ACADIA NATIONAL PARK ITS FIELD OPERATIONAL TEST

State of Maine Data Analysis

April, 2003

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16. Abstract

This report is one in a series that presents the results of data used to assess the impact of the Intelligent Transportation Systems (ITS) that were part of a field operational test at Acadia National Park on Mount Desert Island off the coast of Maine. ITS deployed at Acadia integrates various components that support the region's needs for transit management, traffic management, and traveler information. Data collected as part of normal operations by agencies within the State of Maine Government were used to assess the impact of ITS on four goal areas: productivity and economic vitality, efficiency, energy and environment, and safety. Hypotheses were formulated in the four goal areas and tested with the data. Due to unavailability or other problems with some of the data, hypothesized impacts of ITS in three of the four goal areas could not be tested with the State's data. The evaluation was able to examine the impact of ITS on energy and environment by using the State's estimates of avoided emissions due to increases in passengers using transit rather than private vehicles. In that ITS encourages use of transit, the conclusion was that ITS appears to benefit the air quality of the region.

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EXECUTIVE SUMMARY

This document is one of series that reports the results of data collected to evaluate the effectiveness of the Field Operational Test of an Intelligent Transportation System fielded on Mount Desert Island, Maine. This system was designed to relieve traffic congestion and enhance overall visitor experience in and around Acadia National Park.

This report addresses the operating data collected by the state of Maine. These data are collected as part of normal state government operations and include such measures as sales tax, traffic counts, accidents, and emissions. Data from 1999 to 2002 were collected and assessed by the evaluation team as part of the overall effort to measure the impact of ITS on Acadia National Park.

Early in the design phase of this FOT, stakeholder groups identified four primary goal areas that pertain to the data available from the State of Maine: productivity and economic vitality, efficiency, energy and environment, and safety. Hypotheses in each of these areas were formulated. Due to unavailability or other problems with some of the data, hypothesized impacts of ITS in three of the four goal areas could not be tested with the State data. The evaluation was able to examine the impact of ITS on energy and environment by using the State's estimates of avoided emissions due to increases in passengers using transit rather than private vehicles. In that ITS encourages use of transit, the conclusion is that ITS appears to benefit the air quality of the region.

ACADIA NATIONAL PARK ITS FIELD OPERATIONAL TEST

State of Maine Data Analysis

1.0 INTRODUCTION

This report is one of in a series that examines the impact of the ITS deployment. It presents the data collected by agencies of the State of Mine from 1999 to 2002. The data collected were part of routine governance and reporting of the agencies represented. These data were obtained from agencies' records by an analyst from Battelle as part of the evaluation of the Field Operational Test.

1.1 Overview of the Evaluation

The Intelligent Transportation Systems deployed at Acadia National Park integrate a variety of components that support the region's needs for transit management, traffic management, and traveler information. The components are interrelated and depicted in Figure 1-1. The relationship between the individual system components, the functional requirements, the system elements, and the needs addressed are shown in Table 1.1. Further elaboration can be found in the Acadia National Park ITS Field Operational Test: Strategic Plan.[1] Based on the collective feedback of the stakeholders, the overriding impact of the ITS technologies should be to reduce vehicle congestion in Acadia National Park. Reduced congestion will have the added benefits of increased mobility of visitors and residents, aesthetic and environmental benefits of fewer vehicles parked on roads, improved management of the transportation system, and safety benefits of less traffic and better emergency response.

The evaluation strategy was developed in cooperation with local partners and representatives from the state and federal Departments of Transportation. Despite the broad range of backgrounds and points of view of this group, their conclusions were very similar. There was considerable agreement among the project team that customer satisfaction and mobility were higher in priority than the other goals. However, other evaluation goal areas (safety, efficiency, productivity and economic vitality, and energy and environment) also held some level of importance among the stakeholder organizations.

The overall evaluation approach was based on several evaluation tests that combined primary and secondary data collection and analyses. Visitor on-site interviews, mail-back questionnaires to visitors and local areas businesses, personal interviews, direct observation, and system and historical data analysis were performed. The visitor and business surveys collected primary data on user awareness and satisfaction. Personal interviews with Island Explorer and Acadia National Park staff and other key stakeholders provided in-depth perspectives on issues affecting

[1] Acadia National Park ITS Field Operational Test Evaluation Strategic Plan, July 2000. Available at the ITS JPO evaluation Website: http://www.its.dot.gov/eval/docs_stateregionl.htm.

deployment and use of the technology. The systems data from the ITS components were used to document the type, content, and sources of information made available through the various input systems and characterize the use of various user interfaces by stakeholders. The data from agencies within the State of Maine government are the subject of this report, and findings of the other tests are reported in other documents in this series of individual test results.

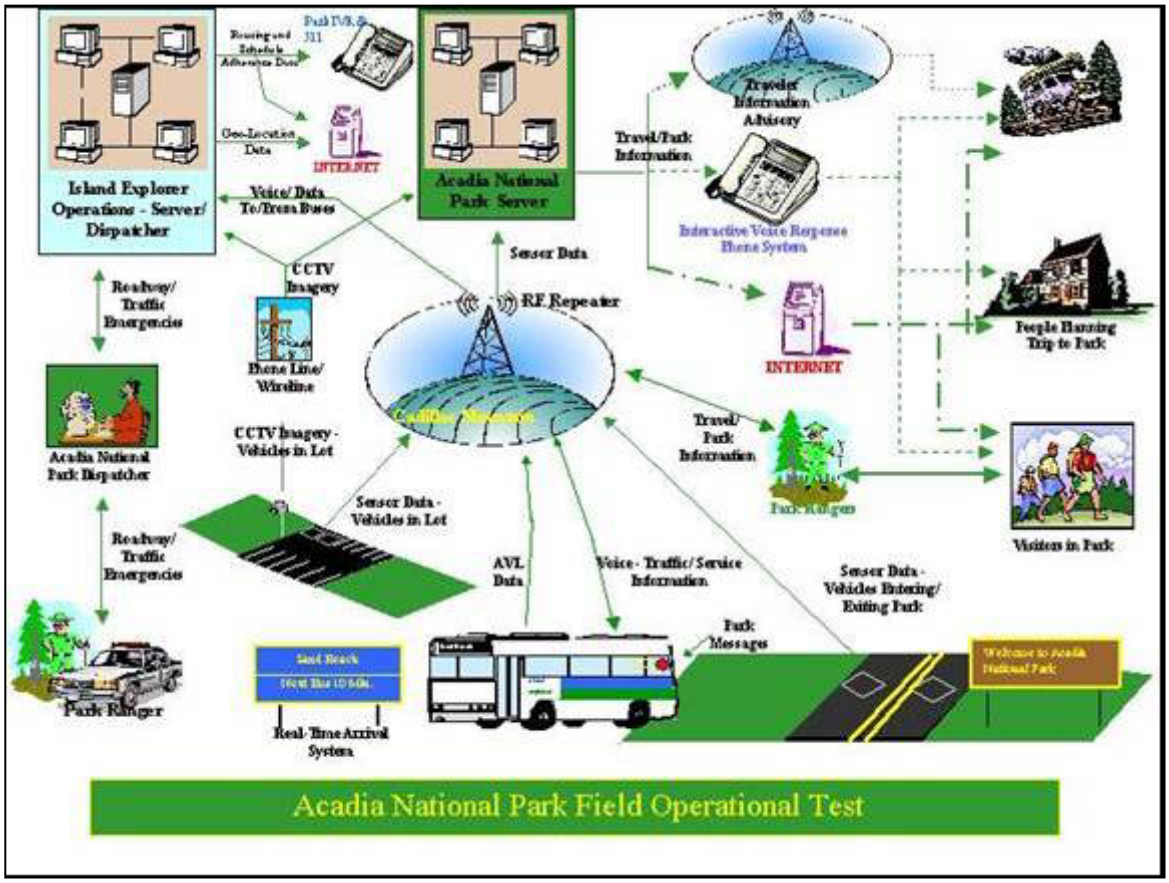


Figure 1-1: System Architecture for ITS FOT at Acadia National Park

Table 1.1: ITS System Components

System Component	Functional Requirements	System Elements	Needs Addressed
Island Explorer Two-way Voice Communications	Transmit and receive to/from/between vehicles and dispatch center	Transceivers; vehicle and base station Repeater to amplify signal	Improved efficiency Improved safety Real time traffic information for park staff, reduce crush load conditions, incident detection
AVL for Island Explorer	Compute and transmit vehicle location Integrate vehicle locations with departure signs, display vehicle locations[2], integrate into enunciator	Vehicle transmitter TCP/IP Network Connectivity, GPS Transceiver, GIS Applications, Travel Time Applications	Improved efficiency and performance Decreased use of POV's Improved safety and response Real time updates Increase ridership
Departure Sign for Island Explorer	Transmit location Compute departure Transmit to departure signs	Display sign, Software, Wireless/Wireline Communications	Improved scheduling information Increase ridership
Automated Annunciator for Island Explorer	Determine location Automatically play next stop and other pertinent announcements	Vehicle annunciator	Improve efficiency Reduce delays Increase safety Improve visitor experience
Passenger Counter for Island Explorer	Auto-count boardings/ dismounts at selected stops, Store information	Sensor to perform counts Data storage	Increase efficiency Improve planning Increase data options Reduce vehicle crush loads
Parking Lot Monitoring[3]	Record number of vehicles entering and exiting, provide slow scan video of parking area[4], transmit data, display video, store data from vehicle counts	Counting sensor Video camera Display monitor Wireless/wireline communications TCP/IP network connectivity	Decreased use of POV's Provide planning data Information for Rangers Decreased Response times
Automatic Ranger/Vehicle Geo-Location[5]	Determine location +-10 meters, transmit same to server, display locations on map	Transmitting unit GPS Transceiver Repeater for signal GPS/GIS Software	Information for Rangers Exact locations of Rangers Decreased response times Improved visitor safety, security
Entrance Traffic Volume Recorder[6]	Record and transmit number of vehicles entering and exiting, store data	Counting sensor Transmission unit	Count vehicles Provide Planning Data Decrease use of POV's
Traveler Information System	Collect and integrate data, disseminate data to appropriate audience	Interactive telephone messaging system[7], Web page, parking status signs	Increase availability and display options of information, Decrease use of POV's, Improve visitor experience

[2] Not operational during the Field Operational Test
[3] Observation was used as an alternative to automated parking monitors as a way to communicate parking lot status to visitors through the website and specially created parking status signs
[4] Eliminated from the Field Operational Test
[5] Eliminated from the Field Operational Test
[6] Not operational during the Field Operational Test
[7] Not operational during the Field Operational Test

2.0 GOAL AREAS ADDRESSED

As part of the planning for the ITS FOT, project stakeholders were asked to identify the important goal areas for evaluation of the effectiveness of this FOT. The goal areas identified were safety, mobility, efficiency, productivity and economic vitality, energy and environment, and customer satisfaction. In order to evaluate how effective this FOT was in addressing these goal areas, a further breakdown was accomplished to identify objectives, a hypothesis supporting the objectives, identification of measures, and data collection methods.

The data collected from the State of Maine records were pertinent to objectives and hypothesis in several goal areas. Table 2.1 below illustrates the goal areas that were identified by the stakeholders as relevant to data from State government.

Table 2.1: Goal Areas, Objectives, and Hypothesis Relevant to State of Maine Data

Evaluation Area	Objective	Hypotheses
Productivity and Economic Vitality	To increase economic contribution to Mount Desert Island and Acadia National Park	ITS attracts visitors and enables higher revenue capture during stay
Efficiency	To increase the number of customers served	ITS provides better operating information, which allows for more efficient deployment of resources to a greater number of Park visitors
Energy and the Environment	To reduce emissions from motor vehicles on Mount Desert Island	ITS-improved Island Explorer service will result in fewer trips by private vehicle and a consequent improvement in air quality
Safety	To increase transportation safety in Acadia National Park and Mount Desert Island	ITS will reduce hazardous conditions by better management of transportation resources

3.0 DATA COLLECTED

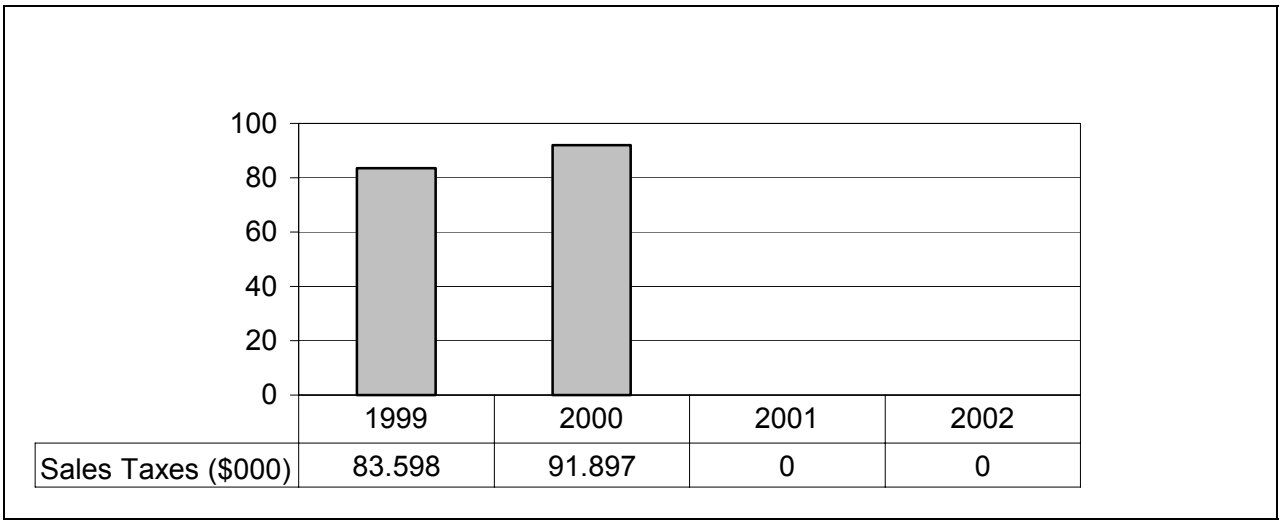
In order to determine the impact of the ITS deployment in the three goal areas in Figure 2-1, State government data normally collected for governance and reporting purposes were used. Data included the sales taxes, traffic counts, vehicular accidents and emissions. The evaluation used data from several State Government agencies, including the Department of Transportation for traffic and accident data, Department of Revenue for sales tax data, and Department of Environmental Protection for air quality modeling data. The data were collected for the years 1999 through the 2002.

4.0 DISCUSSION OF RESULTS

The results are presented below according to the three evaluation goal areas for which the State of Maine statistics were used: productivity and economic vitality; efficiency; and safety.

4.1 Impact of ITS on Productivity and Economic Vitality

Stakeholders of the Field Operational Test anticipated that ITS might provide direct economic benefits to the Mount Desert Island in the form of higher sales taxes collected by local businesses. It was hypothesized that ITS would contribute to enhanced visitor experience and longer stays and thereby result in higher expenditures during their visits. To assess the impact of ITS, records were obtained from Maine's Department of Revenue. Sales tax data were selected that showed taxes collected during the summer months from Mount Desert Island businesses generally associated with tourism, such as restaurants, retail establishments, and lodging. Figure 4-1 summarizes the data.



	1999	2000	2001	2002
Sales Taxes ($000)	83.598	91.897	0	0

Figure 4-1: Sales Tax Revenues During Summer Months by Year

Figure 4-1 shows an increase in taxes collected between 1999 and 2000. Tax data for 2001 and 2002 was not available at the time of this report. Consequently, the hypothesis of economic impact after ITS was implemented could not be tested with sales tax data.

4.2 Impact of ITS on Efficiency

It was hypothesized that ITS would lead to improved efficiency in Park operations. Park staff would be able to serve greater numbers of visitors and the demand on Park resources would be distributed more efficiently. One measure of usage of the Park is the amount of traffic on its roads. To test the hypothesis, traffic counts were obtained from Maine Department of Transportation, which has a permanent traffic sensor installed at Thompson Island Bridge on

Route 3 to detect vehicles entering Mount Desert Island from the mainland. Traffic counts for 2001 were not available because the traffic counting equipment malfunctioned that year. Figure 4-2 summarizes the available data.

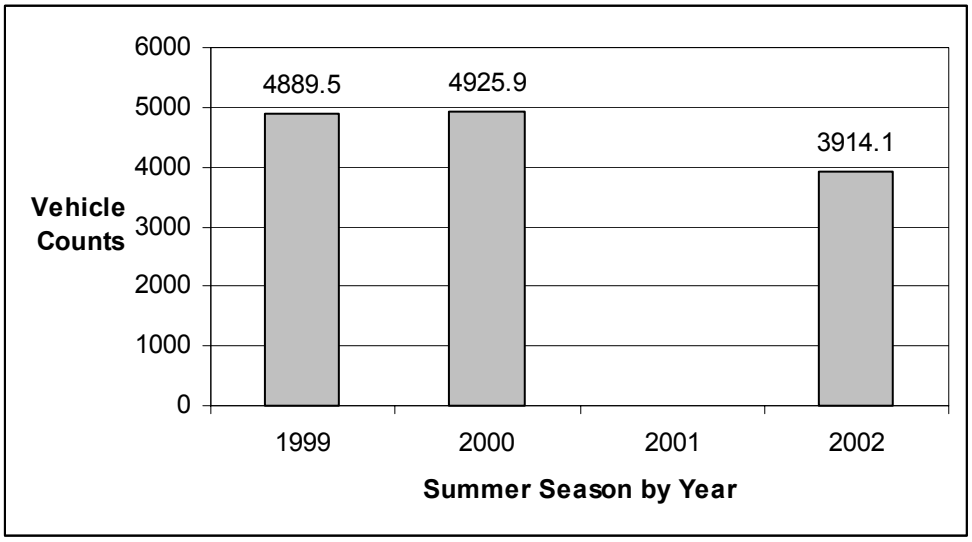


Figure 4-2: Traffic Entering Mount Desert Island, 1999 - 2002

The dramatically lower (-25%) counts of traffic coming onto Mount Desert Island in 2002 are difficult to explain. One possibility is that the traffic sensor that caused the problem with the 2001 data was still a problem in 2002. Another explanation might be the economic slow-down after September 11 terrorist attacks. However, that explanation does not appear to be consistent with the increase in visitors 2002 as compared to 2001 that Acadia National Park reported,[8] which would suggest that traffic had actually increased from the previous year. Consequently, for the purposes of the evaluation these traffic count data were not considered useful for testing the efficiency hypothesis.

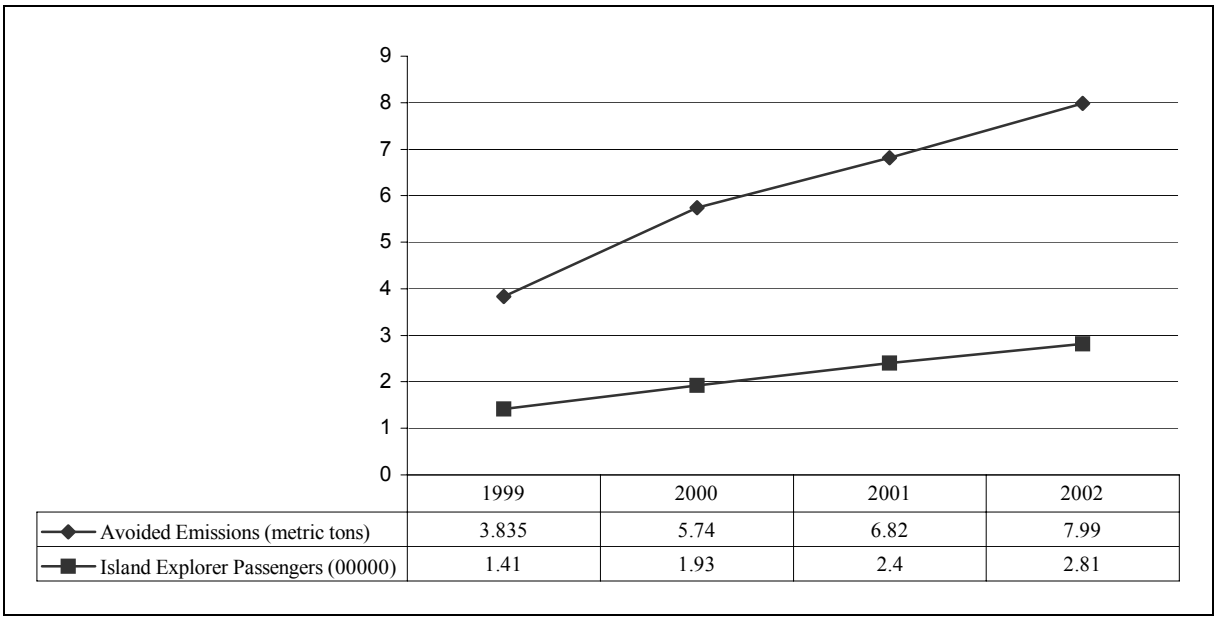
4.3 Impact of ITS on Energy and Environment

ITS technologies were expected to have a positive effect on energy usage and environment through encouragement of use of transit rather than private vehicles. However, measurement of air quality and the potential benefit that ITS might provide quantitatively is no simple matter. The amount of traffic within the Park is a key indicator of potential energy and environmental impact. While it was impractical to directly measure fuel use or emissions of vehicles, the total number of vehicles is a useful surrogate. Unfortunately, good estimates of vehicles counts are not available. As noted in the previous section, 2002 traffic counts from the Maine DOT sensor at the entrance to Mount Desert Island are suspect. However, perhaps the most reliable indicator

[8] Refer to the test results reported in Coleman, T. and C. Zimmerman, "Acadia National Park Data Analysis," April, 2003 posted at http://www.its.dot.gov/eval/docs_stateregionl.htm.

is perhaps the number of passengers on the Island Explorer bus, as they represent visitors who would otherwise be using their own vehicles to reach destinations within the Park.

The impact of the Island Explorer on air quality on Mount Desert Island is estimated by use of the emissions model known as Mobil 5 used by Maine Department of Environmental Protection. The evaluation team obtained the DOT's estimates of seasonal totals of emissions avoided through displacements of trips in private vehicles with Island Explorer ridership. The ridership data and the model's output are shown in Figure 4-3. The avoided emissions are the total of VOC (volatile organic compounds) and NOx (nitrogen oxide) expressed in metric tons. The Mobil 5 model calculated 1.17 tons of emissions that were avoided in 2002, the year ITS was operational, compared to 2001. In that ITS technologies have been shown to be a factor in visitors' willingness to use transit, the evaluation team concluded that ITS had a positive environmental impact through the reduction of vehicle-based emissions.



	1999	2000	2001	2002
Avoided Emissions (metric tons)	3.835	5.74	6.82	7.99
Island Explorer Passengers (00000)	1.41	1.93	2.4	2.81

Figure 4-3: Island Explorer Passengers and Avoided Emissions by Year

4.4 Impact of ITS on Safety

Data on motor vehicle accidents within the Park are reported by Park rangers, and accidents on all other roads on Mount Desert Island are reported by Maine Department of Transportation. Because visitors driving their own vehicles and the Island Explorer bus use roads monitored by both the State and the Park, both sets of accident data were collected for the evaluation. The definition of an accident is that it involves a motor vehicle with over $1000 in damage or involves any personal injury. Figure 4-4 shows the number of accidents reported by Maine Department of Transportation during the summer months. Unfortunately, accident data for 2002 were not available from the Maine Department of Transportation at the time of this report. Thus,

for the purposes of the evaluation it was not possible to test the safety impact of ITS on routes outside of the Park.

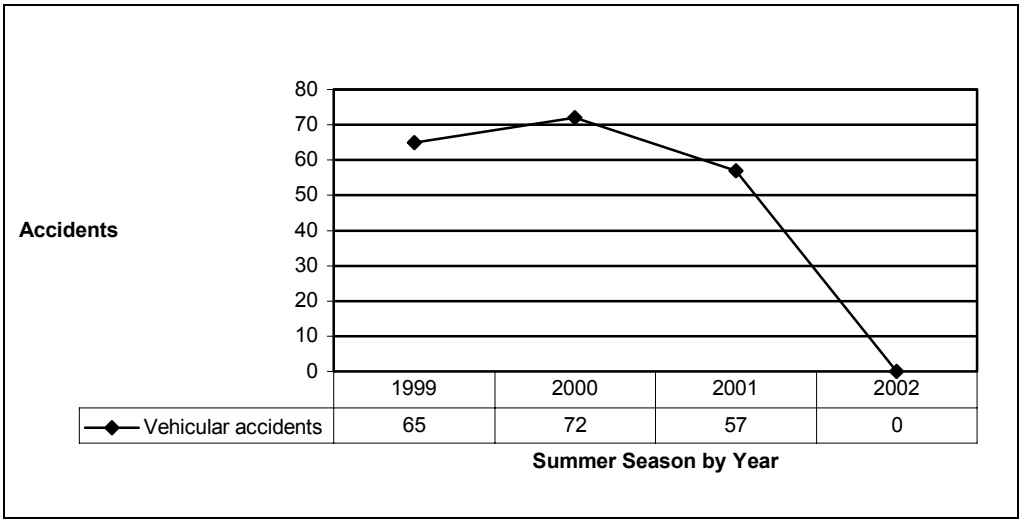


Figure 4-4: Vehicular Accidents Outside of Acadia National Park, Summer Seasons 1999-2002

5.0 CONCLUSION

The operational data from agencies in the State of Maine Government were obtained to test hypotheses in the goal areas of productivity and economic vitality, efficiency, energy and environment, and safety. Due to unavailability of 2002 data on sales tax revenues and vehicular accidents, it was not possible to assess the economic and safety impacts of ITS. In addition, traffic count data were not available in 2001 due to a malfunctioning sensor and the 2002 data appear spurious as well, thereby precluding a test of the efficiency impact of ITS using the traffic data. Consequently, only one hypothesis was testable in this part of the evaluation—the impact of ITS on air quality. The estimated air quality impact of the increase in passengers using the Island Explorer bus between 2002 and 2002 indicated that an additional 1.17 metric tons of emissions were avoided in the year that the ITS technologies were operational. Thus, the evaluation team concluded that using ITS technologies to encourage usage of the Island Explorer rather than use of private vehicles can have a measurable effect on air quality in the region.

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