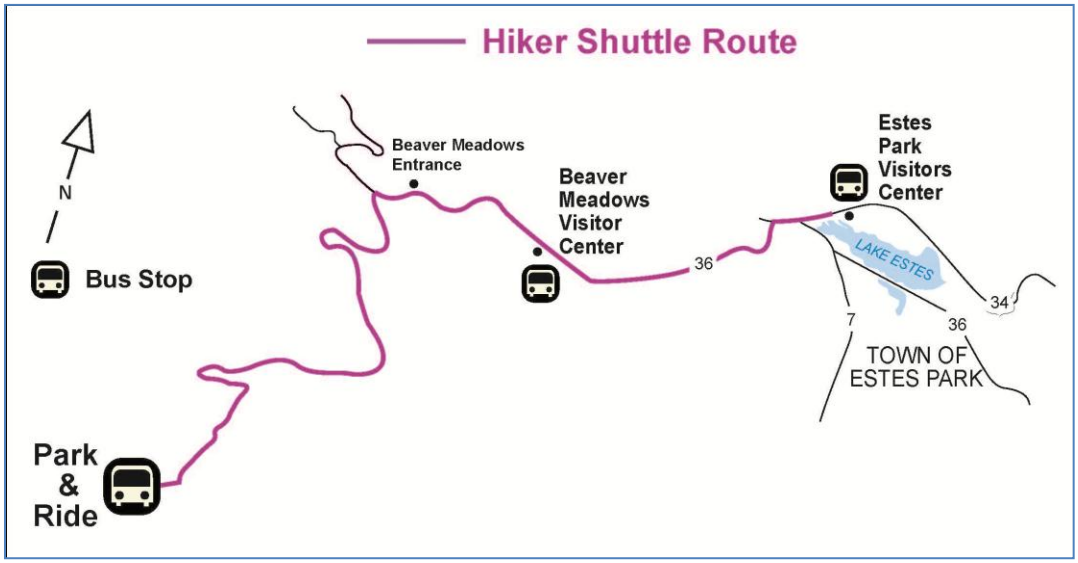
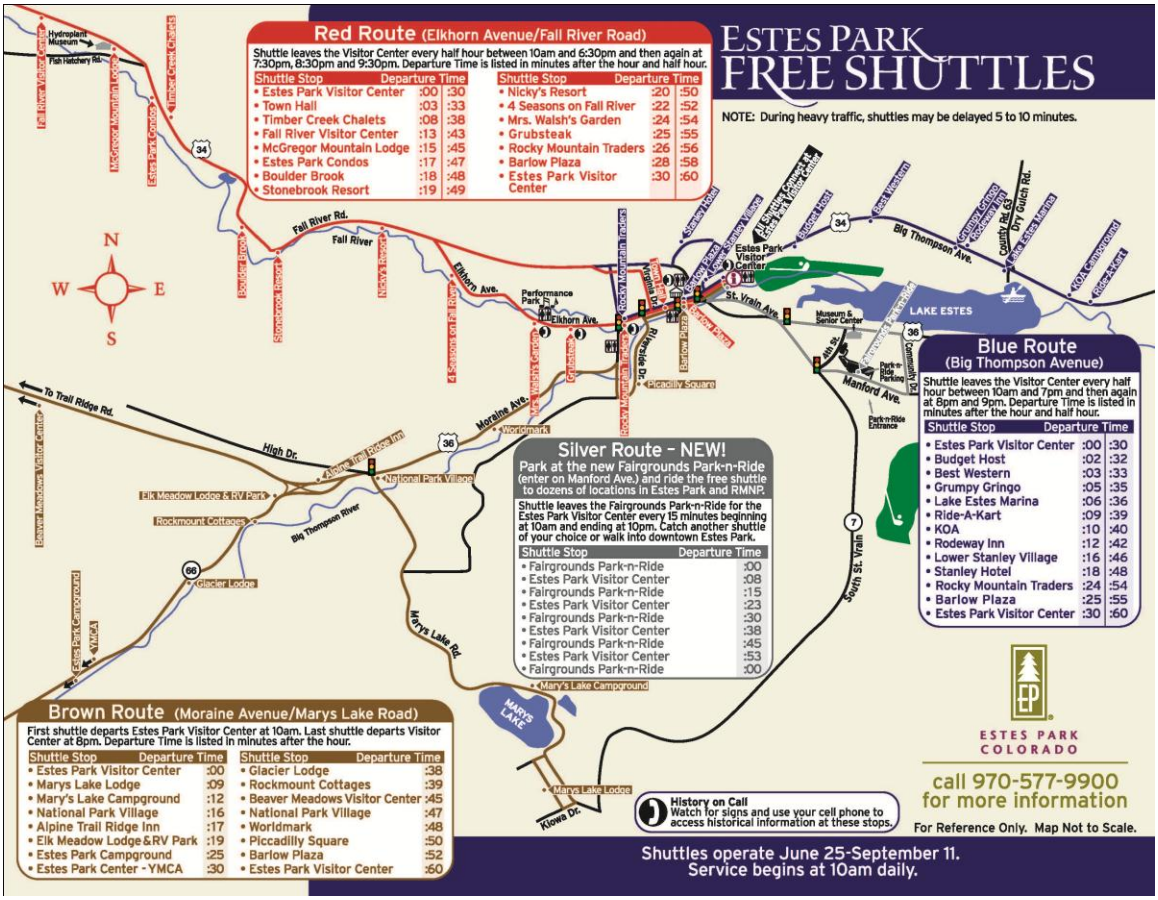


Figure B.2. Estes Park Shuttle Routes



APPENDIX C. DYNAMIC MESSAGE SIGNS

Figure C.1. Locations of Dynamic Message Signs

Figure C.2. Dynamic Message Sign

APPENDIX D. ONSITE SHUTTLE SURVEY

ESTES PARK TRAVEL SURVEY 2011

PLEASE READ FIRST:

We are working with Rocky Mountain National Park and the Town of Estes Park to improve travel conditions and provide useful travel information to improve your recreation experience! Please take a moment to answer the following questions. Your participation in this survey is voluntary and anonymous and should only take about 5 minutes. **Thank you!**

If you would like more information about the Paul S. Sarbanes Transit in Parks Technical Assistance Center, please visit www.triptac.org If you would like more information about this survey, please contact Kourtney Collum at (207) 581-2897 or by email at kourtney.collum@maine.edu

To be completed by interviewer: Initials _____ Location _____ Date _____ RG _____

Section I. Travel information

1. **Is this your first time visiting Estes Park/Rocky Mountain National Park?**
   ☐ Yes ☐ No

2. **How would you rate your overall experience visiting Estes Park/Rocky Mountain National Park?**
   ☐ Very good ☐ Good ☐ Average ☐ Poor ☐ Very poor

3. **How would you rate your travel experience (i.e. driving, navigating, parking) while visiting Estes Park/Rocky Mountain National Park?**
   ☐ Very good ☐ Good ☐ Average ☐ Poor ☐ Very poor

4. **How long do you plan to spend visiting Estes Park/Rocky Mountain National Park?**

   _____ **HOURS** (if less than 24 hours) or _____ **DAYS** (if 24 hours or more)

5. **Which route did you travel to arrive to the area on this trip?**
   ☐ U.S. Highway 36 (From Boulder, Longmont, and Lyons area)
   ☐ U.S. Highway 34 (From Fort Collins, Loveland area)
   ☐ Colorado State Highway 7
   ☐ Other (please specify): _____

6. **Did you see an electronic message sign while traveling on this trip?**
   ☐ Yes → If yes, go to question 6a
   ☐ No → If no, go to question 7

   6a. Please look at the map attached to your clipboard. At which location(s) did you see an electronic message sign? (*Please check* ALL *that apply*)

   ☐ Location 1 (Near the town of Lyons)
   ☐ Location 2 (On the descent into Estes Park)
   ☐ Location 3 (Right before the turn for the Fairgrounds Park-n-Ride)
   ☐ I don't remember

   6b. For each location where you saw an electronic message sign, how strongly do you agree or disagree with the following statements about the placement of the signs? (*Please check* ONE *box only)*

	Strongly Agree	Somewhat Agree	Neither	Somewhat Disagree	Strongly Disagree
The sign at **Location 1** was in a good spot	☐	☐	☐	☐	☐
The sign at **Location 2** was in a good spot	☐	☐	☐	☐	☐
The sign at **Location 3** was in a good spot	☐	☐	☐	☐	☐

   6c. Did at least one of the electronic message signs display a message prompting you to tune to AM 1630?

   ☐ Yes ☐ No

7. **Did you tune to AM 1630 during this trip?**

☐ Yes → If yes, go to question 7a ☐ No → If no, go to question 8

7a. How strongly do you agree or disagree with the following statements about how your travel plans were influenced based on the information provided on AM 1630?
(*Please check* **ONE** *box for each statement*)

	Strongly Agree	Somewhat Agree	Neither	Somewhat Disagree	Strongly Disagree
The information influenced me to use the Park-n-Ride	❒	❒	❒	❒	❒
I decided to visit certain attractions within the park ***later*** in the day based on the information	❒	❒	❒	❒	❒

7b. How strongly do you agree or disagree with the following statements about AM 1630?
(*Please check* **ONE** *box for each statement)*

	Strongly Agree	Somewhat Agree	Neither	Somewhat Disagree	Strongly Disagree
The information was accurate	❒	❒	❒	❒	❒
The information saved me time	❒	❒	❒	❒	❒
I was able to get around easier with the information	❒	❒	❒	❒	❒
I would plan to use this information if visiting again	❒	❒	❒	❒	❒
The information helped me avoid traffic congestion	❒	❒	❒	❒	❒
I needed more information (please specify): _____	❒	❒	❒	❒	❒

8. **What is your reason for using the Fairgrounds Silver Route shuttle today?** (*Please check* **ALL** *that apply)*

☐ To visit attractions within Rocky Mountain National Park
☐ To visit shops located in Estes Park
☐ To commute to/from work
☐ Other (*please specify*): _____

9. **Have you used a shuttle to travel around Estes Park/Rocky Mountain National Park prior to this visit?**

☐ Yes ☐ No

10. **Which shuttle route(s) have you used or do you plan to use while visiting Estes Park/Rocky Mountain National Park during this trip?** (*Please check* **ALL** *that apply*)

	Have Used	Plan to Use
The **Hiker** Shuttle to Rocky Mountain National Park	❒	❒
The **Bear Lake** Shuttle	❒	❒
The **Moraine Lake** Shuttle	❒	❒
The Fairgrounds **Silver Route**	❒	❒
The Shopper Shuttle **Red Route**	❒	❒
The Shopper Shuttle **Blue Route**	❒	❒
The Campground Shuttle **Brown Route**	❒	❒

11. **How did you learn about the Fairgrounds <u>Silver Route</u> shuttle?** (*Please check* **ALL** *that apply*)

- ☐ Previous visits
- ☐ Family or friends
- ☐ A newspaper article
- ☐ Electronic message signs
- ☐ AM 1630
- ☐ From visitor center staff
- ☐ From hotel/lodge/campsite staff
- ☐ The Town of Estes Park website
- ☐ The Rocky Mountain National Park website
- ☐ Through my employment with Rocky Mountain National Park
- ☐ Through my employment with a business in Estes Park
- ☐ Other (please specify): _____

12. **Please indicate how strongly do you agree or disagree with the following statements about the Fairgrounds <u>Silver Route</u> shuttle?** (*Please check* **ONE** *box for each statement*)

	Strongly Agree	Somewhat Agree	Neither	Somewhat Disagree	Strongly Disagree
The shuttle schedule is confusing	❒	❒	❒	❒	❒
The shuttle saved me time	❒	❒	❒	❒	❒
The shuttle is convenient	❒	❒	❒	❒	❒
The shuttle does not run frequently enough for my needs	❒	❒	❒	❒	❒
Getting on and off the shuttle is physically challenging for me or someone in my group	❒	❒	❒	❒	❒
I had to switch shuttles too many times to get to my desired destination	❒	❒	❒	❒	❒
The shuttle does not have sufficient room for my gear	❒	❒	❒	❒	❒
It seems difficult to travel with children on the shuttle	❒	❒	❒	❒	❒
I enjoyed my experience using the shuttle	❒	❒	❒	❒	❒
I would use the shuttle again	❒	❒	❒	❒	❒

Section II. About you

13. **What is your zip code *or* country of residence?**

Zip code _____ *or* Country of residence _____

14. **How many people are you traveling with today, including yourself?**

_____ Children (5 years or younger)
_____ Children (6-17 years)
_____ Adults (18-64 years)
_____ Seniors (65 years or older)

15. **Is there anything you would like to share related to your travel experience? Please feel free to write your thoughts in the space below.**

_____

_____

_____

_____

THANK YOU FOR COMPLETING THIS SURVEY!

APPENDIX E. ONSITE VISITOR SURVEY

ESTES PARK TRAVEL SURVEY 2011

PLEASE READ FIRST:

We are working with Rocky Mountain National Park and the Town of Estes Park to improve travel conditions and provide useful travel information to improve your recreation experience! Please take a moment to answer the following questions. Your participation in this survey is voluntary and anonymous and should only take about 5 minutes. **Thank you!**

If you would like more information about the Paul S. Sarbanes Transit in Parks Technical Assistance Center, please visit www.triptac.org If you would like more information about this survey, please contact Kourtney Collum at (207) 581-2897 or by email at kourtney.collum@maine.edu

To be completed by interviewer: Initials _____ Location _____ Date _____ RG _____

Section I. Travel information

1. **Is this your first time visiting Estes Park/Rocky Mountain National Park?**
   ☐ Yes ☐ No

2. **How would you rate your overall experience visiting Estes Park/Rocky Mountain National Park?**
   ☐ Very good ☐ Good ☐ Average ☐ Poor ☐ Very poor

3. **How would you rate your travel experience (i.e. driving, navigating, parking) while visiting Estes Park/Rocky Mountain National Park?**
   ☐ Very good ☐ Good ☐ Average ☐ Poor ☐ Very poor

4. **How long do you plan to spend visiting Estes Park/Rocky Mountain National Park?**

   _____ **HOURS** (if less than 24 hours) or _____ **DAYS** (if 24 hours or more)

5. **Which route did you travel to arrive to the area on this trip?**
   ☐ U.S. Highway 36 (From Boulder, Longmont, and Lyons area)
   ☐ U.S. Highway 34 (From Fort Collins, Loveland area)
   ☐ Colorado State Highway 7
   ☐ Other (please specify): _____

6. **Did you see an electronic message sign while traveling on this trip?**
   ☐ Yes → If yes, go to question 6a
   ☐ No → If no, go to question 7

   6a. Please look at the map attached to your clipboard. At which location(s) did you see an electronic message sign? (*Please check* **ALL** *that apply*)

   ☐ Location 1 (Near the town of Lyons)
   ☐ Location 2 (On the descent into Estes Park)
   ☐ Location 3 (Right before the turn for the Fairgrounds Park-n-Ride)
   ☐ I don't remember

   6b. For each location where you saw an electronic message sign, how strongly do you agree or disagree with the following statements about the placement of the signs? (*Please check* **ONE** *box only)*

	Strongly Agree	Somewhat Agree	Neither	Somewhat Disagree	Strongly Disagree
The sign at **Location 1** was in a good spot	☐	☐	☐	☐	☐
The sign at **Location 2** was in a good spot	☐	☐	☐	☐	☐
The sign at **Location 3** was in a good spot	☐	☐	☐	☐	☐

   6c. Did at least one of the electronic message signs display a message prompting you to tune to AM 1630?
   ☐ Yes ☐ No

7. **Did you tune to AM 1630 during this trip?**

☐ Yes → If yes, go to question 7a ☐ No → If no, go to question 8

7a. How strongly do you agree or disagree with the following statements about how your travel plans were influenced based on the information provided on AM 1630?
(*Please check* **ONE** *box for each statement*)

	Strongly Agree	Somewhat Agree	Neither	Somewhat Disagree	Strongly Disagree
The information influenced me to use the Park-n-Ride	❒	❒	❒	❒	❒
I decided to visit certain attractions within the park ***later*** in the day based on the information	❒	❒	❒	❒	❒

7b. How strongly do you agree or disagree with the following statements about AM 1630?
(*Please check* **ONE** *box for each statement)*

	Strongly Agree	Somewhat Agree	Neither	Somewhat Disagree	Strongly Disagree
The information was accurate	❒	❒	❒	❒	❒
The information saved me time	❒	❒	❒	❒	❒
I was able to get around easier with the information	❒	❒	❒	❒	❒
I would plan to use this information if visiting again	❒	❒	❒	❒	❒
The information helped me avoid traffic congestion	❒	❒	❒	❒	❒
I needed more information (please specify): _____	❒	❒	❒	❒	❒

8. **Have you used a shuttle to travel around Estes Park/Rocky Mountain National Park prior to this visit?**

☐ Yes ☐ No

9. **Which shuttle route(s), if any, have you used or do you plan to use while visiting Estes Park/Rocky Mountain National Park during this trip?** (*Please check* **ALL** *that apply*)

	Have Used	Plan to Use
The **Hiker** Shuttle to Rocky Mountain National Park	❒	❒
The **Bear Lake** Shuttle	❒	❒
The **Moraine Lake** Shuttle	❒	❒
The Fairgrounds **Silver Route**	❒	❒
The Shopper Shuttle **Red Route**	❒	❒
The Shopper Shuttle **Blue Route**	❒	❒
The Campground Shuttle **Brown Route**	❒	❒

10. **How did you learn about the shuttle(s)?** (*Please check* **ALL** *that apply*)

- ☐ Previous visits
- ☐ Family or friends
- ☐ A newspaper article
- ☐ Electronic message signs
- ☐ AM 1630
- ☐ From visitor center staff
- ☐ From hotel/lodge/campsite staff
- ☐ The Town of Estes Park website
- ☐ The Rocky Mountain National Park website
- ☐ Through my employment with Rocky Mountain National Park
- ☐ Through my employment with a business in Estes Park
- ☐ Other (please specify): _____

11. **The following are possible reasons why you may have decided NOT to use the Fairgrounds <u>Silver Route</u> shuttle. Please indicate how strongly you agree or disagree with the following statements.**
(*Please check* **ONE** *box for each statement*)

	Strongly Agree	Somewhat Agree	Neither	Somewhat Disagree	Strongly Disagree
I was not aware of the shuttle	❒	❒	❒	❒	❒
The shuttle wasn't running when I arrived	❒	❒	❒	❒	❒
I had trouble finding the shuttle schedule	❒	❒	❒	❒	❒
The shuttle schedule is confusing	❒	❒	❒	❒	❒
The shuttle does not run frequently enough for my needs	❒	❒	❒	❒	❒
Getting on and off a shuttle is physically challenging for me or someone in my group	❒	❒	❒	❒	❒
I would have to switch shuttles too many times to get to my desired destination	❒	❒	❒	❒	❒
The shuttle does not have sufficient room for my gear	❒	❒	❒	❒	❒
It seems difficult to travel with children on the shuttle	❒	❒	❒	❒	❒
Other (please specify): _____	❒	❒	❒	❒	❒

Section II. About you

12. **What is your zip code *or* country of residence?**

Zip code _____ *or* Country of residence _____

13. **How many people are you traveling with today, including yourself?**

_____ Children (5 years or younger)
_____ Children (6-17 years)
_____ Adults (18-64 years)
_____ Seniors (65 years or older)

14. **Is there anything you would like to share related to your travel experience? Please feel free to write your thoughts in the space below.**

_____

_____

_____

_____

THANK YOU FOR COMPLETING THIS SURVEY!

APPENDIX F. MAIL SURVEY

ESTES PARK TRAVEL SURVEY

PLEASE READ FIRST:

The person who completed the onsite travel survey on your most recent visit to the Town of Estes Park/Rocky Mountain National Park should complete this survey. This is an effort by the Paul S. Sarbanes Transit in Parks Technical Assistance Center and the Town of Estes Park to understand how travel affects your experience. Thank you for your participation!

Section I. About your use of visitor shuttles

1. **During your most recent visit to Estes Park/Rocky Mountain National Park, did you use a visitor shuttle?**
   - ☐ Yes →If yes, go to question 1a
   - ☐ No → If no, go to question 2

   1a. What was your reason for using a visitor shuttle while visiting Estes Park/Rocky Mountain National Park? (*Please check* **ALL** *that apply*)
   - ☐ To visit attractions within Rocky Mountain National Park
   - ☐ To visit shops located in Estes Park
   - ☐ To commute to/from work
   - ☐ Other (*please specify*): _____

   1b. How did the price of gasoline influence your decision to use a visitor shuttle?
   - ☐ It did not influence my decision to use a shuttle
   - ☐ It somewhat influenced my decision to use a shuttle
   - ☐ It completely influenced my decision to use a shuttle

2. **How often do you use each of the following modes of transportation to get around when visiting a national park or other recreation area?** (*Please check* **ONE** *box for* **EACH** *item)*

	Always	Often	Occasionally	Seldom	Never
Car	❒	❒	❒	❒	❒
Visitor shuttle	❒	❒	❒	❒	❒
Bicycle	❒	❒	❒	❒	❒
Walking	❒	❒	❒	❒	❒
Group tour bus	❒	❒	❒	❒	❒
Other (*please specify*) _____	❒	❒	❒	❒	❒

3. **We would like to know if any of the following would influence your future use of visitor shuttles. How would your use of visitor shuttles be influenced by the following?** (*Please check* **ONE** *box for* **EACH** *item)*

	Strongly Increase My Use	Somewhat Increase My Use	Not at all Increase My Use	Not Sure
Extended hours on all shuttle routes	❒	❒	❒	❒
Increased frequency of shuttle pick-ups and drop-offs	❒	❒	❒	❒
An interpretive program played onboard the shuttle to describe the areas natural and cultural history	❒	❒	❒	❒
Vouchers for discounts at shops in downtown Estes Park	❒	❒	❒	❒
Additional space for gear such as coolers, camping gear, strollers or bicycles	❒	❒	❒	❒
Information about the environmental benefits of shuttle use, such as reduced air and noise pollution	❒	❒	❒	❒
Special recreation opportunities, such as drop-off & pick-up for one way hikes	❒	❒	❒	❒
Rising gas prices	❒	❒	❒	❒
Electronic signs showing real-time shuttle arrival/departure	❒	❒	❒	❒
Direct shuttle routes between parking and park attractions	❒	❒	❒	❒
Park shuttles that operate on alternative fuels such as ethanol, propane, electricity or biodiesel	❒	❒	❒	❒

Section II. About your opinions towards shuttle use

4. **We would like to know more about your opinions toward using the visitor shuttles on your next trip to Estes Park/Rocky Mountain National Park. Please read each of the following questions carefully, as the response options change, and check the box that best describes your opinion.** (*Please check* **ONE** *box for* **EACH** *statement*)

	Extremely Pleasant	Somewhat Pleasant	Neither	Somewhat Unpleasant	Extremely Unpleasant
For me, taking the visitor shuttle next time would be	❒	❒	❒	❒	❒

	Extremely Likely	Somewhat Likely	Neither	Somewhat Unlikely	Extremely Unlikely
Most people who are important to me would support my decision to take the visitor shuttle next time	❒	❒	❒	❒	❒

	Extremely High	Somewhat High	Neither	Somewhat Low	Extremely Low
My ability to take the visitor shuttle next time is	❒	❒	❒	❒	❒

	Extremely Good	Somewhat Good	Neither	Somewhat Bad	Extremely Bad
For me, taking the visitor shuttle next time would be	❒	❒	❒	❒	❒

	Extremely Likely	Somewhat Likely	Neither	Somewhat Unlikely	Extremely Unlikely
Most people who are important to me think I should take the visitor shuttle next time	❒	❒	❒	❒	❒

	Extremely Easy	Somewhat Easy	Neither	Somewhat Difficult	Extremely Difficult
For me, taking the visitor shuttle next time would be	❒	❒	❒	❒	❒

	Extremely Strong	Somewhat Strong	Neither	Somewhat Weak	Extremely Weak
My intention to take the visitor shuttle next time is	❒	❒	❒	❒	❒

	Extremely Likely	Somewhat Likely	Neither	Somewhat Unlikely	Extremely Unlikely
For me, taking the visitor shuttle next time is	❒	❒	❒	❒	❒

5. **This question explores your views about the positive and negative outcomes people may associate with using the visitor shuttles at Estes Park/Rocky Mountain National Park. Please rate the following statements between extremely likely and extremely unlikely to express your degree of certainty that use of the visitor shuttles will lead to a given outcome.** (*Please check* **ONE** *box for* **EACH** *statement*)

	Extremely Likely	Somewhat Likely	Neither	Somewhat Unlikely	Extremely Unlikely
Reduce my tension and stress caused by driving	❒	❒	❒	❒	❒
Allow me to reduce my environmental impact (such as air or noise pollution)	❒	❒	❒	❒	❒
Make me experience infrequent buses with long lines	❒	❒	❒	❒	❒
Make me feel crowded, touristy	❒	❒	❒	❒	❒
Alleviate my stress related to finding parking	❒	❒	❒	❒	❒
Make me feel rushed or short on time	❒	❒	❒	❒	❒
Allow me to save money by not using gas for my own vehicle	❒	❒	❒	❒	❒
Enhance my sightseeing ability	❒	❒	❒	❒	❒
Allow me to explore at my own pace	❒	❒	❒	❒	❒
Provide enough space for my personal belongings	❒	❒	❒	❒	❒

6. **This question explores your views about the desirability of outcomes people may associate with using the visitor shuttles at Estes Park/Rocky Mountain National Park. Please rate the following statements between extremely desirable and extremely undesirable to express your opinion about the outcomes associated with using a visitor shuttle.** (*Please check* **ONE** *box for* **EACH** *statement*)

	Extremely Desirable	Somewhat Desirable	Neither	Somewhat Undesirable	Extremely Undesirable
Reducing the tension and stress of driving	❒	❒	❒	❒	❒
Reducing my environmental impact (such as air or noise pollution)	❒	❒	❒	❒	❒
Experiencing infrequent buses with long lines	❒	❒	❒	❒	❒
Feeling crowded, touristy	❒	❒	❒	❒	❒
Alleviating stress related to finding parking	❒	❒	❒	❒	❒
Feeling rushed or short on time	❒	❒	❒	❒	❒
Saving money by not using gas for my own vehicle	❒	❒	❒	❒	❒
Enhancing my sightseeing ability	❒	❒	❒	❒	❒
Exploring at my own pace	❒	❒	❒	❒	❒
Having enough space for my personal belongings	❒	❒	❒	❒	❒

Section III. About how you plan for trips

7. **There are many different ways to get travel information when taking a trip. How useful would each of the following ways of getting travel information be to you?** (*Please check* **ONE** *box for* **EACH** *item*)

	Very Useful	Somewhat Useful	Neither	Somewhat Un-Useful	Not at all Useful
Rocky Mountain National Park website	❒	❒	❒	❒	❒
America's traveler information phone number (511)	❒	❒	❒	❒	❒
Park brochure/map	❒	❒	❒	❒	❒
Park newspaper	❒	❒	❒	❒	❒
Host of private campground/hotel/bed & breakfast	❒	❒	❒	❒	❒
Traveling guide/tour book	❒	❒	❒	❒	❒
Chamber of commerce or state visitors bureau	❒	❒	❒	❒	❒
Text updates on a cellular phone	❒	❒	❒	❒	❒
Apps available for Smartphones	❒	❒	❒	❒	❒
Online	❒	❒	❒	❒	❒
Highway advisory radio	❒	❒	❒	❒	❒
Friends or family	❒	❒	❒	❒	❒
Other visitors	❒	❒	❒	❒	❒

8. **When planning for your most recent visit to Estes Park/Rocky Mountain National Park, which mode(s) of transportation did you <u>plan</u> to use?** (*Please check* ALL *that apply*)
   - ☐ Car
   - ☐ Visitor shuttle
   - ☐ Bicycle
   - ☐ Walking
   - ☐ Group tour bus
   - ☐ Other (*please specify*) _____

9. **Which mode(s) of transportation did you <u>actually</u> use on your most recent visit to Estes Park/Rocky Mountain National Park?** (*Please check* ALL *that apply*)
   - ☐ Car
   - ☐ Visitor shuttle
   - ☐ Bicycle
   - ☐ Walking
   - ☐ Group tour bus
   - ☐ Other (*please specify*) _____

   9a. **If you <u>actually</u> used a mode of transportation different from what you had <u>planned</u> to use, please explain why.**

   _____

   _____

10. **How often do you use public transportation at home?**
    - ☐ Never
    - ☐ Hardly ever
    - ☐ At least once a month
    - ☐ At least once a week
    - ☐ Almost everyday

11. **Have you used a visitor shuttle while visiting another park or recreation area?**
    - ☐ Yes (*please specify where*) _____
    - ☐ No

Section IV. About you

12. **Who were you traveling with on your most recent visit to Estes Park/Rocky Mountain National Park?** (*Please check only* **ONE**)
    - ☐ Alone
    - ☐ With friends
    - ☐ With family
    - ☐ With family & friends
    - ☐ As a member of a group or club
    - ☐ Other (*please specify*) _____

13. **How many times have you visited Estes Park/Rocky Mountain National park before your most recent visit?**
    - ☐ It was my first visit
    - ☐ 1 time
    - ☐ 2-3 times
    - ☐ 4-5 times
    - ☐ 6 times or more

14. **What is the highest level of education you have completed?**
    - ☐ Some high school
    - ☐ High school diploma/GED
    - ☐ Some college
    - ☐ Bachelor's degree
    - ☐ Graduate degree

15. **What type of overnight accommodations did you use during your most recent trip to Estes Park/Rocky Mountain National Park?**
    - ☐ I did not stay overnight
    - ☐ I am a resident of Estes Park
    - ☐ Hotel/motel in town
    - ☐ Bed and breakfast
    - ☐ Estes Park YMCA
    - ☐ Private campground
    - ☐ Campground within Rocky Mountain National Park
    - ☐ With friends/family
    - ☐ Other (please specify) _____

16. **What is your gender?**
    - ☐ Male
    - ☐ Female

17. **What is your age?** _____**YEARS**

18. **Is there anything you would like to share related to your travel experience? Please feel free to write your thoughts in the space below.**

THANK YOU FOR COMPLETING THIS SURVEY!
Please return the completed survey in the postage paid, self-addressed envelope provided. If you would like more information about the Paul S. Sarbanes Transit in Parks Technical Assistance Center, please visit www.triptac.org If you would like more information about this survey, please contact Kourtney Collum, School of Forest Resources, University of Maine, 5755 Nutting Hall, Orono, ME 04469 or call (207) 581-2897 or email kourtney.collum@maine.edu

APPENDIX G. SURVEY MAILINGS

Date

Respondent Name
Street
Town, State Zip

Dear (Respondent) ,

Recently you should have completed an on-site travel survey while visiting Estes Park, Colorado. At that time, you were invited to participate in an extended mail survey that is part of a study being conducted by the Paul S. Sarbanes Transit in Parks Technical Assistance Center. As we mentioned before, your participation in our study will greatly aid our research. The best way for us to understand the issues and challenges experienced by Estes Park travelers is to learn directly from people like you.

We would like the member of your family/household that completed the on-site travel survey to fill out this extended survey. Completing the survey should only take about 10 minutes and is completely voluntary. Except for your time and inconvenience, there are no risks to you from participating. Return of the survey implies consent to participate. You may skip any questions you do not wish to answer.

A code number has been assigned to your survey to protect your identity, maintain the confidentiality of your responses, and determine which participants have not responded so that we can send a replacement survey. Your name will not be associated with your responses to the survey. The electronic data will be kept on a password protected computer, and paper data, such as the physical surveys, will be kept in a locked office. The key linking the code to your name will be destroyed within one year, after data analysis is complete, and the physical surveys will be destroyed within five years.

When you have completed the survey, please return it to the University of Maine in the postage-paid envelope enclosed with the survey. If you have questions, comments, or concerns about the study, you may contact us directly at (207) 581-2875. If you have questions about your rights as a research participant you may contact Gayle Jones, Assistant to the University of Maine's Protection for Human Subjects Review Board at (207) 581-1498.

Thank you again for your participation!

Kourtney Collum
Graduate Research Assistant
University of Maine
Parks, Recreation & Tourism Program
& the Paul S. Sarbanes Transit in Parks TAC

John Daigle, Ph.D.
Associate Professor
University of Maine
Parks, Recreation & Tourism Program
& the Paul S. Sarbanes Transit in Parks TAC

John J. Daigle
Parks, Recreation and Tourism Program
5755 Nutting Hall
University of Maine
Orono, ME 04469-5755

Dear Survey Participant:

Last week we mailed you a questionnaire asking about your opinions and preferences concerning shuttle use when visiting Estes Park.

If you have already completed and returned the questionnaire, please accept our thanks. If you have not yet completed it, please do so today. The questionnaire was sent to a small but representative sample of Estes Park visitors. It is extremely important that your responses be included in the study, as the results will be used to assist in the future management of transportation in the Estes Park/Rocky Mountain National Park region.

If you did not receive the questionnaire, or if it has been misplaced, please call me at (207) 581-2897 and we will mail a replacement questionnaire to you today.

We value your thoughts about your experience traveling in Estes Park/Rocky Mountain National Park and look forward to hearing from you.

Kourtney Collum
Graduate Research Assistant
University of Maine
Parks, Recreation & Tourism Program

John J. Daigle
Associate Professor
University of Maine
Parks, Recreation & Tourism Program

Date

Respondent Name
Street
Town, State ZIP

Dear (Respondent) ,

About four weeks ago, you should have received a mailed invitation to complete a survey that is part of a study being conducted by the University of Maine in association with the Paul S. Sarbanes Transit in Parks Technical Assistance Center. To the best of our knowledge, it has not been returned. We are writing to encourage you to complete and return the survey. Your participation in our study will greatly aid our research.

We would like the member of your family/household that completed the on-site travel survey to fill out this extended survey. As mentioned before, the survey should take about 10 minutes to fill out. Except for your time and inconvenience, there are no risks to you from participating. Participation is voluntary. Return of the survey implies consent to participate. You may skip any questions you do not wish to answer. A code number has been assigned to your survey to protect your identity and maintain the confidentiality of your responses. Your name will not be associated with your responses to the survey.

If you have already mailed your completed survey, please accept our sincere thanks. If not, we have included a replacement survey for your convenience. Once completed, please return it to the University of Maine in the postage-paid envelope enclosed with the survey. If you have questions, comments, or concerns about the study, you may contact us directly at (207) 581-2875. If you have questions about your rights as a research participant you may contact Gayle Jones, Assistant to the University of Maine's Protection for Human Subjects Review Board at (207) 581-1498.

Your willingness to participate in this study is greatly appreciated.

Sincerely,

Kourtney Collum
Graduate Research Assistant
University of Maine
Parks, Recreation & Tourism Program
& the Paul S. Sarbanes Transit in Parks TAC

John Daigle, Ph.D.
Associate Professor
University of Maine
Parks, Recreation & Tourism Program
& the Paul S. Sarbanes Transit in Parks TAC

APPENDIX H. INTERVIEW PROTOCOL FOR VISITOR SURVEY

Data collectors will be stationed at a table within the survey area. They will approach every 6th person that passes by and ask them to participate in the survey. If the 6th person declines to participate, they will then ask the next person until they locate a willing participant.

Interviewer: Hello. I'm a researcher working with the Town of Estes Park.

We're doing a study to assess visitor travel experience and awareness of traveler information. All surveys are voluntary and anonymous and your answers will in no way be linked to you. You may skip any questions you do not wish to answer. Your participation is very important, because after visiting today, you have a unique perspective on the strengths and challenges of transportation in the area. Would you be interested in taking 5 minutes to complete this survey which will be used to improve travel conditions in the area?

If No…...

Thank you for your time. Enjoy your visit! (*Record gender, party size, number of children under the age of 5 on non-response form*)

If Yes…..

THANK YOU! We just have a few qualifying questions before you begin the survey. Are you 18 years or older? *(This question should only be asked if the person appears to be younger than 26)*

If Yes…..

Did you park your car at the Park-n-Ride located near the Fairgrounds and use the Silver Route shuttle to get into town?

If Yes…..

That's great. You will actually have an opportunity to complete this survey on your shuttle ride back to the Park-n-Ride later today, so we won't take up any more of your time now. Thank you for taking the time to talk with us. Enjoy your trip!

If No……

Ok, you qualify to participate in this survey. It should only take about 5 minutes to complete, and when you're done you can return it to me.

We are also asking visitors to participate in a more comprehensive survey which you can complete now, or at home at your leisure. The information that you would provide would be extremely helpful to the Town of Estes Park and Rocky Mountain National Park. The results from the survey will give managers insight into what would enhance your travel experience when visiting the area, and help them improve the current transportation system. I have a copy of the mail survey here. If you have an extra 5-7

minutes, you can complete it now and return it to me when you're done. If you don't have time, you can take it with you and return it in the pre-paid envelope that's attached to it. Would you be interested in participating in the survey?

If Yes, they will participate in the comprehensive survey….

(Data collector will then provide the respondent with a clipboard and pencil. A copy of the appropriate survey instruments will be attached to the clipboard. If the respondent wishes to complete the comprehensive survey onsite, simply give them both surveys. If they wish to complete it at home, give them the onsite survey, the comprehensive survey, and a pre-paid mail envelope to return it in. Ask them to complete the onsite survey, and then fill out their information on a Mail Survey card, so that they can be sent a reminder post card for the comprehensive survey. Then read the following statement.)

There is a short statement on this card indicating that your participation in this survey is completely voluntary. We want to assure you this information will be kept confidential and that your name and address will not be given to any other group or used by us beyond the purposes of this study.

Will you please write your name and address at the top of the card?

THANK YOU very much and I would be happy to answer any other questions about the study.

If No, they will not participate in the comprehensive survey…..

Well we appreciate you taking the time to complete the onsite survey.

(Data collector will then provide the respondent with a clipboard and pencil. A copy of the appropriate survey instrument will be attached to the clipboard.)

THANK YOU very much and I would be happy to answer any other questions about the study.

APPENDIX I. INTERVIEW PROTOCOL FOR SHUTTLE SURVEY

The data collector will be on the shuttle and will address visitors as they are returning from the CVB to the Park-n-Ride lot.

Interviewer: Hello. I'm a researcher working with the Town of Estes Park.

We're doing a study to assess visitor travel experience and awareness of traveler information. We want to invite one person from each group to take a 5 minute survey which will be used to improve travel conditions in the area. All surveys are voluntary and anonymous and your answers will in no way be linked to you. You may skip any question you do not wish to answer. Your participation is very important, because after visiting today, you all have a unique perspective on the strengths and challenges of transportation in the area. Would any of you be interested in helping us by participating in this survey?

If No…..

Thank you for your time. Enjoy your visit! (*Record gender, party size, number of children under the age of 5 on non-response form*)

If Yes…..

THANK YOU! For the sake of randomizing our survey results, could we please have the person in your group with the last birthday complete this survey. This person must be 18 years of age or older.

(Data collector will then provide respondents with a clipboard and pencil. A copy of the appropriate survey instruments will be attached to the clipboard.)

When you are done with your survey, you can return it to me.

We are also asking visitors to participate in a more comprehensive survey which you can complete now, or at home at your leisure. The information that you would provide would be extremely helpful to the Town of Estes Park and Rocky Mountain National Park. The results from the survey will give managers insight into what would enhance your travel experience when visiting the area, and help them improve the current transportation system. I have a copy of the mail survey here. If you have an extra 5-7 minutes, you can complete it now and return it to the survey box located at the Park-n-Ride shuttle stop. If you don't have time, you can take it with you and return it at your leisure in the pre-paid envelope that's attached to it.

If Yes, they will participate in the comprehensive survey….

> *(If the respondent wishes to complete the comprehensive survey onsite, simply give them both surveys. If they wish to complete it at home, give them the onsite survey, the comprehensive survey, and a pre-paid mail envelope to return it in. Ask them to complete the onsite survey, and then fill out their information on a Mail Survey card, so that they can be sent a reminder post card for the comprehensive survey. Then read the following statement.)*
>
> There is a short statement on this card indicating that your participation in this survey is completely voluntary. We want to assure you this information will be kept confidential and that your name and address will not be given to any other group or used by us beyond the purposes of this study.
>
> Will you please write your name and address at the top of the card?
>
> THANK YOU very much and I would be happy to answer any other questions about the study.

If No, they will not participate in the comprehensive survey…..

> Well we appreciate you taking the time to complete the onsite survey.
>
> THANK YOU very much and I would be happy to answer any other questions about the study.

BIOGRAPHY OF AUTHOR

Kourtney Kristen Collum was born on January 23, 1987 in Monroe, Michigan. Kourtney has two wonderful parents, Brian and Dawn, who taught her the value of education at a young age and passed their strong Midwestern work ethic onto both her and her sister, Shannon. Kourtney graduated from Monroe High School in June of 2005 and Western Michigan University in May of 2009. In the summers during college Kourtney worked on several conservation projects in New Zealand, Maine, and Colorado. Of all of these experiences, her time working on the trail crew at Baxter State Park left the most indelible impression. Longing for the north woods, Kourtney decided to return to Maine in 2010 to pursue a graduate degree. In her spare time Kourtney enjoys reading and collecting books, hiking and exploring Maine with her boyfriend Patrick, gardening, making delicious food and spending time with her lovely family in Michigan. Kourtney is a candidate for the Master of Science degree in Forest Resources from the University of Maine in May, 2012.