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Improved Methods of Visitor Attendance Collection at Massachusetts State Parks

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Abstract

The team conducted this research to help the Massachusetts Department of Conservation and Recreation (DCR) improve their state park attendance collection methods. We divided the DCR's parks into categories based on modes of public access to the facilities. Then we conducted a survey and phone interviews with state park directors across the nation to identify state of the art visitor attendance collection methods currently being employed throughout the nation. We used a performance characteristics scale to rate each method according to the categories of park access. Based on this scale, we recommended the most effective methods of tracking park attendance at various kinds of state parks to the DCR.

Executive Summary

With a steady decrease in governmental spending on public facilities across the nation, the quality of public parks is in danger. Budgeting decisions for public facilities, such as parks, are partly based on estimations of the public use. In the case of parks, this estimation is done through an analysis of park visitation data. Because of this, documentation of demand and utilization of public facilities is an important tool for state agencies dedicated to conserving and operating public parks.

However, attendance data is essential to more than budgeting purposes. According to Cessford and Muhar (2003) reliable data on park visitation are "essential for a variety of strategic and operational planning tasks in park management" for it may help increase the efficiency of resource allocation, and may even be used to increase public use. Because of this, visitation data can be considered the life blood of any recreational facility, whether it is a state, national or municipal.

With a clear understanding of the value of visitation data, the Massachusetts Department of Conservation and Recreation (DCR) is interested in assessing their methods of data collection for possible improvements. DCR (2011), an agency dedicated to protecting nature and history through the conservation of parks in the Commonwealth of Massachusetts. With "450,000 acres... of forests, parks, greenways, historic sites landscapes, seashores, lakes, ponds, reservoirs and watersheds,"(About) Massachusetts has over 150 facilities overseen by the DCR.

Although current practices provide the DCR with sufficient visitation data to conduct all essential operations, the data is not enough to give a complete understanding of the DCR's visitation. Presently the DCR uses two methods for visitor data calculation. These methods used by DCR facility managers are centered on knowledge based estimations or fee based counts. .

The purpose of this project is to provide a recommendation of several efficient visitor attendance collection methods for different facility categories, which may be mixed and matched to form a system compatible to any DCR facility. This work will enable the DCR to rely on data and to analyze data in a systematic way to improve planning for parks and allocation of scarce public resources.

To fully understand what methods of data collection would produce the most accurate visitation count for the DCR, the team visited a variety of DCR facilities and conducted interviews with staff. These interviews provided specific information about individual parks, such as methods used to record attendance, park features, infrastructure, and uses. Using this information, four categories were created: controlled vehicular access (CVA), dispersed vehicular access (DVA), controlled pedestrian access (CPA), and dispersed pedestrian access (DPA). These categories allow the team to develop a method compatible to the four park types instead of focusing on individual parks.

To determine the best methods for visitation data collection, a thorough study of methodologies was completed. Methodologies used by the National Park Service (NPS), and multiple state /municipal park and recreation agencies were compiled with the use of interviews, literature review, and surveys. Technologies that were popular or fit with DCR's needs were further investigated and additional research was conducted.

Finally, methods were analyzed with a performance characteristics scale to objectively compare each method or technology. The analysis focused on comparing the cost, accuracy and reliability that each method might provide. In order to accurately identify the best fits for DCR, methods were analyzed with respect to the different categories.

With the results obtained from thorough research, it was determined that the DCR should improve their system for data collection. First, the implementation of an agency wide procedure for the electronic submission of visitation numbers on a weekly or daily basis is highly recommended. This is a simple and cost effective way to begin building a source of knowledge. Although the implementation of an electronic submission policy is valuable to DCR, it will not necessary provide accurate data. In order to ensure improvement of accuracy, a system for data collection should be implemented to each access setting category. From the performance characteristics scale and research, it was determined that the best two methods for controlled vehicular access parks are road tubes and sampling. For controlled pedestrian settings, radio sensors were determined to be the best. For disbursed vehicular and pedestrian access settings, sampling methodologies are the most effective.

Attendance data is a valuable tool to the DCR. This was clearly defined by the results of the interviews, literature review, and surveys. Attendance data can provide aid in park management and increase awareness and advocacy within the Commonwealth.

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Authorship

Although the sections of this report were each written by a single author, the group completed many revisions as a whole. All team members contributed to the report and the primary author of each section is listed below.

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1. Introduction

It seems that every time you open a newspaper or watch the news, words such as “budget cuts”, “downsizing” and” recession” dominate the media. With the current fiscal state of the nation, decreases in the allocation of funds to public resources become the norm, putting parks all across the United States in grave danger. Because of this increase in budget cuts, it is vital that visitation to public parks increases, or the existence of many parks could be in jeopardy. Yet, before this issue can be addressed, one must understand the current level of visitation activity. Funding, which can be considered the lifeblood of parks, is highly influenced by visitation data, whether it be for state, national or municipal parks. Many important decisions pertaining to a park’s livelihood are made from a direct analysis of visitation data. According to Cessford and Muhar (2003), reliable data on park visitation are “essential for a variety of strategic and operational planning tasks in park management”. One of the most important jobs that park administrators have is to monitor and record the level of visitation that a park receives. These records may be used to understand and analyze trends within visitation rates. Understanding trends allows park managers to allocate resources, staff and money in the most efficient and effective way. In addition, visitation data may give insight into visitor demographics, another important tool a park administrator may consider when allocating their resources. Visitation data is vital for the welfare of a park, yet the process of collecting reliable and consistent data is far from simple.

The main source of concern for DCR is there is no systematic way of collecting attendance data throughout the agency. As of now, DCR’s parks use institutionalized attendance formulas on a park to park basis, estimates, inferred counts and occasionally a park that does not even track attendance. In their current situation, DCR could analyze attendance trends on a park

to park basis but there is no form of accuracy for these numbers. Accurate numbers and consistency throughout the agency's attendance collection methods will provide useful resources for an array of benefits. This includes advocacy, resource allocation, attendance trends and levels, budgeting and building a constituency amongst the park users and the community.

For DCR to take full advantage of these benefits, our team determined the most suitable methods of data collection for DCR facilities. This will be done through a careful examination of the different available techniques for visitor monitoring and an assessment of best practices. This information will aid us in providing a feasible proposal for developing a systematic data collection plan for Massachusetts state parks.

The first stage of the project consisted of learning about DCR facilities and determining common features to create categories. By creating multiple categories the team provided solutions for each category that can be applied to a group of parks. The categorization of parks was completed through research and interviews with DCR directors. In addition a study of current methods was conducted through interviews and a survey with state park directors. The team also conducted a thorough literature review to ascertain best practices nationwide. This will ensure that the recommendations developed by this project will allow DCR to create a new system of data collection that is efficient and accurate.

2. Background

Fredrick Law Olmsted (Mitchell, 2005), the man responsible for designing many public parks, such as Central Park in New York and the emerald necklace of Boston, believed that parks were one of the greatest gifts to society. In order to fulfill the potential of Olmsted's dream, we must assure that the liveliness of parks is maintained. An important factor to maintaining parks is accomplished in part through maintaining accurate data on park visitation. In order to effectively utilized data on park visitation we must have systematic methods for collecting data. This chapter will focus on the social functions of parks and on how a clear understanding of park visitation patterns can help park managers to effectively fulfill their mission.

2.1. Parks

Parks in the United States protect the environment, preserve our history and allow residents to enjoy America's ecology and culture. In August of 1916, President Woodrow Wilson signed "The Organic Act" creating a new agency. The National Park System was given the mission "to conserve the scenery and the natural and historic objects and the wildlife therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations" (National Park Service, 2010, Overview). Visitors can enjoy such activities as hiking, camping, swimming, photography, wildlife viewing or just simply going for a jog or walk to keep in shape. In the U.S. there are many different types of parks that can be visited, some with fees and some without. Some of these parks consist of campgrounds, hockey rinks, baseball fields, lakes, ponds, mountains or other facilities. All of these parks have the same goal of preserving the environment, culture and providing enjoyment and appreciation of natural resources for their visitors. The variety of the

parks provides a source of activity, reflection, information, and appreciation for all types of people.

2.1.1. History of Parks

National Parks were created to preserve natural ecological processes in an area or to protect a historical site that defines our culture and heritage. George Catlin (1796-1872) is credited as the person who articulated the idea of having a national park (About.com, 2010). In 1832, Catlin was worried about the impact on the wildlife and wilderness due to the constant westward expansion of Americans. The first national park in the United States was not established until forty years later. By an act of the U.S Congress, Yellowstone National Park was established on March 1, 1872, becoming the first of many national parks.

The National Park Service (NPS) (2010) was created in 1916, under the Department of Interior, to control and maintain the national parks. "The Organic Act" created a new agency, The National Park Service, "to conserve the scenery and the natural and historic objects and the wildlife therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations" (Overview). The NPS was put in control of the existing parks at the time. However, some of the areas later named parks were administered by the War Department and the Forest Service. With the three different services maintaining these protected areas, there was no unified system of management for government owned park property. An Executive Order issued in 1933 transferred all of the national parks to the National Park Service. The NPS now controls 376 areas that cover 83 million acres in the United States and other U.S.-owned territory.

2.2. Visitor Monitoring Techniques

Visitor monitoring is an integral part of maintaining and managing parks (Cessford and Muhar, 2003, p. 242). Data collected can aid park managers or agencies in charge of multiple parks to make well informed decisions for the welfare of parks. The most common use for visitor attendance data is for budgetary purposes. Such data may be used for efficient allocation of money as well as personnel. In addition, visitation records may provide more information than just visitation numbers. Some of the data that are collected provide an insight into the most popular uses of the park, impacts on the conservation of an area due to visitation, as well as demographic information about visitors. Such information can be used by park managers to improve both individual parks and the parks system as a whole.

Although the collection of such data may seem superficially simple, it is actually quite a complex process. This is because every park is different, causing difficulty in creating a single universally applicable system. Due to these circumstances, there are many monitoring techniques in the park management world, each with its own merits and drawbacks. Most monitoring techniques, according to Cessford and Muhar (2003), "fall within four broad types…direct observations…on-site counters…visit registration…inferred counts" (242). In this section the four types of data collection will be described in order to identify the tools that may prove to be most beneficial to DCR.

The best way to identify the ideal methods for data collection in a park is to determine a balance between "accuracy and practical capacity" (Cessford and Muhar, 2003, p. 244), thus finding a balance between accurate results and using techniques that are appropriate for the location, the amount of money allocated for the data collection process and the necessity of the visitation count. In order to specify techniques to be used, park managers must explain reasons

why the data being collected are necessary. Doing so will allow them to truly identify what aspects of data collection are most significant. These factors will be equally important for the DCR.

2.2.1. Direct Observations

Direct observation is data collection by a staff member's observations or through reviewing video recordings (Cessford and Muhar, 2003, p. 244). Such methods include counts made during field observations, videos, and time lapse monitoring through stationary or aerial cameras. This type of data collection is preferable because it gives more information than just headcounts. Direct observations can provide information about who visitors are, what they do in the park, average number of people per group and other qualitative information that other methods of data collection may not describe. The quantitative and qualitative data collected are important because they may be used to create a visitation formula when used in combination with an on-site counting device similar to ones that will be discussed in the next section. A drawback to this observation technique is that it is based on human analysis and may be manipulated, developing a bias. Misleading information may be produced from direct observation as human error is inevitable thus making it hard to produce fully accurate data when direct observations are used.

2.2.2. On-site Counters

On-site counters are automatic, pre-programmed mechanisms, such as sensors that look for a specific trigger that they will identify as a count (Cessford and Muhar, 2003, p. 244). These mechanisms can range from simple mechanical gate triggers, which are inexpensive and provide good raw data, to more sophisticated systems that use radio waves or light beams that are disturbed by movements and record each impulse as a visitor.

Although on-site counters work well for providing raw data under the appropriate circumstances, there are many factors that must be present in order for the information to be accurate. On-site counters work best when they are placed in areas that require the visitors to go through one by one, or through a "bottle neck" (Cessford and Muhar, 2003, p. 244). Applying the mechanism in this way will ensure that the mechanism can count every single visitor who goes by. The analysis of each individual site is imperative for deciding what counting mechanism will give the best data. In addition to the physical features of the area, another factor that may reduce accuracy of an on-site counting system is weather. Some of these mechanisms, depending on the particular device used, may be especially sensitive and may be disturbed or may physically deteriorate under adverse weather conditions. Metal mechanisms might not be the best fit in cold and rainy environments. These conditions can cause rusting and can cause metal to become brittle and break. Cold, near freezing temperatures, will cause battery life to be significantly shorter, and snow or dirt may cause mechanical systems to jam. High winds, in combination with trees or bushes, can cause sensors to capture the motion of the trees and bushes and interpret it as a person, producing an incorrect count. Finally, if weather does not interfere with on-site counters, it is not uncommon for vandalism to be a problem. For these reasons, on-site counters must be strategically placed and maintained in order to provide accurate data.

2.2.3. Visit Registration

Visit registration methods could include such things as an attendance questionnaire, the upkeep of a visitation logbook, and maintaining a count for campground bookings (Cessford and Muhar, 2003, p. 245). Due to the limited number of possibilities, visit registration may provide a limited picture of who really attends parks. The data provided by such methods are limited by the fact that they depend on an individual visitor's willingness to help. In addition, because the

settings in which this type of method can be used are so limited, the information provided may not be representative or may be only partially accurate.

2.2.4. Inferred Counts

Inferred counts are made through the observation of indicators of park usage, such as the number of parked cars at one point in time, the number of traces left on trails from visitors, or information obtained from interviews with park staff or a selected sample of visitors (Cessford and Muhar, 2003, p. 245). Inferred counts through tracing refers to monitoring of such things as the number of dog dropping disposal bags taken from park dispensers. By observing the effects of visitors on the conservation of the habitat, managers may estimate the amount of usage the parks receive. Out of the four types, inferred counts are the least reliable. This is due to its reliance on assumptions that may not have a clear, systematic rationale. Not only does this system rely on assumptions too much, but it can be easily manipulated to introduce biases.

2.3. Surveys

Surveys are an important tool when it comes to ascertaining facts or behaviors that cannot be directly observed by the researcher (Colorado State University, 2011). Surveys can use online or written questionnaires, where the person being surveyed fills out a digital or physical form by filling in blanks and checking off boxes. Surveys can also be done using interviews, whether over the phone, by a video call or face-to-face. These generally work by the surveyor asking questions of the person being surveyed and taking notes on his or her answers. Each method of surveying can be more or less beneficial or efficient, depending on the topic of the survey and the assets of the researcher. A large company may have enough employees to use phone calls to survey a large number of people, whereas a digital online survey may be more convenient for a

smaller company or organization that does not have enough employees to spare for person-to-person surveying.

Researchers can use surveys to collect many different types of data. Parks could use surveys to collect data that cannot be observed by staff (Colorado State University, 2011). The survey could include questions to get data from visitors such as demographics and opinions on the quality of the facilities or the quality of the experience the visitors had.

2.3.1. Demographic Data

Demographics are most easily explained as the answer to questions such as, "Who are you?" or "How would you describe yourself?" and more (Geolytics, 2000). Demographics are data used to classify people and put them into categories according to some classification system. Categorizations range from factors such as age and race to the amount of education a person has or a person's political views. A person's demographic characteristics can only be determined accurately by asking that person. Each person's demographics are unique since no two people are ever the same.

Researchers sometimes want to know this information in order to better understand who their customers are or to understand the views of different sectors of the population (Geolytics, 2000). One way to find out this information would be to survey the population or a targeted group. A survey can include questions asking the respondents who they are, what they do, their opinions or views, and how they would describe themselves.

2.3.2. Surveys from other Parks and Recreational Facilities

Many parks and recreational facilities use surveys to acquire data such as demographics and visitors' opinions on the quality of the facilities. Two examples of these surveys are from the George Washington Carver National Monument and the Rocky Mountain National Park (*Rocky*

Mountain National Park Visitor Study, 2010; *George Washington Carver National Monument Visitor Study*, 2010). The majority of these surveys focus on obtaining visitor opinions of park facilities and services and what prompted the visit. These data can be used by the parks to improve their quality and to better understand how visitors are finding out about the park. There is also a shorter section toward the end of both surveys that has several questions that pertain to demographic data. Three of these questions have to do with education and race.

2.4. Visitor Attendance Formulas

Visitor attendance formulas are used to estimate attendance for a certain time period (Bushman, 2007). A basic formula for example would be:

Number of Vehicles x Average Number of People in a Single Vehicle

= Total Number of Visitors at a Park

A formula such as this one could be used to determine the number of people at a single moment or for much longer periods of time. These formulas can take into consideration many different variables that can affect the attendance numbers to obtain a more accurate estimate. Variables such as time of the year, weather, and the average number of people in a single car can have a significant effect on visitor attendance patterns.

2.4.1. Formulas used by Parks and Recreational Facilities

Some parks and recreational facilities have created their own attendance formulas. These parks and facilities have gone through careful research to determine what numbers should be held constant throughout the formula (Bushman, 2007). One example explained by Bushman is the formula used by the Department of Natural Resources, Maryland Park Service. In March of 2007 they implemented a set of attendance reporting procedures using the following formula to determine daily visitation:

Daily Visitation = Vehicle Count x Turnover Coefficient x Average Visitors/Vehicle

Each park and facility will have different visitation numbers and need different turnover coefficients and average visitors per vehicle ratios (Bushman, 2007). The turnover coefficients are estimated ratios of total vehicles to hourly vehicle counts. The Maryland Park Service used the following process to determine the values of the constants used for each individual park. To determine the visitor per vehicle ratio at a single park or facility, park workers spend 30 minutes counting the number of visitors and the number of vehicles. The data are collected for different days throughout a one month time span. The total number of visitors divided by the total number of vehicles results in the average number of visitors per vehicle at that specific park or facility.

Average = Total # of visitors / Total # of vehicles

After determining the average visitor per vehicle, the Maryland Park Service found it necessary to account for the difference in counts at different times in the day using spot counts and total daily vehicle counts (Bushman, 2007). The spot count is the count of vehicles during the moment of observation and the total daily count is all the spot counts from the day added together. To determine the turnover coefficient to account for the difference in counts at different times in the day, they add each of the turnover coefficients and divide by the number of turnover coefficients.

Overall Turnover Coefficient = Sum of Turnover Coefficients / # of Turnover Coefficients

Each turnover coefficient is found by dividing the total daily count by a single spot count and repeating for each spot count (Bushman, 2007).

Turnover Coefficient = Total Daily Count / Spot Count

After obtaining these two constant numbers, the park staff will then be able to get a count of the vehicles at any time during the day and be able to produce a statistically reliable daily visitation count (Bushman, 2007).

2.5. Department of Conservation and Recreation (DCR)

The Department of Conservation and Recreation (2011) is a government agency in Massachusetts that runs most of the state's environmental and recreational facilities. DCR was proposed by Governor Mitt Romney and was approved by Legislation in 2004. The Department of Conservation and Recreation was created to merge the functions of two existing agencies in Massachusetts, the Metropolitan District Commission and the Department of Environmental Management. The main goal of DCR is "to protect, promote and enhance our common wealth of natural, cultural and recreational resources" (About). With this goal in mind, DCR plans to improve their facilities, expand public involvement and make all of the resources under its management available to increase the connection between people and the environment.

In order to fulfill the goal of the Department of Conservation and Recreation (2011), DCR is split into four distinct divisions. The four divisions of DCR are: State Parks and Recreation; Urban Parks and Recreation; Water Supply Protection; and Planning and Engineering. The Division of State Parks and Recreation focuses on the parks and facilities outside of the Greater Boston Area. The Division of Urban Parks and Recreation focuses on the parks and facilities within the Greater Boston Area. (Information about Water Supply Protection and the Planning and Engineering department can be found in Appendix A). The divisions of DCR have separate tasks, but work towards the common goal of improving Massachusetts' parks and facilities.

2.5.1. Division of State Parks and Recreation

The Division of State Parks and Recreation maintains nearly 300,000 acres of parks and other state reservations outside of the Greater Boston area (DCR, 2011, About). The division watches over a total of 106 parks in 4 different areas. There are 25 parks in Western Massachusetts (See Figure 1), 35 in Central Massachusetts (See Figure 2), 21 in Northeastern Massachusetts (See Figure 3) and 25 in Southeastern (See Figure 4) Massachusetts. This division provides services and planning programs to private and municipally held land and resources, as well as operating runs the state parks and conservation sites outside of the Greater Boston area.

Figure 1- Map of Western Massachusetts DCR owned parks (DCR, 2011, Find a Park)

Figure 2 - Map of Central Massachusetts DCR owned parks (DCR,2011, Find a Park)

Figure 3 – Map of Northeastern Massachusetts DCR owned parks (DCR, 2011, Find a Park)

Figure 4– Map of Southeastern Massachusetts DCR owned parks (DCR, 2011, Find a Park)

2.5.2. Division of Urban Parks and Recreation

The main focus for the Division of Urban Parks and Recreation is to preserve and maintain the parks in the Greater Boston area (DCR, 2011, About). There are a total of 36 parks to be taken care of in the Greater Boston area (See Figure 5). The variety of parks consists of Heritage State Parks, Woodland Reservations, River Reservations and Coastal Reservations. Aesthetics for these parks is important to maintain because they are natural or historical sites in a relatively urban setting.

Figure 5 – Map of DCR owned parks in Greater Boston Area (DCR, 2011, Find a Park)

2.6. Summary

In this chapter we explore the general ideas that revolve around the challenge presented by DCR. The topics discussed range from the creation of the idea of a public park to the present day divisions of DCR, as well as current methods for data collection used by DCR and data

collection systems in use throughout the world. Knowledge obtained about attendance formulas and data collection techniques gives a good understanding on the different methods that will be valuable for the various categories of parks. Information obtained from the background research helped the team create a thorough DCR with a valuable recommendation in order to generate accurate attendance data collection methods.

3. Methodology

The goal of our project is to propose better methods of collecting attendance data at parks administered by the Massachusetts Department of Conservation and Recreation (DCR). The team began this task by developing a profile of DCR's parks and other parks around the world. To do this, we discussed many parks with several DCR employees, starting with our sponsor liaison, Johanna Zabriskie, and moving on to those with more hands-on experience with the parks, such as the Recreation Bureau Chief, Gary Briere. We visited several parks to give us our own hands-on view of individual parks, methods for data collection, and park characteristics. Using the collected information from our interviews and park visits, we developed four categories to identify the access characteristics of the DCR parks. Categorizing the parks allowed us to focus on a few general characteristics instead of analyzing each individual park and helped us to categorize and gather information from state park directors through a survey that we drafted. The survey asked how parks around the nation acquire their visitor attendance data and helped us to identify new methods that we had not previously discovered. In addition, we were able to contact park systems around the nation to find out their method of data collection and what they use the information for. Finally to select the best options for attendance data gathering, each method was analyzed with the help of a performance characteristic scale. The performance characteristic scale rated each method on a scale from 0.01 to 1.00 depending on the rating from 1 to 5 of the costs, accuracy and reliability.

3.1. Determine Characteristics and Features of Parks

The method used to attain visitation data at each individual park depends on the characteristics it features such as; size, function, entrance, region, and setting. By conducting interviews with DCR staff, such as the Recreation Bureau Chief and Park Supervisors, and by

visiting several parks within DCR, the feature that best helps collect visitation data was identified. Having identified this feature it was possible to determine some categories parks may be divided into. By creating categories, the team was able to recommend methods for each category that provides accurate and systematic data collection.

3.1.1. Interview with DCR Recreation Bureau Chief

In addition to using the DCR website database and visiting a sample of DCR's parks for determining the physical features, we interviewed the DCR's Recreation Bureau Chief, Gary Briere, who knows a great deal of information about all the parks controlled by DCR. Additionally, Gary Briere works closely with the parks and has a good understanding of each park's physical features. He has insight on current flaws in the data collection conducted at many of DCR's parks.

Interviewing the DCR's Recreation Bureau Chief and understanding the current barriers in data collection accuracy helped provide insight into characteristics of parks that required the team's attention. The interview focused on two major categories. The first was the physical characteristics of the parks, and the effects these characteristics have on park routine. This information was used to see if there was any staff with extra time, specific entrance types, or any other characteristics that could be used effectively for taking attendance. The second category, park usage, specifically, the common types of activities in which visitors participate, allowed us to gain information on what visitors do and how they move once inside the park. The team also asked Gary Briere if he could suggest a few parks with different physical features, particularly entrance types, which we could visit and talk with the park supervisors. For complete list of questions see Appendix A.

3.1.2. Visiting DCR Parks

To understand the administration and attendance collection of various parks, we visited several parks that differed in recreation and access points. The first time the team visited parks was in May, 2011. Accompanied by four DCR employees, two out of the three team members visited four rural parks. These parks included Regatta Point, Douglass State Forest, Blackstone Heritage Park and Purgatory Chasm. The characteristics that varied among these state parks were their recreational activities. At each of the parks, we spoke with the park supervisors and asked them questions that mainly focused on how they gather attendance data and, if they had an ideal collection method, what it would be.

After reviewing the information we received from these state parks, the team wanted to visit some parks in an urban setting. With the help of the Recreation Bureau Chief, Gary Briere, the team chose four urban parks to be visited. The four parks we visited were the Charles River Esplanade, the Artesani, Melina S. Cass Recreation Center and Swimming Pool and Castle Island. Instead of choosing four different parks based on the recreation activity, we decided to choose the parks depending on how the public accesses these parks. Similar to our previous visit to state parks, we interviewed the park supervisors. However, this time we were more prepared with the questions we wanted to ask. This included the same questions as the first field trip but we included questions about their staff and how data collection helps with the administration of the park. The team also observed how people enter the park and the different activities visitors engage in while in the park. In addition photographs of the different access points and recreational activities were taken. By visiting and interviewing the supervisors at these state parks, we had a better understanding of how we wanted to approach categorizing the DCR parks. To see the interview protocol, see Appendix B.

3.1.3. Categorizing Similar Parks

Although parks differ in size, activities, facilities, population in the surrounding area and other characteristics, many parks are similar to each other. There were many ways we could have categorized the parks. Parks could have been categorized by their current attendance collections methods. For example, parks with entrance fees could be in one group, parks that have gated entrances and exits could be another, and parks that use vehicle counts for visitor estimations could be another group. Another way we could have categorized parks is by the facilities at the parks, such as ponds, swimming pools, camping grounds, trails, and many more. There are many other options that we had considered before making our final decision. In order to determine which categorization strategy was the best, the team analyzed the information from the interviews, field trips, and park maps. Through an analysis of characteristics of the parks and their current attendance methods, we were able to determine the most appropriate way to categorize parks for our study.

After we chose the categories that best suited our study, we divided all of the parks in the DCR into the appropriate respective categories. Our reason for splitting all of DCR's parks into categories was that if an attendance collection method works for one park in that category, it should work with all the other parks within that same category. In the end, this categorization helped us to simplify our questionnaire, made it easier to analyze the different methods that other parks use, as well as making our final proposal to DCR more concise.

3.2. Collecting Current Methodologies

To understand how to better collect attendance data, we conducted research on what other organizations are doing in North America. To do this the team completed internet research, sent out an online survey to state park agencies nationwide and conducted interviews with agency

administrators in both state park systems and municipalities. The information that we gathered helped us to find the best practices for collecting attendance data in other park and recreation facilities. With these best practices, we were able to match them with DCR's needs to provide recommendations that will fit into each of the categories.

3.2.1. Survey to State Parks Nationwide

Many parks have different methods of collecting visitor attendance data. To help us determine some of the best methods for collecting visitor attendance data, we surveyed state park directors across the nation to obtain information about their attendance data collection methods. We composed an email and a survey to send to state park directors (See Appendix C to see the E-Mail Cover Letter and Appendix D for the Survey).

The survey was created using a website called Survey Monkey. The website has a program that helps its users easily create and distribute surveys. The survey included questions that helped us learn about the attendance collection methods that the other states or agencies use for each of the categories we developed, how accurate their attendance collection methods are, and other information based on our categories of parks. We were able to analyze what the most common method used for collecting attendance data at each of the agencies is. The team was also able to take statistical data on how accurate each agency believes their collected attendance data is.

3.2.2. Interviews with Other Parks Nationwide

The team also conducted interviews with various organizations across the nation. We were able to talk to state park system officials in New York and New Mexico. We also got to interview park systems from the city level; this included Westerville, Ohio, Phoenix, Arizona, and Boston, Massachusetts. With these interviews we asked questions that concerned the

methodologies of how each of these systems collects attendance data. The team asked whether or not they have looked into new attendance collection methodologies. Also, the team asked about the purposes for which the agency uses their attendance data. To view the interview protocol, see Appendix E.

3.2.3. Researching Policies and Methodologies

The team conducted online research to find the policies used by state parks and municipalities. Through the online research, the team was able to collect information about specific parks rather than the park system as a whole. Most of the information we gathered about how parks count is through the National Parks Service. Other municipalities we looked into were New York's Central Park, Washington D.C.'s National Mall, Alberta Provincial Parks and Recreation, and other state parks systems such as those of Minnesota, Pennsylvania and Maryland. The information gathered was specifically about how each of these systems gathers their attendance information. Not only did the team research the different methodologies and how they are implemented, we also researched how attendance data is used or can be useful for park systems. Literature on these various data uses provided the team with a better understanding on why accurate attendance information is important.

3.3. Researching Available Technologies

To replace the need for complete human interaction with counting attendance, the team researched technologies to replace human counting. On the internet we discovered a number of companies that produce some of these technologies. Using these companies and their websites we were able to find a number of different technologies based on their collection methods. To be able to analyze the technologies according to their cost effectiveness, we acquired certain

information about each product. Some of the information we focused on were capital investment, battery life, installation costs, maintenance, and reliability.

Most of the information we needed was available online, but in order to obtain the remainder of the information the team emailed six different companies. The generic e-mail template can be viewed in Appendix F. We received responses from three of the companies, but two of them were not fully comfortable with discussing the products in depth over e-mail. In these cases with the two companies EcoCounter and Chambers Electronics we scheduled phone calls to discuss the products and the DCR in more detail. The specific questions that we asked these two companies can be seen in Appendix G. By making these phone calls we were able to obtain more accurate costs and other information according to how we intended to use the technologies.

3.4. Determine Appropriate Visitor Monitoring Techniques for DCR Parks

This section focuses on the selection and proposed implementation for new data collection methods for DCR parks. In order to determine the most appropriate method for a particular park, we analyzed the cost and effectiveness of each method.

3.4.1. Analysis of Visitor Attendance Collection Methods

In order to determine which methods best serve DCR's data collection needs, methods were compared against each other in a performance characteristics scale. These methods were gathered from the interviews, surveys and research the team conducted. We also sorted these methods into their respective access setting. To compare the methods in each access setting, three objectives were identified; accuracy, cost and reliability. In order to rate these objectives,

we assessed them in two ways; what does DCR want to achieve by implementing a new system of data collection and how each of the different methods can achieve these goals.

With this information, we created two features for each objective. For accuracy, we rated the methods based on frequency of data submission and marginal error. The marginal error was broken down into three additional categories; frequency of data collection, the effect of weather on the method and if a multiplier is needed to fulfill the method. The cost was rated by the capital investment for the method and the operational cost for each year. Reliability was rated on the methods lifetime and simplicity of use. Each of these six features for each objective was rated on a scale of one to five. Five being the best option for the feature, while one was the worst for the feature. For a complete breakdown of points, see Appendix H.

Lastly the final score of a system as a whole was determined by finding the combined percentage of the three fundamental objectives. Yet because one objective could be more valuable to DCR, each fundamental objective was given a weight. This was done so the final score could be dominated as best seen fit by the different fundamental objectives. The weight of the final score is distributed as follows; 40% on cost, 35% on reliability and 25% on accuracy. Using these final scores, the team was able to take the top two choices from each category and create recommendations by comparing and contrasting the benefits of the two choices.

3.4.2. Analysis of Best Practices

With the top two choices for each access setting gained from the performance characteristics scale, we conducted a thorough analysis by comparing and contrasting the two methods for each category. Since the two methods pose two different advantages and disadvantages, DCR will be able to choose which method best suits their needs for attendance data collection. Such information that we compared to each method was an in depth analysis of

the accuracy, cost and reliability. All information that we provided helped to make our final recommendations for each access setting to DCR.

3.5. Summary

In order to produce the best recommendations for data collection to the DCR, the team visited parks, conducted interviews with park directors, sent a survey to park directors across the nation, and conducted other forms of research. From all our research and sources, the team developed several categories to divide parks into and a method for finding the best method for each of these categories of parks. We then presented our conclusions and recommendations to the DCR in the rest of this IQP report.

4. Results and Analysis

In order to recommend better methods for collecting attendance data at DCR parks, the team began by analyzing the data acquired from the interview with the Recreation Bureau Chief and by visiting a selected sample of DCR's parks. Using this analysis, we were able to categorize parks into either one or two of the four following categories: Controlled Vehicular Access (CVA), Dispersed Vehicular Access (DVA), Controlled Pedestrian Access (CPA), and Dispersed Pedestrian Access (DPA). We then conducted interviews and discussions with park directors outside of the DCR. Another contact we had with park directors was through a survey. Via the survey and interviews, the park directors informed us about their own visitor attendance collection methods as well as about the purposes for which they use their attendance data. Also, additional research led us to explore both new and available technologies that are used for tracking attendance. The team then used all of this information to compile a performance characteristics scale. With the ratings for methods in each category, we then were able to compare and contrast the top two options for final analysis on what the team recommends to DCR.

4.1. Uses for Park Attendance Data

According to Alan Tate, "User counts are the only form of profit and loss account that exists in park management. It is an object lesson in the patient, persistent and professional application of sound business principles in the public realm" (Harnik, 2004). Park administrators use attendance data to make important decisions to build a relationship between the people funding the park system and the users of the parks, as well as to make important decisions about the administration of their park. These administration decisions could include creating an advocacy to obtain increased funding and garner public support; hiring more staff members and

making general capital investments needed in parks. Also, attendance information can be used to make decisions to pursue the organization's mission. The mission includes improving outdoor recreational opportunities and natural resource conservation. Accurate attendance numbers can prove useful in saving the organization money and other resources.

4.1.1. Attendance Trends and Levels

Attendance trends are useful in many ways when analyzing attendance data. On the individual park level, a park supervisor can allocate staff or resources appropriately for each season, day of the week and possibly each hour of the day. For example, the supervisor of Cass Recreation Center and Swimming Pool stated that better attendance information and trends would allow him to know how much chlorine to order or how to best administer the chlorine to the pool at particular times of the day. He would also have the ability to know how many lifeguards to schedule for a typical weekday or weekend. Many of the uses for attendance trends in individual parks are best applicable on a park to park basis depending on the activities and other resources that affect the administration of the park.

Attendance trends can be used by an organization for a variety of analysis opportunities, such as year by year comparison or comparing attendance to revenue. The attendance for the current year can be compared to previous years for the system as a whole or to trace attendance patterns for each individual park. This can raise questions as to why attendance levels at the parks have increased or diminished, creating an opportunity to either mirror the administration of parks that are doing well or to review why a park is doing poorly. In addition, the attendance trends can be used to make rough estimates for future park use. An example for this scenario occurs with a select few Alaskan National Parks. Attendance was gathered from 1997 to 2005. With this data, Alaskan officials determined that average percent change had been an increase of

4% per year. With this they created a projection of visitation at their parks for 2010 and 2015 (Denali, 2006).

Another opportunity for useful attendance trends is to compare attendance with other resources such as revenue. For example, Peter Finn, New York State Parks Deputy Commissioner of Finance and Administration, stated that attendance data does not have to necessarily be accurate to be useful. He is not worried about how accurate the numbers are, but since the same method of collection has been used in his parks for over ten years, he can analyze the trends. For example, he compares the attendance trends with the revenue obtained from each park. If there is a 10% increase in attendance, he expects to get close to a 10% increase in revenue as well. If the numbers did not match up he could investigate to determine the causes for the discrepancies.

Also, attendance levels, gathered from the attendance data, are important both for park supervisors and high level decision makers in an organization. The organization can make many informed decisions based on the attendance levels of each park. For example, Anita Wysocki, DCR's Camping Program Coordinator, indicated that many of her staff uses attendance records to determine when to open or close the campgrounds in a season. If a campground is not doing well late in the season, her staff may decide to close down the park at an earlier date in future years.

4.1.2. Advocacy with Policy Makers and Potential Funding Sources

From our survey of state park directors across the nation, 75% of the respondents stated they use their attendance data for advocacy. Advocacy includes pleading for funding to create multiple benefits for society, such as equity of accessibility to all social classes, health benefit opportunities, improved quality of life and sustainability of natural resources. This funding can

come from many sources, such as the government, private or public granting agencies, other organizations or private or public foundations, and various special sponsorship opportunities. All of the arguments that parks administrators make to the financial providers need to be supported by data. Attendance data are one of the main pieces of information that a financial provider will look at; these data give an indication of the popularity of the parks with the general public. From these attendance data, the organizations can prove the needs for certain expenditures, such as capital investments to improve park quality or additional staff to fully and efficiently operate the parks. The organization could also advocate to receive resources for educational programs about the parks and their mission.

4.1.3. Building Constituency

Building a constituency among users of the parks creates many benefits for future work in event planning and assisting in advocating to policy makers. Using attendance data, an organization can determine where visitors tend to visit. If the methodology of collecting attendance data has the ability to capture demographic data, park managers could adjust the administration or make recommendations to the agency to make the facilities more accessible to various demographic groups. Having the parks more accessible to all social classes can build a larger constituent base. Attendance information can also be used to attract more people to the parks. For example, park administrators can schedule events at parks with low attendance to attract visitors. Events can be used as a marketing strategy to attract people who do not usually attend state or urban parks.

Although creating a larger constituent base is good for an agency, the agency needs to take into consideration their mission statement about natural conservation. For example, the Organic Act mission for NPS is to preserve the parks in such a manner that leaves the

environment unimpaired for future generations to use (National Park Service, 2010, Overview). With most missions, such as the NPS's, a balance between promoting parks and preservation needs to be made. According to Fredrick Law Olmstead, "And there's numerous lawsuits and case law and philosophical statements from great conservation leaders over the years that the rights of future generations, when it comes to parks, the rights of future generations are more important than the immediate desires of the present" (Repanshek, 2010).

4.1.4. Budgeting

Budgeting is one of the most important uses of attendance data. The funding that an organization is given has to be dispersed amongst the parks within its system. Accurate attendance data can assist in determining how much funding an individual park should receive. If a park has low attendance, increased funding could be used to improve its facilities through capital investments or to create marketing opportunities, such as planned events. Alternatively, the administration could adjust that park's budget to correlate better with the attendance levels.

One example of an agency being proactive about their budget is Westerville Ohio State Parks and Recreation. They calculate the cost of operation for a particular park and compare it to the attendance at the park. They then calculate the value per visitor to visit that park. For example, if the daily operating cost of a pool is $1000 and there are 100 users, the value is $10 per person. They then look for ways to reduce that cost per person by either increasing revenue, which could be achieved promoting the pool or by decreasing the expenditures for that pool.

4.1.5. Staff Allocation

Improved staff allocation is an important benefit derived from gathering better attendance data. An organization can determine which parks either need more staff or which need fewer staff. For example, DCR managers are able to determine how many lifeguards to hire for their

pools for a particular season. A park with 500 visitors per day needs quite a few more lifeguards than a pool with only 200 visitors in a day.

With the implementation of new methodologies and technologies comes opportunity to utilize limited staff resources more effectively. If a staff member currently uses a portion of their day counting or estimating visitors, a mechanical counting device could free up the staff member to work on different park duties, such as making sure the park is clean, communicating with the visitors or any other duties that a particular park might require. This saves time and effort in completing a task that can be done mechanically, and can save the organization from hiring additional staff to improve park services.

4.1.6. Potential Implications

A challenge with attendance data does arise when it comes to advocacy and reviewing the numbers. Our interviews revealed that many agencies have looked into new methodologies; however, they are anxious about what trends the new attendance collection might show. For example, New Mexico State Parks contracted with a local university to analyze their attendance data, consisting of two years of surveying and hard counts. The analysis yielded numbers significantly lower than the numbers generated by their current methodology. Because of the great differences, the state parks system discarded the recommendations because they were afraid that they would lose funding. This example is dissimilar to the problem of DCR in the sense that, most of the current attendance counts involve guessing; implementing new methodologies will be beneficial even if the current counts are overestimated. Although new methodologies may pose certain implications, having a systematic way of capturing attendance data can be beneficial for both the agency and its parks.

4.2. Park Access Settings

After visiting several DCR parks, the team began to understand which features were key for public use data collection. The team determined that the way visitors access a park or facility will determine which methods may best be used to collect visitation information at each park. In fact, it is significantly more important that the method used to collect data be adapted to the type of entrance to the park rather than being influenced by any other feature. For this reason, it was decided that the parks would be grouped into categories based on the types of park entrances. With the assistance of Gary Briere, DCR Recreations Bureau Chief, the team identified four common access settings as follows: controlled vehicular access (CVA)**,** disbursed vehicular access (DVA), controlled pedestrian access (CPA), and disbursed pedestrian access (DPA).

4.2.1. Controlled Pedestrian Access (CPA)

A controlled pedestrian access setting is characterized by facilities with a limited number of access points where visitors must enter through gated entrances, doors or turnstiles. A controlled pedestrian entrance setting makes data collection simple and increases the level of accuracy. From our survey to state parks nationwide, 60%[1] of the park systems that have this access setting felt highly comfortable with their attendance collection method and data. This is the easiest access setting to receive accurate attendance data.

Recreation areas such as pools require staff to monitor the number of people in the pool due to public health and safety regulations. Their count is taken as people walk into the pool area, normally through a gate, creating a controlled pedestrian setting. This is true for recreation areas such as the Melnea A. Cass Recreation Center (seen in Figure 6); this facility has a single

[1] This number is based on the 20 survey respondents, some of whom chose Not Applicable as their responses because they do not have the access setting or they do not count this type of access setting.

access door and requires every person who enters the facility to sign a registration sheet and to sign out before leaving. This system provides an exact count.

Figure 6 - Melnea A. Cass Arena Entrance.

4.2.2. Controlled Vehicular Access (CVA)

A controlled vehicular access park is characterized by having one main parking lot or access route, or having limited vehicular access points. The Belle Isle Marsh Reservation (Figure 7) is a perfect example of this category. This park can only be accessed through one road and only has one parking lot as seen in figure 8. From our survey to state parks nationwide, 40%[2] of the park systems that have this access setting felt highly comfortable with their attendance

[2] This number is based on the 20 survey respondents, some of whom chose Not Applicable as their responses because they do not have the access setting or they do not count this type of access setting.

collection method and data. According to the survey, this is the second easiest access setting to receive accurate attendance data.

Figure 7 - Belle Isle Marsh Reservation. Google Maps, 2011.

Figure 8 - Belle Isle Marsh Reservation parking lot and entrance road. Google Maps, 2011

4.2.3. Dispersed Vehicular Access (DVA)

A disbursed vehicular access park or facility has no designated parking areas; visitors park their cars in dispersed places where accurate counts are difficult to obtain. Another feature that is often present in a dispersed vehicular access setting is the absence of a gate or barrier around the perimeter of the area. Examples of this setting are popular beaches, urban parks or large rural settings. Pleasure Bay and its beaches (Figure 9) are a perfect representation of disbursed vehicular access. Visitors may park their cars along the entire bay (Figure 10) and may

even park on one of the many adjacent roads (Figure 11). From our survey to state parks nationwide, 15%[3] of the park systems that have this access setting felt highly comfortable with their attendance collection method and data. According to the survey results, this is the second hardest access setting to receive accurate attendance data.

Figure 9 - Pleasure Bay. Google Maps,

2011.

Figure 10 - Pleasure Bay Parking. Google Maps, 2011.

[3] This number is based on the 20 survey respondents, some of whom chose Not Applicable as their responses because they do not have the access setting or they do not count this type of access setting.

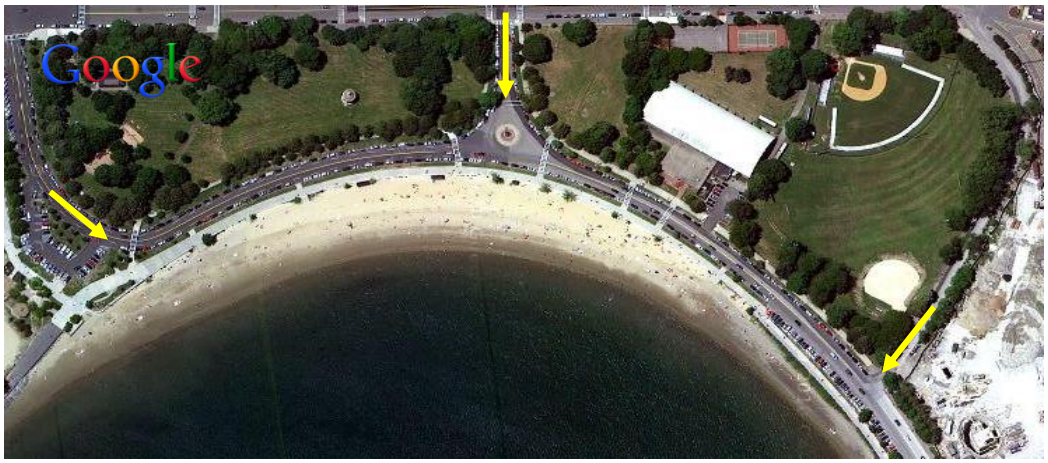


Figure 11 - Pleasure Bay Multiple Access Roads. Google Maps, 2011.

4.2.4. Dispersed Pedestrian Access (DPA)

A disbursed pedestrian access park can be defined as having an infinite number of access points. To get an understanding of this category, one can think of a park where visitors may enter at any point around the park's perimeter, with no gates or restrictions. A famous example of such a park would be New York's Central Park, a large park with countless numbers of entrances. A DCR example of such a facility would be the Charles River Esplanade, which does not have a designated parking lot, has nine overhead pedestrian bridges for access, and many other pedestrian entrances. This park is not only a frequent location for tourists but its running and biking trails are crowded with locals. Figure 12 illustrates how many entrance points the park has and how difficult it may be to create a count. From our survey to state parks nationwide, 10%[4] of the park systems that have this access setting felt highly comfortable with their attendance collection method and data. The results of the team's survey and park visitation trip shows this is the hardest access setting at which to gather accurate attendance data.

[4] This number is based on the 20 survey respondents, some of whom chose Not Applicable as their responses because they do not have the access setting or they do not count this type of access setting.

Figure 12 - Charles River Esplanade

4.2.5. Hybrid Categories

The purpose of placing parks in different categories is so that the team may find suitable data collection systems for these common categories rather than designing unique systems for every individual park. Therefore, it was important that the chosen categories would encompass all or most of DCR parks and recreation areas without over generalizing. Hybrid categories are used for parks that may have both vehicular and pedestrian access settings. For example,

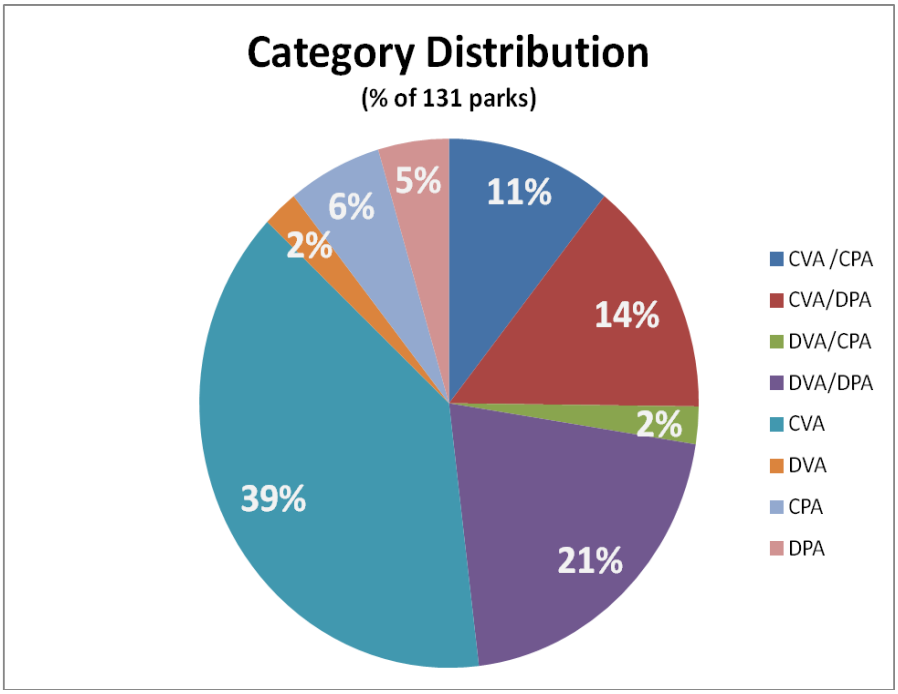
Blackstone River and Canal Heritage State Park have multiple parking lots that are commonly used, yet because the park is in a residential area, many visitors simply walk from their homes and enter the park on foot. Figure 13 shows the park's two main parking lots at one side of the Blackstone trail and figure 14 shows the third parking lot at the end of the trail which is also surrounded by many homes. This demonstrates that, although there are many parking lots, some visitors may also enter on foot. Out of the 131 DCR parks, 48% of parks could be categorized by more than one means of access category. Graph 1 illustrates in detail the distribution of all single and hybrid access categories within DCR

Figure 13- Blackstone River and Heritage Park: Two main parking lots circled in red.

Google maps, 2011.

Figure 14 - Blackstone River and Heritage Park: trail head parking lot circled in red. Note the proximity to residential areas.

Google maps, 2011.



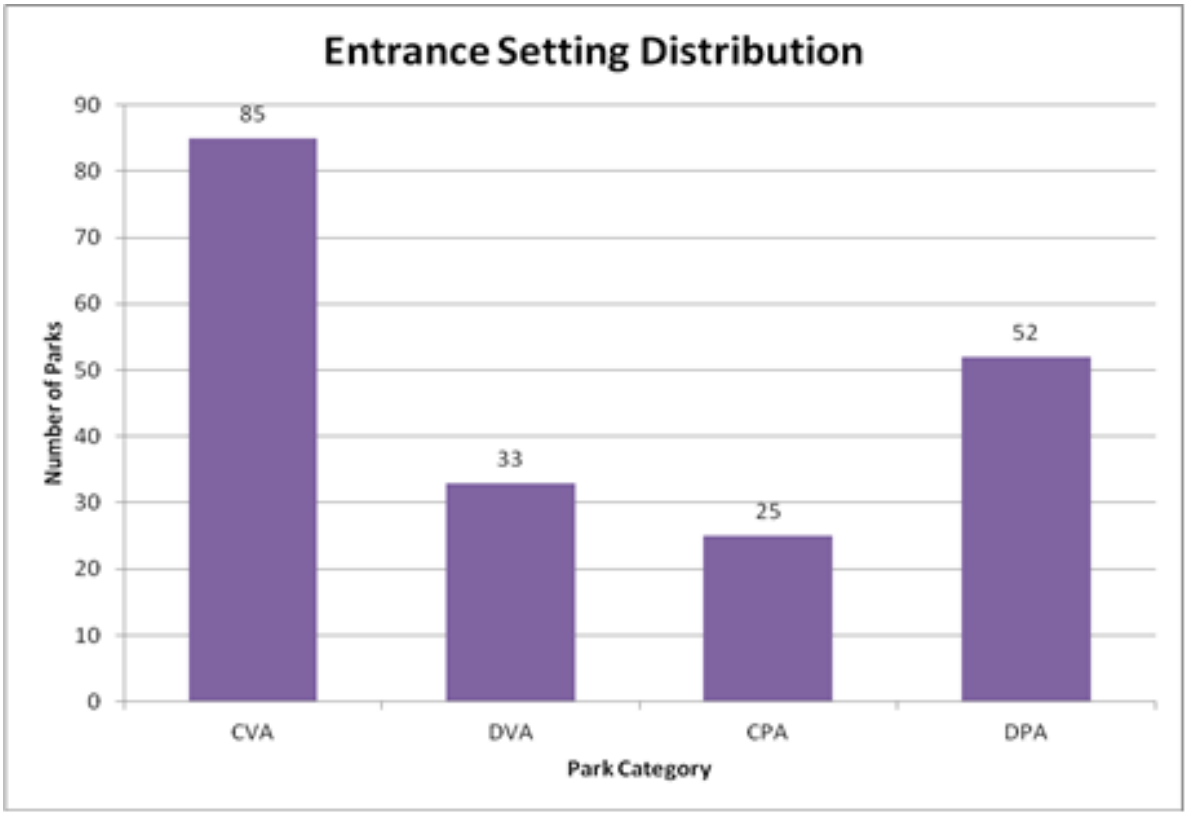
Graph 1 - Access Category Distribution of DCR

4.2.6. Category Distribution within DCR

When the 131 parks within the stewardship of DCR were categorized, we found that the most common entrance setting was controlled vehicular access. Graph 2 shows the number of parks containing each of the entrance settings. CVA and DPA parks and recreation areas are the dominant settings. Note that it is possible for a park to exhibit more than one type of access and therefore the total number of access settings is larger than 131 in this graph.

Another important finding is that 56% of the 131 parks have a controlled setting; this is helpful for DCR because having a controlled setting for both pedestrian and vehicular entrances makes attendance collection much easier.

Now that an understanding of categories and their place within DCR was formulated, we begin to discuss possible systems and technologies to implement in the categories.



Graph 2 - Entrance Setting Distribution Bar (n=131)

4.3. Technologies Used to Collect Attendance Data

The implementation of technologies, to obtain visitor attendance data, can allow staff to spend their time with other work. There are several main types of technologies that can be used for attendance data collection, including: proximity counters, pressure counters, and visual counters. Specific designs within each class of technology are fairly constrained as to the access settings where they can be implemented; otherwise the counter will not be able to obtain the data properly. Note also that vehicle counters utilize a person per vehicle multiplier to convert the actual vehicle count to an estimated visitor count.

4.3.1. Proximity Counters

Inductive loop counters and radio sensors can be classified as proximity counters. The detecting portion of the inductive loop counter is usually placed underneath a road and can detect vehicles above the ground (Diamond Traffic Products, *Inductive Loop Counters*, 2011). The collection unit, a small box, is contained just above ground on the side of the road in a protective casing. When a vehicle passes through the proximity of the inductive loop, its electromagnetic current is detected by the counter, the same way a metal detector detects metal, and the counter increments the count by one. These counters can be used for controlled vehicular access parks by installing them under the entrance roads to the park. Since the counter is located under the road, little to no maintenance is required. On the other hand, the counter will require a person per vehicle multiplier that will change a hard count of vehicles into an approximate count of people. Also, in order to install the inductive loop counter a section of the road must be dug up, making this technology relatively more expensive than other options. The cost to buy the inductive loop system is roughly $1,000 to $1,500 and the installation by a contractor is estimated to be about $1,000. So the price is around $2,000 to $2,500 to install one unit.

Radio sensors can be used for counting both vehicles and pedestrians (Green Space, 2010). They can be installed easily on the side of entrance roads or walking paths. Installation is comprised of attaching two units, a transmitter and a receiver, on opposite sides of the road or path. A radio signal is directed across the path; when a pedestrian or car enters the area, the signal changes and the receiver counts the instance of the change. These counters can be implemented in controlled pedestrian access parks at the entrance to trails or heavily visited areas, and in controlled vehicular access parks on the entrance roads. The radio signals will work in any weather condition and through thin wood or plastic, allowing the device to be protected

from vandalism. However, it will not give accurate results if there is too much obstruction, such as vegetation. The signals can distinguish between pedestrians, vehicles and animals. Another advantage is the device will count every individual even if they are in groups. The estimated price for this device is between $1,000 and $1,500 per unit. This device does not require a contractor to install.

4.3.2. Pressure Counters

Two technologies that can be classified as pressure counters are road tubes and piezoelectric sensors. Road tubes are cylinders filled with pressurized air that increments the count when a vehicle rolls over the tube (Green Space, 2010). This device can be used at controlled vehicular access settings by placing the counter on the side of the entrance roads of the park with the tubes laid across the road. The road tubes are easy to install because they are placed on top of a road and can be moved merely by picking them up and carrying them to a new position. They may need to be removed during the winter to allow for plowing; otherwise, the tubes could be damaged. This device deteriorates much quicker than similar vehicle counting devices. However, this device is half the price of the inductive loop or radio counter, about $500 to $1,000 depending on the complexity of counter. This device does not require a contractor to install.

Piezoelectric sensors are the most costly devices, with the hardest installation, that the team analyzed. The piezoelectric sensors are installed underneath the road with the box shaped counter off to the side of the road and above the ground (Diamond Traffic Products, *Piezo Axle Classifiers,* 2011). The installation of the detecting portion of the piezoelectric sensor is a sensitive process compared to inductive loop counters and therefore have a higher installation cost. Piezoelectric sensors work by converting the pressure or weight of a vehicle into an

electrical charge that can be measured. When the electrical signal is generated, the sensor increases its count by one as well as gains information about the vehicle's weight, speed, axle count, and more. This additional information may be more than what the DCR needs. These sensors require low maintenance; however, weather can affect the counts produced by this device. For example, the winter can cause ice or snow to freeze on top of the piezoelectric sensor and skew the numbers generated. This device is also highly expensive; it costs roughly $1,000 to $1,500 to buy the device and $1000 to $2,000 to have the device installed by a contractor. Again, these sensors would be used at a controlled vehicular access settings and require a person per vehicle multiplier.

4.3.3. Visual Counters

There are three types of visual counters: cameras, light beam sensors, and heat sensors. Video surveillance cameras use image processing techniques to recognize pedestrians or vehicles (Green Space, 2010). These devices can be installed in areas such as main roads or entrances for both controlled pedestrian and vehicular access parks and can view a large area. One simple image processing method detects movement across the screen and counts those movements. Some video surveillance cameras with more sophisticated software are accurate enough to distinguish between every person in a group and can register a mother carrying a child as two counts. Unfortunately, this can make them overly sensitive and cause them to also count small animals such as birds. The price per unit of this device is roughly $500 to $1,000. Some Information Technology staff member would have to install this device, so it does need some expertise in installing but not necessarily a contractor.

Light beam sensors are comprised of two units, the transmitter and the receiver, between which an infra-red beam extends (Green Space, 2010). These units can be installed on opposite

sides of a road or path for pedestrians or vehicles. A vehicle or pedestrian passing between the two units momentarily obstructs the infra-red beam from reaching the receiver. When the receiver does not detect the beam it then knows to add one to its current count. Light beam sensors tend to be a relatively inexpensive technology and are easy to install and relocate. Their disadvantages are that they cannot distinguish between a vehicle, pedestrian or an animal and the range of the infra-red beam is limited, making it nearly impossible to use on wider roadways. This device costs roughly $1,000 per unit and does not require a contractor to install.

Heat sensors use an infrared detection system to detect changes in ambient air temperature (Green Space, 2010). When a person passes the counter, his or her body heat changes the temperature of the air which causes the device to count the visitor. Heat sensors can be implemented in controlled pedestrian access parks at entrances to trails or paths. These counters require constant maintenance for them to continue to work properly; obstructions as small as a spider web over the counter can alter the accuracy of the data collection. Also, during the winter the accuracy can be faulty because of the heavy layers of clothing concealing the pedestrian's body heat, causing them to pass by the sensor undetected.

4.4. Attendance Collection Methods

For most access settings, attendance collection methodologies are needed in order to formulate a systematic policy for the organization. The systematic policy will allow for consistent attendance collection that can be used for all of the reasons stated earlier. The information we received from the surveys, interviews and case studies were analyzed to give us a better understanding of common methods used by parks across the country. It was useful to see that for the four access settings, most of the methodologies in use are similar in many ways. The only differences in the methodologies are the adjustments that needed to be made to improve

accuracy, such as person-per-vehicle multipliers, and the frequency with which visitation data can be collected to minimize time and effort. Figure 15 shows a map of the states the team interviewed, gathered research from or surveyed to learn more about their attendance collection methods.

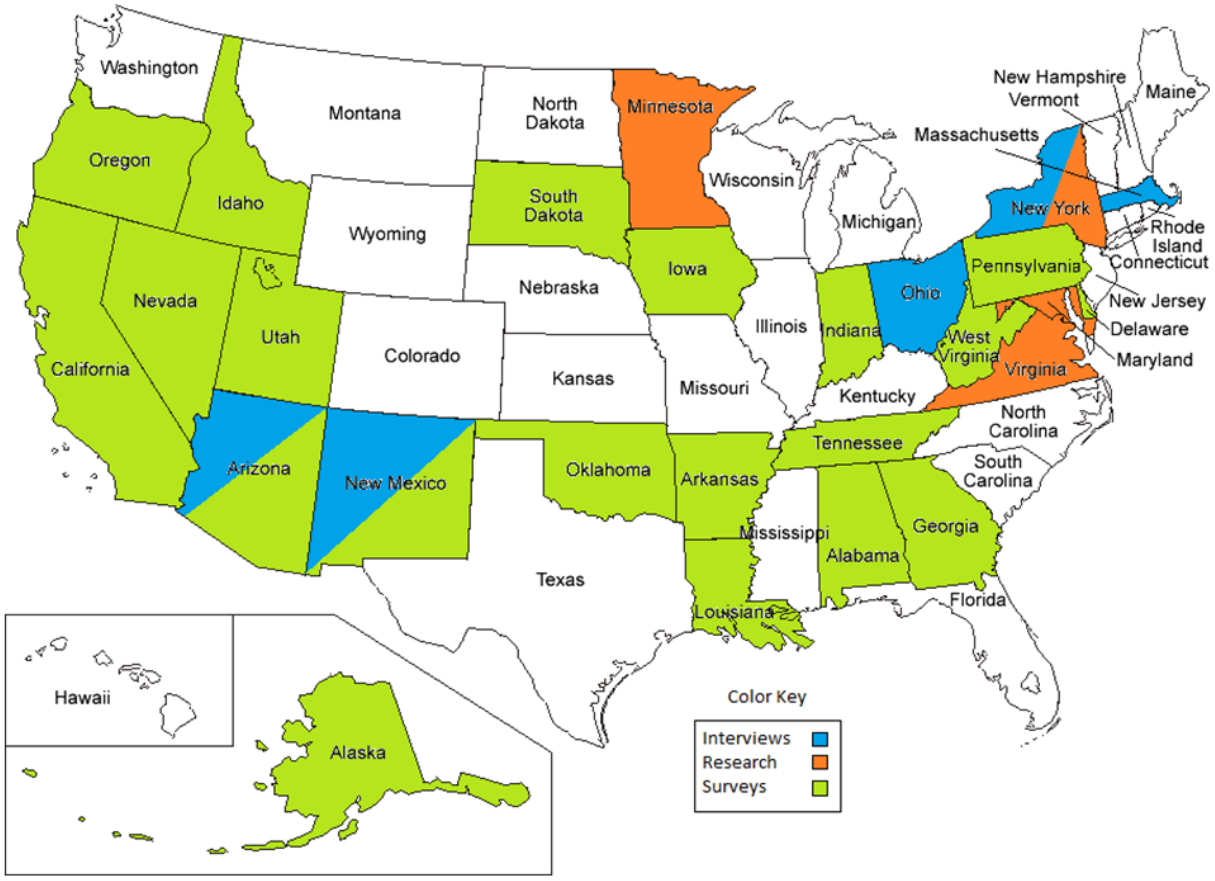


Figure 15 - Map of the various states we interviewed, researched and surveyed.

4.4.1. Making Hard Counts

An organization can also decide to get completely accurate information and make hard counts using technology, staff or volunteers. Hard counts can be relatively easy or extremely difficult to obtain, depending on the type of park. Using our access settings, hard counts could be most easily obtained at controlled pedestrian access parks, whereas it would be most difficult to

obtain hard counts at dispersed pedestrian access parks. Hard counts can be obtained using technologies or a staff member stationed in a place where counts are easy to make. A good example of this type of method is used by Cass Recreation Center and Swimming Pool. For the recreation center portion, each person entering either has to sign in or show their membership badge to the worker at the desk. On the pool side of the facility, there is a staff member at the gate to the pool with a hand counter, counting the people entering the pool. With minimal time and money, accurate hard counts are only viable in the controlled pedestrian settings.

4.4.2. Using an Attendance Formula

Attendance formulas can be used to make an estimate of the number of park visitors. There are many different ways to establish an attendance formula; however according to our survey, all attendance formulas need some sort of hard count. For controlled vehicular access, the survey results indicated that the organizations used different types of technological counts, such as inductive loop and pressure counters, human counts and ticket sale information for their hard counts. However, over half of the respondents that use an attendance formula use multiple hard counts to verify their numbers. A typical vehicular access attendance formula is the number of cars that enter the park, which is the hard count, multiplied by a person-per-vehicle factor.

Daily Visitation = Vehicle Count x Person-Per-Vehicle

Dispersed vehicular access attendance formulas are typically less accurate than those used for controlled vehicular access. For example, Maryland Park Service uses an attendance formula that is as follows:

Daily Visitation = Vehicle Count x Turnover Coefficient x Average Visitors per Vehicle

The average visitor per vehicle is the same as that used by a controlled vehicular access; however the big difference between the two types of equations is the turnover rate. This turnover rate is the average time a visitor will stay at a park.

We found only one instance of an attendance formula for pedestrian access. Westerville Ohio Parks and Recreation uses an attendance formula to track how many people attend sporting events on their playing fields. Depending on the sport, they calculate the number of players on the field, and then they multiply that by 1.5, which is a spectator per player estimate. The sporting teams provide a schedule to park administrators so that they can multiply the estimated attendance per game by the number of games being played to yield a total attendance count for the season.

4.4.3. Making Educated Estimates

Special events are common for many parks. However, collecting visitor attendance data at special events may be difficult because of the larger numbers of people attending the events. For example, Douglass State Park does not use their attendance formula for the Fourth of July. This is due to the overflow of cars that take over the park's parking lot and more than half of the cars that the park supervisor would normally count for the formula are parked on adjacent streets. Many special events that are not organized by the park management often require a permit. The person requesting the permit may be required to provide an estimated number of visitors. Another method for estimating attendance at special events is by visual inspection. An estimate of the number of visitors can be derived by knowing the area of the park and counting the number of people in a certain sized area. This method has been used at the Esplanade in Boston using police and news helicopters. This aerial view provides an estimated visitor density, which can be multiplied by the area of the park.

4.4.4. Taking a Sample

Sampling for a certain period of time is most common in dispersed pedestrian access settings. Sampling consists of taking a hard count for a certain portion of the day; either once a day or multiple times a day. This hard count is then used to estimate the attendance for a set period of time. Depending on how frequently the particular organization wants to collect this attendance information determines how much time and effort to devote to sampling. Having a daily sample will gather much more accurate and consistent data than taking the attendance monthly or seasonally. Also, on bad weather days, taking a daily sample will have less deviation in the final reports. Alberta Provincial Parks and Recreation has a good example of combining hard counts with sampling. They use traffic counters to count the number of cars that travel into their parks and multiply that by a person-per-vehicle multiplier. The multiplier is determined by extensive sampling completed 20 random times a year. This sample includes stopping each car and conducting a survey about their trip and the number of people in the party. To see more examples of daily, seasonally, or yearly sampling see Appendix V.

Using a focal point in a park to make an estimate is another form of sampling. This method is completed by choosing one spot in a park to get a hard count and multiplying it by a ratio multiplier of how many people visit that one point compared to the rest of the park. In order to generate this ratio, a hard count of the total visitors of the park and how many people pass through the focal point need to be made.

Multiplier = Total # of Visitors in the Park / Total # of Visitors at the Focal Point

This hard count of total number of visitors only needs to be completed once. Afterwards, a hard count only needs to be taken at the focal point, which is simple compared to taking a count in a huge park. The focal point count and the multiplier is calculated together to provide an estimate

as to how many visitors have been in the park. An example of a focal point is the number of visitors that cross the bridge, figure 15, in the Charles River Esplanade in Boston, figure 16.

Figure 16 - Bridge at the Charles River Esplanade that could have a technology counter to be used as a focal point.

Figure 17 - Picture of Charles River Esplanade as a whole, the red balloon is the bridge focal point, Figure 15. (DCR)

Using the access settings, technologies and current methodologies, we will be able to combine the three to create a systematic means of gathering attendance data for DCR.

4.4.5. Policy for Data Submission

The accuracy of visitation data is not always in the methodology for collection, how the information is submitted is equally important. For example, the team viewed many documents that local pools are required to submit on a weekly basis. Many of the documents had missing information, wrong dates and some of the numbers were hard to read. Also, the time it took to plug the visitation numbers of just the pools took two to three hours for one person.

New Mexico State Parks implemented an electronic data submission policy. On a weekly basis each park electronically sends their data via an application that their Information Technology Department created. This electronic submission eliminates the need for a staff member to sort through paperwork and manually place the information into a spreadsheet. Also, it is a quick and easy process for all parks to implement; there is no paperwork to fill out.

4.5. Analyzing Methodologies in Each Access Setting

To select the best method for each entrance setting, the methods were compared using a performance scale. This system compared the cost, accuracy, and reliability of methods in each of the access categories that it could be applied to. For cost, accuracy and reliability, there are two subsections each that the methods can be compared to on a scale of 1 to 5. The cost of each method is rated on capital investment and cost of operation. Accuracy is rated by the frequency of data collection, if the method is affected by weather, and if the method requires a multiplier. The effects of weather (3 points) and a multiplier (2 points) were combined to total 5 points. The reliability of the method is determined by its lifetime and if the staff is required to go through training to learn the method. In this rating system, 5 is the best choice and 1 is the worst. The two subsections for each feature were added together and divided by 10, the maximum score, to give a number between 0 and 1. Then through the research and talks with Gary Briere, weights were

determined for cost (40%), accuracy (25%) and reliability (35%). The final scores can range from 0 to 1 depending on their performance in each category. For a more complete explanation of the performance characteristic scale refer to Appendix W and for the full results refer to Appendix X. Please note that since the scores are so close, changing the weights may provide different results for the best method in each access category. Our spreadsheet (see Appendix X) is structured such that DCR may easily change the weighting of various factors as they wish and immediately see alternative results. This section will review the highest scoring methods and the reasons why they received the highest score.

4.5.1. CVA

Method	Cost	Accuracy	Reliability	Final Score
Sampling	0.28	0.2	0.28	0.76
Piezoelectric	0.2	0.2	0.28	0.68
Road Tubes	0.32	0.2	0.245	0.77
Inductive Loops	0.24	0.225	0.28	0.75
Tickets/Clicker	0.24	0.225	0.21	0.68

Table 1 - Performance Characteristics Results for CVA.

From our performance characteristics scale the team determined that the best two methods for controlled vehicular access parks are Road Tubes and Sampling. Compared to the other methods sampling has the second lowest overall costs, including capital investment and operational costs. Technologies require high capital investment ranging from $500 to $1500 and an installation cost ranging from $1000 to $2000, whereas sampling only requires a staff member to spend roughly an hour per day to sample the cars in the parking lots which we estimated to cost around $3200 per year; based on $9 per hour and 365 days. Sampling also has a noticeable

advantage when it comes to the simplicity of use, or in other words it does not require much staff training.

When analyzed with the performance characteristics scale and our study, road tubes scored the highest rating within the CVA category. Road tubes require less expenses compared to other technologies analyzed. Road tubes have an estimated capital investment of $500 to $1000 and do not require installation since they are placed on top of the road. This low cost gives them a high advantage in the team's performance characteristic scale because of the heavy weight associated with cost in the scale.

Road tubes are more accurate than sampling. Road tubes will collect information on a continuous basis, and every car the drives over the road tube will be counted. Sampling only gathers car counts at different times of the day, leaving gaps in time where cars may not be counted. The only need for staff interaction when using road tubes is to collect the count which the road tube provides at the end of the day or week, which takes roughly 5 minutes a day compared to the hour spent taking samples.

4.5.2. CPA

Method	Cost	Accuracy	Reliability	Final Score
Light Beam Sensor	0.28	0.225	0.28	0.79
Heat Sensor	0.28	0.225	0.28	0.79
Radio Sensor	0.28	0.25	0.28	0.81
Log Book/Clicker	0.24	0.25	0.21	0.70
Sampling	0.28	0.2	0.28	0.76

Table 2 - Performance Characteristics Results for CPA.

For controlled pedestrian access parks light beam sensors, heat beam sensors, and radio sensors received the highest score from the performance characteristics scale. Light beam

sensors and heat beam sensors both received the same scores for each cost, accuracy, and reliability because of the similarity between one another. Their cost is $1000, the lowest among the considered methods for CPA. Though it does not reflect in the performance characteristic scale, the cost of radio sensors can be higher, $1000-$1500, but they make up for their price with their increased accuracy. Light beam sensors and heat sensors have a higher margin of error than radio sensors because, unlike radio sensors, they cannot distinguish between groups or animals. In this situation all three methods are equally as cost effective and therefore the decision may depend more on individual prices presented by the company the DCR decides to work with or the location in which the technology is to be installed.

Any of these three sensors could be installed on the sides of trail heads, entrance gates, or even inside the door to a building. Installing the heat or light beam sensors inside the door of a building would increase its accuracy since there will no longer be weather or other nature related causes of error. In this case the heat or light beam sensors would be more cost effective because of their lower costs and the removal of error factors.

Another factor that helps distinguish which of these three technologies is best is the degree of accuracy required. This could depend on the controlled pedestrian access park where the technologies are employed. For example, pool facilities need an accurate count because of the health and safety regulations that must be followed. It is important that staff keep an exact count of the visitors in the pool area so that the capacity of the pool is maintained. In addition keeping an exact count of visitors will aid in determining the required chlorine levels in the pool. Knowing the amount of chlorine that a pool needs is valuable because lack of chlorine in the water can allow the growth of bacteria, and too much chlorine itself is unhealthy for a swimmer.

In the end it is up to DCR's definition of the unique needs of the various parks which will determine whether to employ heat beam sensors, light beam sensors, or radio sensors. Each of these technologies can have their counts captured at the end of the day or week easily by the park supervisor.

4.5.3. DPA

Method	Cost	Accuracy	Reliability	Final Score
Daily Sampling	0.28	0.2	0.28	0.76
Weekly Sampling	0.32	0.175	0.28	0.78
Monthly Sampling	0.36	0.125	0.28	0.77
Seasonal Sampling	0.32	0.1	0.28	0.70
Visual Camera	0.32	0.2	0.21	0.73
Focal Point	0.245	0.315	0.245	0.81

Table 3- Performance Characteristics Results for DPA.

Although all the methods were close, using a focal point to estimate visitation is the highest rated method. The cost for this method was rated the lowest because, unlike the other methods, this method uses a piece of technology to count for the sample rather than a staff member. So not only does it have a capital investment cost of $1,000 to $1,500 for the technology, there is an operation cost of mechanical failures that may take place, and there needs to be an intensive data collection, conducted by staff or volunteers, to determine the ratio of how many people visit the park compared to the focal point. Using a focal point is much more accurate than the other DPA methods; this is because the piece of technology will continuously gather counts for everyone passing through that point. This method is highly rated for the parks that do not have the staff required to conduct a sample. The park supervisor only needs to take 5 minutes to collect the hard count from the piece of technology, and then multiply that number by the ratio. The disadvantage of this method is the ratio that was gathered from one day's work

may not reflect that of every single day in that year or years to come. So this number may have to be generated every one to two years.

Weekly sampling was ranked second on our performance characteristic scale. The cost is based on a staff member conducting a sample count for one hour on a weekday and one hour on weekend day. If the hourly pay is $9, this calculates out to be roughly $936 to do weekly sampling for an entire year. This method is staffing intensive compared to that of the focal point sampling. Instead of spending 5 minutes a day collecting the numerical information from a piece of technology, the park supervisor or their staff have to spend 2 hours a week completing hard counts. For an entire year that comes out to be 104 hours compared to the 30.5 hours (5 minutes x 365 days) of collecting attendance data. That is 73.5 more hours of time spent on collecting attendance data than using a piece of technology. Also, the technology will continuously gather attendance numbers, compared to counting 2 hours in the week period. This leaves gaps in attendance accuracy; the staff may count at a peak time, which in turn would overestimate the other times in the day or the week. This method is also affected by the weather, if the count is taken on a rainy day, then it potentially underestimates the nice days, or vice versa. However, this method does generate more accurate estimations for different seasons. The average ratio of people passing through a focal point in the winter may be different than that of the summer. The weekly sampling estimates will track these seasonal changes.

4.5.4. DVA

Method	Cost	Accuracy	Reliability	Final Score
Sampling	0.28	0.2	0.245	0.73
Human Formula	0.32	0.175	0.245	0.74
Technology Formula	0.32	0.2	0.175	0.70

Table 4 - Performance Characteristics Results for DVA.

Although the three systems that were compared had similar final scores, the human formula method had the highest score by .01. For this rating system, human count can be described as a staff member doing a spot count of parked cars once a day. This process takes approximately 15 minutes a day. This spot count is then multiplied by a person-per-vehicle ratio and a turnover rate. The cost is determined by a staff member spending 15 minutes a day, 365 days a year and receiving pay of $9 an hour. This is roughly $820 a year to take a sample every day. Every 5 year period, there will need to be two intensive data collection methods. These methods include determining the person-per-vehicle factor and turnover rate for the park. These multipliers are given a lifetime of 5 years due to the change in various trends. Such as family sizes, the types of cars people are using, and many more factors.

Sampling came in second for our performance characteristic scale; this method consists of a staff member going out multiple times a day, and for this study we used 4 times a day of 15 minute samples. So at $9 an hour, an hour a day for a whole year is roughly $3,285. This method is staffing intensive; however, it tracks the trends throughout the day better than the attendance formula. Another advantage sampling has over the human formula is that this method only uses a single person-per-vehicle multiplier, rather than both person-per-vehicle and turnover rate multipliers. Since the access setting is dispersed, it may be harder for a staff member to count the number of cars in the park due to distances from each other.

Although these two samples work for DVA settings, the team analyzed the access setting data and determined it would be resource consuming to include these methods into the system. Of the 33 parks with the dispersed vehicular access setting, only 3 are pure DVA. The distribution of the other 30 is as follows: 27 of the parks are a combination of DVA and DPA and the other 3 parks are a combination of DVA and CPA. Since the other 2 access settings, CPA and DPA, each have a method that ranked .81 on the performance characteristics scale, it would be a better recommendation to only use one of the two methods in DVA for the 3 parks that are DVA only. For the access settings that are a combination of DVA and some other access setting, the performance scale suggests that using the other access settings' methods would be more cost efficient, reliable and accurate.

4.6. Summary

Using our research on technologies and other parks, the team achieved its goal in concluding the best methods for visitation analysis. We determined the best methods for collecting visitation data to be: CPA: radio sensors, CVA: road tubes, DPA: focus points, and DVA: human formula. With the benefits of attendance data the team has proven the importance of improving systems of data collection. Additionally the results provide important procedures, such as the creation of multipliers and electronic attendance submission.

5. Conclusion and Recommendations

This chapter summarizes the team's analysis of systems for attendance data collection and provides a comprehensive recommendation for DCR. The team has recommended at least one system for counting attendance in each of the four access settings which the team identified. Our recommendations are based on case studies and the outcome of the performance characteristics scale for each system.

5.1. Conclusions on the Visitation Analysis of DCR State Parks and Recreation Areas

Through the field trips, viewing of literature, interviews and surveys conducted, it is evident that the DCR needs to institute systematic methods for data collection. Although some DCR parks are following methods similar to the ones that have been found to be most effective, the lack of guidelines or agency wide policies for data collection do not allow DCR to fully reap the possible benefits of accurate data collection and analysis. The lack of systematic methods became evident during the field trips and interviews with DCR park supervisors; most of whose attendance data was estimated with the use of experience. Because managers are not required to submit attendance on a more routine basis, the agency itself cannot use the data to its full potential. It is important that data be submitted from all parks to the agency. For Example DCR camping supervisor, Anita Wysocki, uses data from the camping reservation software to decide how long camp sites should remain open, yielding valuable information to the DCR.

In order for the DCR to maximize the uses of its attendance counts, new systems for data collection should be adopted. The team has determined that the best way for DCR to do this is to implement a system for each of the four entrance settings: controlled vehicular access; dispersed vehicular access; controlled pedestrian access; and dispersed vehicular access. For CVA parks,

the team found that road tubes are the best choice. This is because implementation, operation, and maintenance cost is lower compared with other technologies that provide the same degree of accuracy. For CPA, it was concluded that radio sensors are the best choice. This is because although their price is higher than the price of comparable technologies, the accuracy that radio sensors provide in natural environments is higher and therefore a better option for DCR parks.

It was determined that the best system for data collection available for both dispersed categories is focal point sampling. Due to the nature of these parks, to only implement a technology will not provide useful information. Yet if a technology is placed at a popular location, a ratio may be determined which can be used to provide an estimate of the total visitation.

The costs that have been described do not take into account the cost of creating a multiplier. A multiplier is a basic tool for data collection that is required for three out of the four recommended methods. The creation of a multiplier may be time consuming and therefore can become costly. Yet once a multiplier is determined it will serve the park from 5 to 10 years. Further a multiplier can still provide useful information even if its level of accuracy is not the best.

5.2. Recommendation for Electronic Data Submission

From the interviews of New York State Parks, New Mexico State Parks and Anita Wysocki, we recommend that DCR implements an electronic data submission policy. Data submission should either be done via internet or smart-phone. We recommend that the submission form be created by the Information Technology Department to save money and

address the needs specific to DCR. Data submission should be completed on a daily basis by each park; however, weekly submission may be easier and is still highly useful.

5.3. Recommendation for Controlled Pedestrian Access

For controlled pedestrian access settings, the team recommends placing a radio sensor at the side of the main entrance or trail head. The count provided by this technology should be collected every day.

Alternatively, for a lower expenditure a light beam sensor or heat sensor could be employed, however, these technologies cannot always distinguish people from animals, may not count each individual in the group and can be affected by weather conditions.

5.4. Recommendation for Controlled Vehicular Access

For controlled vehicular access, we recommend that road strips be purchased and laid across the entrance roads to the park. The numbers provided by the road strip counter should be recorded daily and installed into the following formula.

Daily Visitation = Total # of Vehicles Provided by the Road Strip x Person-Per-Vehicle Person-Per-Vehicle Multiplier

We recommend that DCR take a sample for 30 minutes a day for a week in each season. For this time, controlled vehicular access settings should conduct counts of the visitors in the vehicles entering the park. Doing this for a week will provide DCR with a fairly accurate average for each season at each park. This method will provide a multiplier for each season. This process should be completed at least once every 5 years in order to assure that the appropriate multiplier figure is always employed.

Alternatively, DCR could devote a day at each park to determine the person-per-vehicle multiplier for each individual park. For controlled vehicular parks, we recommend counting the

number of visitors in each vehicle that enters the park. This method will provide a multiplier for each season. This process of multiplier verification, once again, should be completed at least once every 5 years.

5.5. Recommendation for Dispersed Pedestrian Access

For dispersed pedestrian access, we recommend that a focal point sample be taken. In each of the DPA parks a focal point should be identified and some sort of technology be placed there to count. We recommend using a radio sensor for this because it is the most accurate and least likely to fail in different conditions.

This method needs intensive data collection at the beginning where staff or volunteers will count the number of visitors in the park for an entire day and then compare the number to the technology count for the same time period. This process should be completed at least once every 2 years. A shorter time period could be used to count visitation; however, the number will be less accurate. Since this one day will determine a multiplier for two years, we recommend counting the whole day. This will determine the Focal Point Ratio.

Focal Point Ratio = Total Visitation Count / Technology Count

After the focal has been determined, it is simple to gather visitation data. Each day DCR can use the number provided by the technology at the focal point and multiply that by the ratio.

Daily Visitation = Count Generated by Technology x Focal Point Ratio

5.6. Recommendation for Dispersed Vehicular Access

The team recommends that the 27 parks that are DVA/DPA should use the method recommended for DPA. For the 3 parks that are DVA/CPA, DCR should use the method recommended for CPA.

For the three parks that are pure DVA, we recommend using an attendance formula to estimate visitation data. Each day a staff member will make a spot count of the number of vehicles in the park. This number will then be plugged into the following formula:

Daily Visitation = Spot Count x Person-Per-Vehicle x Turnover Rate

Person-Per-Vehicle Multiplier.

We recommend that DCR take a sample once a day for a week in each season. For this time, the dispersed vehicular access settings should conduct spot counts of the visitors in the park and divide by a spot count of vehicles in the park. Doing this for a week will provide DCR with a fairly accurate average for each season at each park. This process should be completed at least once every 5 years.

Alternatively, DCR could devote a day at each park to determine the person-per-vehicle multiplier for each individual park. For dispersed vehicular parks, a count of the total number of visitors should be made divided by the total number of vehicles throughout the day. This method will provide a multiplier for each season. The process should be completed at least once every 5 years.

Turnover Rate

In order to determine the turnover rate, we recommend a survey be taken at each park that requires a turnover rate, for a whole day. The survey should ask the visitors how long they stay at each park. When the survey is completed, take the hours the park is open and divide by the average amount of time a visitor stays at a park to determine the turnover rate. This process should be done at least once every 5 years, employing the formula:

Turnover Rate = Hours of Operation / Average Visitation Time.

Note: The survey can also be structured to gather such additional information that a particular park may want, such as visitor demographics.

Glossary of Acronyms

DCR: Department of Conservation and Recreation of Massachusetts
NPS: National Parks Service
CVA: Controlled Vehicular Access
DVA: Dispersed Vehicular Access
CPA: Controlled Pedestrian Access
DPA: Dispersed Pedestrian Access

References

About.com (2011). National and State Parks. "National Parks - A Brief History." Retrieved April 2011, from http://usparks.about.com/library/weekly/aa012598.htm

Alberta Tourism, Parks Division (2006) Visitation Statistics Retrieved From http://www.albertaparks.ca/pubsandmedia/ Annual Report0506.pdf

Arnberger, A., Haider, W., & Brandenburg, C. (2005). Evaluating visitor-monitoring techniques: A comparison of counting and video observation data. *Environmental Management, 36*(2), 317-327.

Barbara Sinotte. *New England parks guide* Hunter Publishing Incorporated.

Beaman, J., & Stanley, D. (1996). Counting visitors at national parks: Concepts and issues. *Parks Canada, Socioeconomic Branch.in: Benchmarking and Best Practice for National Parks and Protected Areas: National Data Standards on Protected Areas Visitation, Appendix, 8.*

Bushman, C. (2007). *Attendance Reporting Procedures*. Department of Natural Resources Maryland Park Service.

Central Park Conservancy Project Team, (2011, April) Report on the Public Use of Central Park. Retrieved From http://www.centralparknyc.org/assets/pdfs/surveyreport_april2011.pdf

Cessford, G., & Muhar, A. (2003). Monitoring options for visitor numbers in national parks and natural areas. *Journal for Nature Conservation, 11*(4), 240-250.Retrieved March 20th , 2011, from http://www.urbanfisher.de/journals/jnc.

Clemen, R.T. (1996) *Making Hard Decisions: An Introduction to Decision Making Analysis.* Pacific Grove California: Duxbury Press

Colorado State University. (2011). *Writing guide: Survey research.* Retrieved April 16, 2011, from http://writing.colostate.edu/guides/research/survey/

DCR. (2011). *Department of conservation and Recreation*. Retrieved March 22nd, 2011 from http://www.mass.gov/dcr

Department of Natural Resources Maryland Park Services (2007, March 11) Attendance Reporting Procedures Retrieved From http://www.dnr.state.md.us/publiclands/prbminutes.asp

Diamond Traffic Products. (2011). *Inductive Loop Counters.* Retrieved September 15, 2011, from https://www.diamondtraffic.com/productlist/150

Diamond Traffic Products. (2011). *Piezo Axle Classifiers.* Retrieved September 15, 2011, from https://www.diamondtraffic.com/productlist/94

Fay, G., Colt, S., White, E. M., & Pacific Northwest Research Station (Portland, Or.). (2010). *Data survey and sampling procedures to quantify recreation use of national forests in Alaska.* Location: US Dept. of Agriculture, Forest Service, Pacific Northwest Research Station.

Geolytics Inc. (2000). *Demographic Data*. Retrieved April 25, 2011, from http://www.geolytics.com/resources/demographic-data.html

Google Maps. (2011). [Belle Isle Marsh Reservation, Boston, Massachusetts] [Satellite] Retrieved from http://maps.google.com/maps?hl=en&tab=wl

Google Maps. (2011). [Blackstone River and Canal Heritage State Park, Uxbridge, Massachusetts] [Satellite] Retrieved from http://maps.google.com/maps?hl=en&tab=wl

Google Maps. (2011). [Pleasure Bay, Boston, Massachusetts] [Satellite] Retrieved from http://maps.google.com/maps?hl=en&tab=wl

Green Space. (2010). *Visitor Monitoring Guide*. Retrieved September 20, 2011, from http://www.green-space.org.uk/downloads/greenSTAT/visitor_monitoring_guide.pdf

Hadwen, W. L., Hill, W., & Pickering, C. M. (2007). Icons under threat: Why monitoring visitors and their ecological impacts in protected areas matters. *Ecological Management & Restoration, 8*(3), 177-181.

Harnik P.,Kimball A.(2004, October 24)If They Don't Count You Don't Count. Retrieved from http://www.sandiego.gov/park-and-recreation/pdf/bptf/9.harnickpeterandkimballamy-ifyoudontcount.pdf

Kaczynski, A. T., Crompton, J. L., & Emerson, J. E. (2003). Programs that work: A procedure for improving the accuracy of visitor counts at state parks. *Journal of Park and Recreation Administration, 21*(3), 140-151. Retrieved March 20th, 2011, from http://www.rpts.tamu.edu/Faculty/Crompton/Crompton/Articles/3.2.pdf

Landrum, N. C. *The state park movement in America: A critical review.* University of Missouri Press.

Metropolitan Council (2011,April) Annual Use Estimate of the Metropolitan Regional Parks System for 2009.Retrived Fromhttp://www.metrocouncil.org/planning/parks/ParksUse Estimate2009.pdf

Mitchell, J. G. (2005 March). Fredrick Law Olmsted. National Geographic Magazine. Retrieved April 5th, 2011 from http://ngm.nationalgeographic.com/ngm/0503/feature2/fulltext.html#top

Muhar, A., Arnberger, A., & Brandenburg, C. (2002). Methods for visitor monitoring in recreational and protected areas: An overview. *Monitoring and Management of Visitor*

Flows in Recreational and Protected Areas. Institute for Landscape Architecture & Landscape Management Bodenkultur University Vienna, 2001, 1-6.

National Parks Service (2010, October). NPS Overview. Retrieved April 16, 2011, from http://www.nps.gov/news/loader.cfm?csModule=security/getfile&PageID=387483

National Parks Service, (n.d.) NPS Stats. Retrieved from http://www.nature.nps.gov/stats/

National Recreation and Park Association (2009, September 22) Summary Report and White Paper. Retrieved From http://www.nrpa.org/uploadedFiles/Get_Involved/Issue_Resource_Center /UPS-WhitePaper-FNL2-Web.pdf

Network, S. A., & Fay, G. (2007). Southwest Alaska network long-term visitor use monitoring protocol development final report.

Pennsylvania State Parks ( )Economic Impact

Ross, J., & Zealand, N. (2005). *Visitor counters in parks: Management practice for counter calibration* Dept. of Conservation.

Rupf-Haller, R., Wernli, M., & Filli, F. (2006). Visitor counting with acoustic slab sensors in the Swiss national park. *Exploring the Nature of Management*, 72.

Tilden, F. (1962). *The state parks: Their meaning in American life*. New York: Knopf.

United States Department of the Interior. (2010, July). *Rocky Mountain National Park Visitor Study*. Retrieved April 25, 2011, from University of Idaho website: http://www.psu.uidaho.edu/files/vsp/questionnaires/235.1_ROMO_Q.pdf

United States Department of the Interior. (2010, June). *George Washington Carver National Monument Visitor Study*. Retrieved April 25, 2011, from University of Idaho website: http://www.psu.uidaho.edu/files/vsp/questionnaires/229_GWCA_Q.pdf

United States National Park Service. *Parks for America; a Survey of Park and Related Resources in the Fifty States and a Preliminary Plan*. Washington, DC: U.S. Govt. Print. Off.

University of Texas. (1999). *Survey methods.* Retrieved April 16, 2011, from ischool website: http://www.ischool.utexas.edu/~palmquis/courses/survey.html

Vehicle Counters. (2011). *Portable Automatic Vehicle Counters*. Retrieved September 20, 2011 from http://www.vehiclecounters.com/database/index.php?type=counters

WPI. (2011). *The Interactive Qualifying Project (IQP).* Retrieved April 16, 2011, from http://www.wpi.edu/academics/catalogs/ugrad/iqp.html

Appendix A - Interview Questions for Gary Briere

Gary Briere is the Recreation Bureau Chief for DCR and was a liaison for this project. He is highly knowledgeable about the parks. Here are the questions that the team asked him at the beginning of the project.

1. Are there any particular parks that you are concerned with the data collection?
2. What parks would you suggest to go to? (Needs the most focus)
3. Do you have any attendance collection technology in place?
4. Are there any technologies that you are interested in?
5. What is the accuracy level you would like to reach with this project?
6. What is the collected Data going to be used for?
7. Who else do you recommend we talk to?

Appendix B – Interview Protocol for DCR Park Supervisors

We are here today conducting this interview because we would like information for our Interactive Qualifying Project, also known as IQP. The goal of our IQP is to propose to the Massachusetts Department of Conservation and Recreation (DCR) new methods for collecting attendance data for their parks. With the outcomes from this project, DCR should be able to assess each individual park's needs. However, in order to come up with the best possible methods, we would like some more information about your park and attendance collection method used.

Park Information

How many staff do you have at your park in regards to full-time, part-time, and seasonal?

What are the main duties of your staff?

Attendance Collection

How do you track attendance at your park?

If attendance collection is revenue based:

Do you count season pass holders as well?

How do you track attendance in the off season?

If attendance collection is formula based:

When was the last time it was updated?

Do you use a turnover rate?

What is your car factor when plugging into the attendance formula?

How accurate do you believe your count is? (Scale 1-10)

What would be your ideal method of counting attendance at your park?

How would more accurate information assist you in the administration of your park?

Conclusion

Is there anything else you would like to add?

Thank you for your time.

Appendix C – Cover Letter for Survey of State Parks Nationwide

To Park and Recreation Facility Managers,

We are students from Worcester Polytechnic Institute conducting research for the Massachusetts Department of Conservation and Recreation. In response to the lack of accurate visitor attendance data at Massachusetts state parks, we are researching effective types of facility attendance tracking systems and technologies used in recreation settings nationwide. The survey will take between 5 and 10 minutes to complete, and we are happy to share our findings with you. Please feel free to distribute this e-mail to a knowledgeable agency administrator.

Massachusetts has a diverse state park system. As the steward of more than 450,000 acres, the state park system offers facilities ranging from forest environments featuring camping, trail activities and boating, to urban environments with ball fields, swimming pools and walking paths. Though its current attendance tracking systems are limited and dated, the agency estimates that more than 30 million people visit these public lands each year.

The goal of this research is to identify attendance tracking systems that have proven efficient and effective in four common access settings typically found in recreation areas in order to revamp Massachusetts' attendance system. These four settings are:

- Controlled Vehicular Access
    - Gated entrances for vehicles, single access roads, or a single large parking lot where an accurate count can be made if the staff or technology is available.
    - Examples: A gated parking lot at an ocean beach or swimming area.
- Dispersed Vehicular Access
    - Multiple access points for vehicles to enter or exit, or multiple parking lots. Not all of these access points are gated or staffed.

- Examples: Multiple, small trail head parking lots providing access to an extensive trail system.

- Controlled Pedestrian Access
    - Gated entrances for pedestrians or some other single path that can easily be used for attendance collection.
    - Examples: A ticketed park such as a zoo, swimming pool or amusement park.
- Dispersed Pedestrian Access
    - Walk-in access that is unrestricted, with multiple to infinite entrance points.
    - Examples: Washington D.C.'s National Mall, New York's Central Park

We expect that you will find one or more of these access settings in your system or facility. Please follow the link below to complete a short survey on your current attendance tracking systems. If you have any power points or reports on your attendance collection efforts, we would greatly appreciate if you could forward them to us via e-mail. Please complete the survey by **Tuesday, September 27, 2011.**

https://www.surveymonkey.com/s/visitation

We appreciate your assistance and would be happy to share the results of our research with you. If you have any additional questions or if you would like a copy of our final report, you can e-mail us at dcr@wpi.edu.

Thank you for your time,

Nancy Bezies
Bryce Calvetti
Matthew Poppa
dcr@wpi.edu

Appendix D – Survey of State Parks Nationwide

Attendance Collection Analysis

Please complete the survey providing as much detail as possible. It would be most helpful if the answers are focused on the whole organization rather than individual parks or facilities.

If you have any additional information beyond this survey or have any questions or concerns, please feel free to e-mail the research team at dcr@wpi.edu.

Any personal or contact information received through this survey will not be released without express permission from the individual.

***1. Please enter the name of your organization.**

2. How many park and recreation areas are there in your organization's system?

- Less than 50
- 50-100
- 101-150
- 151-200
- More than 200

3. Approximately how many visitors attend your park and recreation areas in a year?

- Less than 1,000,000
- 1,000,000-10,000,000
- 10,000,000-30,000,000
- 30,000,000-50,000,000
- More than 50,000,000

4. What methods does your organization currently use for Controlled Vehicular Access? Select all that apply.

Description:
Gated entrances for vehicles, single access roads, or a single large parking lot where an accurate count can be made if the staff or technology is available.

Examples: A gated parking lot at an ocean beach or swimming area.

- [ ] Attendance Formula
- [ ] Human Count
- [ ] Inductive Loop Counter
- [ ] Infrared Sensor
- [ ] Pressure Sensor
- [ ] Ticket Sales
- [ ] None
- [ ] Other

If other please explain:

5. What methods does your organization currently use for Dispersed Vehicular Access? Select all that apply.

Description:
Multiple access points for vehicles to enter or exit, or multiple parking lots. Not all of these access points are gated or staffed.

Examples: Multiple, small trail head parking lots providing access to an extensive trail system.

- [ ] Attendance Formula
- [ ] Human Count
- [ ] Inductive Loop Counter
- [ ] Infrared Sensor
- [ ] Pressure Sensor
- [ ] Ticket Sales
- [ ] None
- [ ] Other

If other please explain:

Attendance Collection Analysis

6. What methods does your organization currently use for Controlled Pedestrian Access? Select all that apply.

Description:
Gated entrances for pedestrians or some other single path that can easily be used for attendance collection.

Examples: Ticketed park such as a zoo, swimming pool or amusement park.

- [ ] Attendance Formula
- [ ] Human Count
- [ ] Infrared Sensor
- [ ] Motion Sensor
- [ ] Ticket Sale
- [ ] Turnstile
- [ ] Video Surveillance
- [ ] None
- [ ] Other

If other please explain:

7. What methods does your organization currently use for Dispersed Pedestrian Access? Select all that apply.

Description:
Walk-in access that is unrestricted, with multiple to infinite entrance points.

Examples: Washington D.C.'s National Mall, New York's Central Park

- [ ] Attendance Formula
- [ ] Human Count
- [ ] Infrared Sensor
- [ ] Motion Sensor
- [ ] Ticket Sale
- [ ] Turnstile
- [ ] Video Surveillance
- [ ] None
- [ ] Other

If other please explain:

8. On a scale of 1-5, rate the accuracy of your collection methods for each category. (5 being highly accurate in numbers, 1 being not accurate at all)

	N/A	1	2	3	4	5
Controlled Vehicular Access	○	○	○	○	○	○
Dispersed Vehicular Access	○	○	○	○	○	○
Controlled Pedestrian Access	○	○	○	○	○	○
Dispersed Pedestrian Access	○	○	○	○	○	○

9. How frequently do your parks collect attendance data in each of the four categories?

	Daily	Weekly	Monthly	Quarterly	Semi-Annually	Yearly	Never
Controlled Vehicular Access	○	○	○	○	○	○	○
Dispersed Vehicular Access	○	○	○	○	○	○	○
Controlled Pedestrian Access	○	○	○	○	○	○	○
Dispersed Pedestrian Access	○	○	○	○	○	○	○

10. When was the last time your attendance collection methodologies were updated?

- ○ Before 1990
- ○ 1990-1995
- ○ 1996-2000
- ○ 2001-2005
- ○ 2006-Present

11. Have you looked into applying new attendance collection methods into your organization?

- ○ Yes
- ○ No

If yes please explain:

12. What does your organization use the collected attendance data for? Select all that apply.

- ☐ Advocacy
- ☐ Budgeting
- ☐ Building Constituency
- ☐ Capital Investments
- ☐ Event Scheduling
- ☐ Performance Information
- ☐ Staff Allocation
- ☐ None
- ☐ Other

If other please explain:

13. Please provide any additional information that you feel may be beneficial to our study of attendance tracking at recreational settings.

Thank you for your time.

If you would like to review any of your answers before submittal please do so now.

If you have any questions or concerns, or wish to e-mail us with any additional information, such as publications about your attendance collection methodologies, please feel free to contact us at dcr@wpi.edu.

Appendix E – Interview Protocol for Other Park Agencies

We are here today conducting this interview because we would like information for our Interactive Qualifying Project, also known as IQP. The goal of our IQP is to propose to the Massachusetts Department of Conservation and Recreation (DCR) new methods for collecting attendance data for their parks. With the outcomes from this project, DCR should be able to assess each individual park's needs. However, in order to come up with the best possible methods, we would like some more information about your system and attendance collection method used.

1. What methods does your system currently use to capture attendance data?
2. When was the last time your policy was updated?
3. What do you use the attendance data for?
4. Would better attendance figures help you?
5. What new technologies have you looked into implementing?

Thank you for your time.

Appendix F – E-Mail to Technology Companies

Dear [COMPANY NAME] Representative,

The Massachusetts Department of Conservation and Recreation (DCR) is steward of one of the largest state parks systems in the country. Its 450,000 acres are made up of forests, parks, greenways, historic sites and landscapes, seashores, lakes, ponds, reservoirs and watersheds. Though our current attendance tracking systems are limited, the agency estimates that more than 30 million people visit these public lands each year.

The DCR is currently looking into updating methods of visitor attendance collection at its parks and recreational areas. We are particularly interested in making sure that technology is both accurate and cost effective. We have looked into the products manufactured by your company and would like to receive some more information.

Some of your products in particular that we are interested in are:

[INCLUDE A LIST HERE]

Please respond with some estimated prices of your products. If possible, it would be helpful if the prices could be broken down into unit price, software price, installation price, and cost of future maintenance for each product listed.

We appreciate any help you can provide us with.

Thank you,

Matthew Poppa
Department of Conservation and Recreation
Human Resources Office
251 Causeway Street, 6th Floor
Boston, MA 02114
matthew.poppa@state.ma.us

Appendix G – Interview Protocol for Technology Companies

1. Please explain a little bit more about each of your technologies.
2. What is the lifetime of your products?
    a. How long does each product survive for before needed to be replaced?
3. What are the maintenance costs?
4. What is the typical battery life?
5. What are the installation costs?
6. Will the DCR staff members need training to operate the product?
7. How does information get to a computer or such?
8. Is the software free?

Appendix H – List of Mean-Objectives for Method Analysis

Cost

Capital Investment

Score	Outcome
1	> 3000 Dollars
2	2001 to 3000 Dollars
3	1001 to 2000 Dollars
4	501 to 1000 Dollars
5	0 to 500 Dollars

Operational Cost

Score	Outcome
1	>300 Dollars
2	225 to 299 Dollars
3	150 to 224 Dollars
4	75 to 149 Dollars
5	0 to 74 Dollars

Accuracy

Sampling Frequency

Score	Outcome
1	Less than 12 times a year
2	Monthly
3	1 to 7 times a week
4	Several times a day
5	Continuous

Weather and other environmental factors

Score	If
1	Highly affected
2	Somewhat affected
3	Not Affected

Multiplier

Score	If
1	Multiplier required
2	Not Required

Reliability

Lifetime

Score	Outcome
1	One year or less
2	1 to 4 years
3	5 to 7 years
4	8 to 9 years
5	10 years or more

Simplicity

Score	Outcome
1	Extensive Training Required
2	
3	Additional Training Required
4	
5	No Training Required

Appendix I – Interview Notes with Gary Briere

Meeting with Gary Briere and Johanna Zabriskie

At the Department of Conservation and Recreation, 11 AM on 8/31/11

In Attendance: Nancy Bezies, Gary Briere, Bryce Calvetti, Matthew Poppa, Johanna Zabriskie

The first point of order for the meeting was to catch Gary Briere, the Recreation Bureau Chief, up on what our intended methodology was. The first part of our methodology was to conduct an interview with Gary (See Appendix C for Interview Protocol). The group then intends to categorize similar parks, using the best method of categorizing possible. With this information we can determine how to best suit a park for attendance collection, thus allowing all the parks in that category to have similar results with our recommendations. We then would like to continue our research on different methods of attendance collection and try and fit these methods into the different categories. Visiting some of the parks to see the flow of public traffic and talk with park directors will help us to see what type of formula or technological piece of equipment could help out each park. The team would then like to come up with different proposals for each category and come up with a cost-benefit analysis of each proposal for DCR.

Gary Briere had seen the meeting itinerary and the interview protocol, so he jumped right into discussion of our questions, starting with the categories. Categories for parks in DCR suggested by Gary are controlled vehicular access, dispersed vehicular access, controlled pedestrian access, and dispersed pedestrian access. These four parks categories of parks cover about 90%-95% of how parks in Massachusetts are accessed. Most are hybrids between these four categories, for example, controlled vehicular and dispersed pedestrian.

Controlled vehicular access is where there are gated entrances for vehicles or a single large parking lot, where a clear count can be made if the staff or technology is available. It does

not necessarily have to be gated, there may only be a single access road to the park, which could also be controlled if some sort of technology was used to count the cars using it. Some examples of this category in the Greater Boston Area are Douglass State Forest, Horse Neck Beach, and Nantasket Beach.

Dispersed vehicular access is the category of parks that have multiple access points for vehicles to enter or exit, or there are multiple parking lots. Not all of these access points are gated or staffed so there is no clear cut way to gather attendance. An example of this category in the Greater Boston Area is Blue Hills.

Controlled pedestrian access is a category of parks that have either a gated entrance for pedestrians or some other single path that can easily be accounted for attendance collection. Most of these types of parks are facilities, in example, swimming pools or hockey rinks. Some examples of this category in the Greater Boston Area are Chelsea Swimming Pool and Cass Pool.

Dispersed Pedestrian Access is the category of parks that have walk-in access that is not gated or restricted. Meaning there may be multiple to infinite access points. Some examples of this category in the Greater Boston Area are Revere Beach, Esplanade, and Boston Commons. Some national examples could be the National Mall (Such as Washington Monument, Lincoln Memorial, etc.), Central Park, and Battery Park.

Most attendance estimates that DCR knows of are through staff, technology, and revenue. Staff can be useful but is limited during off seasons. Technology can have its flaws on the field, especially get expensive. However, we should look into the technological aspects, considering it is the next generation of items. Examples we can reference are Fast Lanes on the highway (Good for monitoring Controlled Vehicular Access) or Charlie Cards (Which are good for monitoring

Controlled Pedestrian Access). Charlie cards could be useful with the season pass holders, because if they swipe, DCR will know who is in the park. Currently most parks in DCR do nothing in regards to attendance with their season pass holders unless someone is buying a pass at that park. Revenue is a good check of attendance but is not a good yearly approach; this is because DCR does not charge on off season or season pass holders who can use their pass anywhere.

DCR wants us to focus on finding what other states are doing for each of these categories. The end result should not be a proposal for each individual park, but the best results for each category by other state or national parks. DCR can provide us with e-mail contacts to all the other state and national directors. Priscilla has a closer connection with these directors, so having her send the final e-mail will be our best option for optimal results.

The group should come up with an e-mail to contact every state director to see what they do for attendance collection at their parks. Contents of this e-mail should contain an introduction of who we are, who we are working for, and the information that we are researching. Then come up with a questionnaire that will be concise and give us the information we need from the various other states. It was suggested that we may be able to use survey monkey for the questionnaire.

Some examples for the questionnaire could be; do you have any parks like this? (Give an example of our park and maybe a similar better known park like Central Park or the Washington Mall.) What type of attendance approach do you have for these categories? Have an open ended question on how they measure/calculate attendance and other data. Also, another question to keep in mind is how often they collect this data (daily/weekly/monthly/yearly). Then for curiosity of the methods they use, what do they use the data they collect for? We should offer to

send them a copy of our research at the end; this may cause them to be more willing to put the effort into it if they learn about what each of the other states are doing. (Massachusetts cannot be the only place that would like this information.)

Appendix J – Rural Parks Interview and Field Trip Notes

Field Meeting -May 13th 2011

Attendance: Andy Backman, Nancy Bezies, Gary Briere, Bryce Calvetti, Nathaniel Tipton, Johanna Zabriskie

The goal of the meeting is to discuss current attendance count systems in the four different parks, regatta point, Douglass forest, Blackstone Heritage Park and Purgatory Chasm. First we discussed a few general tools and situations that can be found throughout DCR.

Most DCR parks with parking lots use a car factor to find an estimated head count. The car factor is the average of people per car, this factor is custom for every park. This can be found by counting every single car as they enter the park and counting the number of people in every car then finding the average number of people per car. For most DCR parks this count has not been found since the 70's. In addition they do not change this factor with the season despite the fact that visitation umbers change drastically with the seasons.

With over a hundred parks and recreation centers we must find the areas that DCR feels it needs the most help with. Prioritizing parks is something that could potentially be added to our methodology and could help us provide DCR with a most effective proposal for implementation.

From talking about prioritization we have discovered that such places as camping grounds do not require additional attention from the team. This is because when each area is rented out visitors are required to report the exact number of people staying. It is day use areas that bring the most uncertainty to DCR attendance counts. We have learned is that all counts for day use parks are "guess-estimates".

Quinsigamond- Regatta Point

Regatta point on Lake Quinsigamond is an urban recreation center; this location is rented throughout the year for its meeting rooms as well as its boat house for crew races. Because it does have a boat house the center is home to a sailing club, two rowing clubs and numerous summer programs. In additions in the summer it is used by many locals.

This park is mostly accessed by car, having not many people walking in. Because regatta point is located across the street from the U Mass Hospital many workers buy season passes to the park and use the center as a parking lot. This can make counts in accurate, and makes it more complicated to determine whether or not they are considered DCR customers.

The current attendance system used by the regatta point park manager is dependent on ticket sales and vehicular counts. Currently since the normal summer season has not yet begun the ticket sales are done thorough an automatic ticket booth which sells day passes, season passes and bus passes. A partial attendance count is taken from a daily report produced by the automated ticket booth, this report describes the number of each type of ticket sold the privies day.

Because this count does not take into account people who did not buy a day pass or have previously bought season passes the park manager also does and estimated automobile count three times a day. To produce a head count the manager uses a car factor of 2.2 people per car which was found in the 70's. Additional to normal daily use park manager make estimates for special event attendances such as visitors for crew regattas. The park manager does not receive an estimated count from event hosts but rather through his own experience and through collaboration with police. All estimated attendance is reported to headquarters on a weekly basis.

In addition to Regatta Point the same staff also oversees another park not so far away. The additional park has no permanent staff and no ticket booth therefore there is no efficient way to calculate the attendance to the additional small park.

Douglass Park

This is one of the largest forests operated by DCR; it is the intersection of two major long distance trails making it a popular destination. The focus area of the park is centered on the lake where there is a fishing area, many picnic tables, and is surrounded by parking areas. In addition to the main area there are a number of small trail heads throughout the forest.

The attendance factor used at Douglas is 3.4, which unlike most other parks is only two years old. They used to find the factor yearly but it could not be found last year due to lack of staffing. Most of the vehicular counts are done at a ticket booth, which is only open from Memorial Day to Labor Day. Managers use two record sheets to submit estimated attendance counts.

Because there is more parking at trail heads that do not require a ticket many frequent visitors use them instead throwing off the vehicular count. In addition to this there are other factors that reduce accuracy, one of them is that many visitors come in after ticket sales are closed and there is no staff on patrol. Additionally fishing areas are 24hr therefore there are visitors before and after the staff is working.

Blackstone River and Canal Heritage State Corridor

Blackstone has many different areas and exhibitions, in addition to long walking trails. For this reason it can be easily rented out for large events. The center has three main access roads, potentially making it a good candidate for pressure sensors. In addition to the use of a car factor of 2 the park manager uses a turnover rate. Meaning that most visitors will stay at the park

for 1hrs and then leave, and as one group leaves there is a replacement for that car soon after, allowing him to make more educated guesses. Also the park manager has discovered that the three main parking lots have on average similar to identical car counts at one time. With this park manager can estimate the total number of cars in the park fairly accurately, easily and fast.

Most visitors are local people retuning several times a week, because of this they have a strong volunteer system. We discussed using the volunteers to do a more thorough visitor count but the manager does not feel like he would receive an enthusiastic response from volunteers.

The park manager feels that the accuracy of his attendance collection is hurt because the total area that he must over look is about 20 miles with additional parking and can be easily accessed by walk-ins.

Purgatory Chasm State Reservation:

This park has two factors that would make it the perfect candidate for car pressure sensors, these factors are that it can only be reached through one main road and all visitors arrive by car (no walk ins). This park features a playground in addition to the hiking trails that pull in many visitors.

Because this park has no ticket sales it must depend on other methods to estimate visitation rates. Because there are only two possible parking lots park staff count cars and use a car factor of 3 to find a head count. Such counts are made on a daily basis, but producing these kinds of data becomes harder to determine in the off season.

Appendix K – Urban Parks Interview and Field Trip Notes

Field Trip September 2, 2011

Attendees: Nancy Bezies, Bryce Calvetti, Matthew Poppa, Germaine Vallely and Johanna Zabriskie

The goal of this trip was to visit parks with various categories of visitor access in order to further our understanding on the flow and transit of visitors. This research will help us to provide a more thorough and efficient recommendation to DCR.

Charles River Esplanade:

The Charles River Esplanade is an urban recreation center, spanning 3 miles. It contains athletic fields, jogging/biking/walking trail, 2 boat houses, a sailing house, 3 playgrounds and its main attraction, the Hatch Shell Theater. There are no main access points; all 9 pedestrian overpasses are equally popular yet they are not the only entrances to the park. Additionally there are no parking lots reserved for visitors of the park.

The park staff consists of 3 full time workers, 4 seasonal workers and 2 season life guards. This staffing group is about 5 people fewer than previous staffing levels. The full time staff is in charge of the upkeep and maintenance of the park. During the summer season they also must make preparations for summer special events. These events are weekly summer concerts and movies in addition to the big special events such as the Fourth of July celebration. The seasonal workers clean the park and all other duties given to them by the park supervisor. The life guards are in charge of safety on the waterfront.

The staff role in these events is to prepare the area in front of the Hatch Shell for the flood of visitors by adding gates, extra trash cans and helping set up sound systems that are required for the event. After the event, the staff must clean the park for the next morning.

Attendance for the park varies with each event. The summer concert series is normally attended by 8-12 thousand people per evening. The fourth of July, one of the biggest events held in the park, is attended by around half a million people. Other large events are Earth Fest in May and Mix Fest in September. This attendance is calculated through the experience of facility supervisors that know roughly how many visitors can fit in the different areas of the park. For bigger events the city police will help with the attendance estimations, they fly their helicopters over the event and make calculations by knowing the size of the park and how many people can fit in a certain area.

The staff does not have the capacity to make any real attendance counts for the daily use of the park, however, through experience they assure us that the parks gets at least a thousand visitors daily. This is assuming that the weather is nice. The staff informed us that the use of the jogging, biking, walking trails is rather intensive, and is further complemented by tourist and local visitors. The park is considered to be the busiest park in the system because of travel use, and because of the physical features of the park, attendance is nearly impossible to count. Further when asked if having better attendance records would make a difference in the administration and improvement of the park, the park supervisor responded that these numbers would do nothing to favor the park. His main goal is for people to feel safe whether it be 10 people or 10 thousand people.

It was clear that in such a big and popular park attendance records were not significant to administration. The team assumes that is because the popularity of the park is evident and there is no need to prove to officials or budget makers that there is any need. Further the staff feels that any resources or extra work would be spent providing better services.

Category: DISBURSED PEDESTRIAN

Artesani Park:

Artesani Park is a large recreation area that contains many walking trails, large grassy areas, multiple playgrounds and a children's pool. As for access points, most visitors come in vehicles and park in the main parking lot, yet during most summer days the parking lot overflows and many visitors park outside of DCR property. Also, the visitors using the Charles River bike path enter the park from either side along the trail.

The park is staffed by 1 park manager, 3 assistant park managers, 6 seasonal life guards and 1 summer worker (the summer workers have been reduced due to budget cuts, there are usually two). All staff members are dedicated to operational necessities of the park such as cleaning out trash cans and maintaining the grounds. Therefore there is no attendance count effort made, with the exception of the pool. Strict visitor counts are made in respect to pool visitors; this is because pool regulations require hourly pool data collection, one of the required sets of data is the head count. The head count is usually completed when they test the water for contaminants and other chemicals. In addition the staff must keep an accurate count because there is a capacity to the pool and on summer days this capacity can be easily reached.

When asked if they would find accurate attendance data helpful to the administration of the park they assured that it would not change or aid in their administration of the park. This is partly because administration runs smoothly as is and they do not have enough staff to complete any other administrative tasks that the attendance would change.

Category: *Pool*- Controlled Pedestrian

Park- Disbursed Pedestrian. Controlled Vehicle

Cass Recreation Center and Swimming Pool

This facility is divided in two parts, the recreation center and the pool, each with its own entrance. To use the recreation center, all patrons must be members (membership is free). The recreation center features an indoor arena and offers classes. The staffing at this facility is much more extensive than the other parks we have seen; on a busy day there are up to 13 DCR workers at the facility.

The attendance records for this facility are the best we have seen. The attendance at the rec. center is recorded thoroughly in four log books. Included in one of the four log books is a record of every visitor to the center and their reason for attendance, this even includes visitors who are there for inquiries. Because patrons are required to register before entering the rec. center, every single person is counted. Another log is recorded which only pertains to program attendance; this log requires program attendees to report what program they are attending. Further all program instructors must submit another log which describes the attendance and the demographics of the attendees. All logs are submitted to the front desk clerk at the end of the week where they are compiled to be filed weekly. The data collection system for this park is complex and the staff is confident that the accuracy of their data is close if not perfect.

The pool facility also maintains a log; although they do not require membership they do require every visitor to sign a log book and provide an emergency contact number. This is so that every person going in the pool is accounted for. In addition to the logbook there is a staff member who stands at the gate which leads from changing rooms to the pool maintaining a count; this is done to make sure that pool regulations are upheld. The staff feels that the attendance records of the pool are accurate yet not quite as thorough as those kept in the rec. center.

Category: CONTROLLED PEDESTRIAN

Castle Island/Fort Independence

Castle Island is located on a peninsula at the southern tip of Boston; because of this it has a restricted number of entrances. There is 1 vehicle entrance into parking lot and 1 walk-in entrance through a causeway. The park ranger describes both entrances as choke points because these two entrances are the only way to get to the park. These are perfect candidates for pressure sensors; in fact in the late 90's, Boston police placed pressure sensors at the parking lot gate to count the attendance for the season. The number of visitors found was 1.4 million. The Park Ranger believes that since that number was collected the numbers have increased to 2 million. He makes this assumption with the use of a formula he created. Knowing that there are about 500 parking spots between Castle Island and Carson Beach, he uses a car factor of 4 and a turnover rate of 3 or 4 hours, with a total of 15 hours park operation per day. Because the park runs at full capacity from Thursday to Sunday he can estimate the number of days and get a final count. This level of attendance to this park is only surpassed by the esplanade and that is only because of the big events at the esplanade. It is the second most visited park in the state for daily use, following Faneuil Hall.

Another way that the parks attendance could be counted is through the restaurant in the park, Sullivan's. The restaurant itself attracts many visitors to the park when it is in operation (March 1 to November 30th). Because many of the park visitors do visit Sullivan's, a secondary source of data could be obtained through their computer system. This source has not been used but it is possible.

Another attraction in the park is Fort Independence; this fort is part of the national registry of historical places. The fort association (volunteers) offers free tours on weekends but

during the week the fort is closed. The association keeps a record of attendance numbers which would be an additional source of information.

Category: Controlled Vehicular, Dispersed Pedestrian

Appendix L – Survey Results from State Parks Nationwide

2. How many park and recreation areas are there in your organization's system?

Answer Options	Response Percent	Response Count
Less than 50	55.0%	11
50-100	20.0%	4
101-150	15.0%	3
151-200	0.0%	0
More than 200	10.0%	2
answered question		20

3. Approximately how many visitors attend your park and recreation areas in a year?

Answer Options	Response Percent	Response Count
Less than 1,000,000	0.0%	0
1,000,000-10,000,000	65.0%	13
10,000,000-30,000,000	15.0%	3
30,000,000-50,000,000	15.0%	3
More than 50,000,000	5.0%	1
answered question		20

4. What methods does your organization currently use for Controlled Vehicular Access? Select all that apply. Description: Gated entrances for vehicles, single access roads, or a single large parking lot where an accurate count can be made if the staff or technology is available. Examples: A gated parking lot at an ocean beach or swimming area.

Answer Options	Response Percent	Response Count
Attendance Formula	50.0%	10
Human Count	20.0%	4
Inductive Loop Counter	40.0%	8
Infrared Sensor	15.0%	3
Pressure Sensor	20.0%	4
Ticket Sales	45.0%	9
None	10.0%	2
Other	10.0%	2
If other please explain:		3
	answered question	20

5. What methods does your organization currently use for Dispersed Vehicular Access? Select all that apply. Description: Multiple access points for vehicles to enter or exit, or multiple parking lots. Not all of these access points are gated or staffed. Examples: Multiple, small trail head parking lots providing access to an extensive trail system.

Answer Options	Response Percent	Response Count
Attendance Formula	55.0%	11
Human Count	15.0%	3
Inductive Loop Counter	35.0%	7
Infrared Sensor	15.0%	3
Pressure Sensor	20.0%	4
Ticket Sales	25.0%	5
None	15.0%	3
Other	10.0%	2
If other please explain:		5
	answered question	20

6. What methods does your organization currently use for Controlled Pedestrian Access? Select all that apply. Description: Gated entrances for pedestrians or some other single path that can easily be used for attendance collection. Examples: Ticketed park such as a zoo, swimming pool or amusement park.

Answer Options	Response Percent	Response Count
Attendance Formula	25.0%	5
Human Count	30.0%	6
Infrared Sensor	10.0%	2
Motion Sensor	0.0%	0
Ticket Sale	45.0%	9
Turnstile	15.0%	3
Video Surveillance	0.0%	0
None	25.0%	5
Other	5.0%	1
If other please explain:		1
	answered question	20

7. What methods does your organization currently use for Dispersed Pedestrian Access? Select all that apply. Description: Walk-in access that is unrestricted, with multiple to infinite entrance points. Examples: Washington D.C.'s National Mall, New York's Central Park

Answer Options	Response Percent	Response Count
Attendance Formula	30.0%	6
Human Count	15.0%	3
Infrared Sensor	5.0%	1
Motion Sensor	0.0%	0
Ticket Sale	5.0%	1
Turnstile	0.0%	0
Video Surveillance	0.0%	0
None	65.0%	13
Other	0.0%	0
If other please explain:		0
	answered question	20

8. On a scale of 1-5, rate the accuracy of your collection methods for each category. (5 being highly accurate in numbers, 1 being not accurate at all)

Answer Options	N/A	1	2	3	4	5	Response Count
Controlled Vehicular Access	2	1	2	7	4	4	20
Dispersed Vehicular Access	2	1	6	8	2	1	20
Controlled Pedestrian Access	5	0	2	1	3	9	20
Dispersed Pedestrian Access	8	4	3	3	2	0	20
			answered question				20

9. How frequently do your parks collect attendance data in each of the four categories?								
Answer Options	Daily	Weekly	Monthly	Quarterly	Semi-Annually	Yearly	Never	Response Count
Controlled Vehicular Access	5	2	10	0	0	1	1	19
Dispersed Vehicular Access	3	3	11	0	0	1	2	20
Controlled Pedestrian Access	7	1	7	0	0	1	4	20
Dispersed Pedestrian Access	1	1	6	0	0	1	9	18
						answered question		20

10. When was the last time your attendance collection methodologies were updated?		
Answer Options	Response Percent	Response Count
Before 1990	25.0%	5
1990-1995	15.0%	3
1996-2000	15.0%	3
2001-2005	30.0%	6
2006-Present	15.0%	3
	answered question	20

11. Have you looked into applying new attendance collection methods into your organization?		
Answer Options	**Response Percent**	**Response Count**
Yes	65.0%	13
No	35.0%	7
If yes please explain:		13
	answered question	**20**

12. What does your organization use the collected attendance data for? Select all that apply.		
Answer Options	**Response Percent**	**Response Count**
Advocacy	75.0%	15
Budgeting	70.0%	14
Building Constituency	35.0%	7
Capital Investments	45.0%	9
Event Scheduling	35.0%	7
Performance Information	70.0%	14
Staff Allocation	45.0%	9
None	0.0%	0
Other	10.0%	2
If other please explain:		2
	answered question	**20**

Appendix M – Interview with New York State Parks

Interview with Peter Finn (New York State Office Deputy Commissioner of Finance and Administrations of Parks, Recreation and Historic Preservation)

September 22nd, 2011

Attendance: Nancy Bezies, Gary Briere, Bryce Calvetti, Peter Finn, Priscilla Geigis, Matthew Poppa

1. To begin we would like to start with you telling us about your methodologies.

New York has many methods which depend on each individual park. When parks are staffed they would use fees as well as a car count, and multiplier, to estimate attendance. The multiplier was determined by a field survey which has not been recalculated in possibly 10 years. Pete mentioned that it would be too time intensive to redo the field survey for the multiplier. At parks with a single gate or parking lot they use an eyeball count of the number of cars in the parking lot.

2. When was the last time your policy was updated?

In 1999 they redeveloped their entire reporting system by splitting the parks into different categories. The example Pete gave was under a category of Golf you might have 9-hole, 18-hole, and senior passes, giving a number for those in their own categories as well. In the past the parks would each have to fill out paperwork for attendance once per week, but now they have an online form that the parks fill out every day. He told us that when it was done weekly it was possible that some parks worked backwards for the attendance, or in other words they would estimate how many people came that week and just make up numbers for the actual days of the week that summed up to the attendance for the entire week.

3. What do you use the attendance data for?

Pete said that he is not too worried about their attendance data being estimates because their main focus for it is to see if the attendance is going up or down, and this can be done with only estimates. They use this trend analysis of attendance for budgeting and performance. 15 years ago they did a study where fees had not changed, this way they could analyze the fees and revenue. They were able to obtain data based on bad years verses good years, weather, and more factors.

4. Would better attendance figures help you?

Pete explained to us that accurate attendance figures would definitely be helpful. His biggest reason and concern for this was that it would be able to count people who sneak into the park without paying and also people with free passes; senior and disabled passes. At parks without someone to check for cars that do not have passes, some people may not be paying. With an accurate count of attendance and a count from the revenue they would be able to figure out how many people are getting in for free or sneak in.

5. What new technologies have you looked into implementing?

There are two types of technologies we discussed with Pete. The first was tablets that could use a program for inputting attendance data and sending remotely, or could include a credit card reader for buying tickets on site. Another technology was a window sticker with a barcode. The barcode would hold a unique record of valid entry and possibly demographic data that could tell the park system a little about their visitors, such as how many repeat visitors they have. He also mentioned that at the moment with the financial crisis they cannot afford to spend money on technologies, and that the technologies would make the data more accurate but would take more time, making collection less efficient.

Appendix N – Interview with DCR Camping Program Coordinator

Interview with Anita Wysocki (Camping Program Coordinator)

October 3, 2011

Attendance: Nancy Bezies, Bryce Calvetti, Matthew Poppa

1. Could you explain the system DCR uses for camp site reservation?

   DCR first started using Reserve America in 1999; this system was slow and had many errors. Because the site was not real time it often double booked. In 2000 they again updated it but the same problems arose. In 2006/2007 they revamped the system and made it real time. Because both the visitor and the staff member can use the site with only a 15 minute lag there is less miscommunication, further in order to prevent double booking if a potential visitor is looking at a camp site the software will reserve that site for 15 and will not allow any other visitor to book it.

   The software gives a list of the people that will be coming in; it also allows the DCR to contact people if necessary. For example, during tropical storm Irene, the DCR was able to contact campers and inform them that the park would be closed and their reservations would be cancelled.

2. Tell us about how DCR uses the data from the site for management purposes.

Currently Wysocki is looking at the use of different park sites throughout the season in order to decide the dates of operation for the next season. In past years we have decided from the data to only open parks during weekends or to open the camp ground for additional days. But the data that is produced is not nearly as informative as complaint calls. From these calls Wysocki is able to see what parks need to update their buildings or which are running at maximum capacity.

Appendix O – Interview with Westerville, OH Park System

In interview with Jodi Stower (former director of the Westerville, OH Park System)

October 3, 2011

Attendance: Attendance: Nancy Bezies, Gary Briere, Bryce Calvetti, Priscilla Geigis, Matthew Poppa

1. What is your method for capturing visitor attendance?

Worked with different sports associations, using each leagues schedule they would calculate the number of players that would be attending each game, then using a multiplier of 1.5 they would calculate the total number of visitors at each game. That was the major calculation for attendance numbers that Stower had seen in Westerville. Although for fee parks they could keep a good count with the use of the number of tickets sold.

2. What did you use attendance data for?

Stower's former department used attendance data to find the net cost per visitor for different park and activities. With this information they could if necessary choose to decrease expenditures or increase revenue in order to lower the cost per visitor.

Stower recommended that the group talk to John Compton a now retired professor of Texas A&M; she believes he is one of the best people in the industry and has forward thinking.

Appendix P – Interview with Phoenix, Arizona Parks and Recreation

Interview with Kathy Reichert (Phoenix, Arizona Parks and Recreation, Deputy Director)
October 3rd, 2011
Attendance: Nancy Bezies, Gary Briere, Bryce Calvetti, Priscilla Geigis, Matthew Poppa, Kathy Reichert

1. What is your method for capturing public attendance?

Kathy said that Arizona Parks and Recreation uses vehicle counters at the major trail heads. The person-per-vehicle factor for these is 2.7 across the board because that is what the federal government was using. They are in the process of looking into pedestrian trail counters. In the past they used to do human counts in the parks.

2. How often do you collect the data from your park?

Arizona does not analyze the vehicle counter closely, however, the park rangers send in a log every day. The log is a snapshot of time, but it helps show trends of demographics. The log shows what type of groups the ranger talked to, whether they were families or friends, how many people were in the party, and more. Sometimes the log even includes information on whether dogs are or are not wearing a leash in the park; some of it is a lot of random information that could be useful when analyzed.

3. What do you use your attendance collection methods for?

Kathy explained that Arizona is using the information to analyze how many cars travel into a trail head so that they can potentially implement a fee to increase revenue. However, politics play an important role in proposing such a plan. Politics look into numbers so the attendance information and logs sent from the rangers are used to prove a point. If the point is proven it protects budgets and staffing. Demographics could potentially also help greatly with this advocacy.

Appendix Q – Interview with New Mexico State Parks Division

Interview with Steve Tafoya (New Mexico State Parks Division, Field Operations Bureau Chief)

September 29th, 2011

Attendance: Nancy Bezies, Gary Briere, Bryce Calvetti, Priscilla Geigis, Matthew Poppa, Steve Tafoya

1. What is your method for capturing public attendance?

33 out of 35 parks have pneumatic car counters, which are pressure tubes that count when a large weight rolls over the tubes. There is one per entrance to each park and some are decades old that get replaced when needed.

2. How often do you collect the data from the parks?

The data gets entered online weekly by using a software developed by their own IT. All the calculations are made and then the final number is entered online on a Sunday or Monday.

3. How do they calculate the attendance using the count from the pneumatic tubes?

For the calculations every park uses the same formula and multipliers. The formula takes into account average number of people per car and the average number of times the staff drive over the tubes themselves. One would divide the total count by two, to account for the two sets of wheels on a vehicle, giving the total number of vehicles, then multiply that number by the average number of people per car, and finally multiplying the total number of vehicles by the error rate from the staff and minus this number from the previous number. Each of the averages is different for each of the four seasons.

4. How long ago did you create the multipliers?

The multipliers were acquired from the National Park Services in 1970. Recently in 2002 and 2003 students from the University of New Mexico spent the two years to update the person

per vehicle averages through a study. The new averages were much lower than the old averages and were disregarded because they would rather use the larger averages. Without the larger averages they would not have as high attendance data.

5. What do you use the attendance data for?

The data is used to be compared month to month along with the monthly revenue. This analysis is relied heavily on for things such as budgeting and the basis for advocacy. With higher attendance the park system could be given more money for their budget.

6. What company do you acquire your technologies from?

They buy their technology through the Department of Transportation. Steve will be finding the name of the company and sending it to us in an email.

Appendix R – Categorizing DCR Parks into Access Settings

PARK			CVA	DVA	CPA	DVA	Camping	Extra Details	Multi-Category
Abigail Adams			1						1
Ames Nowell State Park				1		1			2
Appalachian Trail				1		1			2
Ashland State Park				1		1			2
Ashuwillticook Rail Trail				1		1			2
Bash Bish Falls State Park			1						1
Beartown State Forest						1			1
Beaver Brook			1			1			2
Belle Isle Marsh			1						1
Blackstone River and Canal Heritage SP			1			1			2
Blue Hills				1		1		Many parking lots but many trails leading to roads	2
Borderland State Park				1		1			2
Boston Harbor Islands				1		1		Are the islands accessible by boat or car?	2

Bradley Palmer State Park			1			1			2
Breakheart			1			1			2
Bristol Blake State Reservation				1		1		I can't see any entrances or anything at all like that on Google maps	2
Brook Farm			1						1
Callahan State Park			1			1			2
Cape Cod Rail Trail				1		1			2
Castle Island			1		1				2
Charles River				1		1			2
Chester-Blandford State Forest			1			1			2
Chestnut Hill Reservation				1		1			2
Chicopee State Park			1						1
Clarksburg State Park			1		1		1		2
Cochituate State Park			1		1			Swimming area	2
Connecticut River Greenway SP				1		1		huge river throughout MA	2

D.A.R. State Forest			1		1		1		2
Demarest Lloyd State Park				1		1			2
Dighton Rock State Park			1						1
Dorchester Shores				1		1		Along the beach from Neponset River to Castle Island	2
Douglas State Forest			1						1
Dubuque, Kenneth Memorial SF			1						1
Dunn State Park			1					parking fee (two entrances)	1
Ellisville Harbor State Park			1			1			2
Elm Bank			1						1
Erving State Forest			1				1	you have to drive on long pond	1
F. Gilbert Hills State Forest			1						1
Fall River Heritage State Park			1			1		main parking lot but people walk form diff areas	2
Federated Women's Club			1				1		1

SF									
Forefather's Monument						1			1
Fort Phoenix State Reservation			1			1			2
Fort Revere				1		1			2
Freetown-Fall River SF				1				several parking lots and paved roads going through	1
Gardner, C.M. State Park			1					fee during season	1
Gardner Heritage State Park					1			closed (in dunn state park)	1
Georgetown-Rowley SF			1						1
Granville State Forest			1				1	must enter through West Hartland	1
Great Brook Farm State Park			1		1				2
Halibut Point State Park			1			1			2
Hampton Ponds State Park				1		1			2
Harold Parker State Forest			1				1		1
Holyoke Heritage State			1		1			parking lot plus parking on street	2

Park									
Hopkinton State Park			1					reservations must be made	1
Horseneck Beach				1	1		1		2
Houghton's Pond Recreation Area			1		1			swimming area with massive parking lot	2
Jug End State Reserve. and Wildlife Mgmt.			1			1		also has camping spots (not mainly a campground though)	2
Lake Dennison Recreation Area			1			1	1		2
Lake Lorraine State Park					1			swimming area	1
Lake Wyola State Park				1		1		swimming area	2
Lawrence Heritage State Park				1		1		building	2
Leo J. Martin Golf Course					1			golf course	1
Leominster State Forest					1				1
Lowell-Dracut-Tyngsboro SF			1			1			2
Lynn Shore				1		1		fee parking	2
Manuel F.			1						1

Correllus SF									
Maudslay State Park				1		1			2
Melnea A. Cass Recreational Complex				1		1			2
Middlesex Fells					1				1
Mohawk Trail State Forest				1		1			2
Monroe State Forest			1		1				2
Moore State Park			1						1
Mt. Greylock State Reservation			1						1
Mt. Holyoke Range State Park			1					multiple parking lots	1
Mt. Sugarloaf State Reservation			1						1
Mt. Tom State Reservation			1						1
Mt. Washington State Forest			1				1		1
Myles Standish Monument SR				1		1			2

Myles Standish State Forest				1	1		1	seasonal	2
Nantasket Beach						1			1
Natural Bridge State Park			1					parking fee seasonal	1
Neponset River			1			1		in Pope John Paul II Park	2
Nickerson State Park				1	1		1		2
Norwottuck Rail Trail			1			1			2
October Mountain State Forest			1				1		1
Otter River State Forest			1				1		1
Pearl Hill State Park			1		1		1		2
Pilgrim Memorial State Park						1			1
Pittsfield State Forest			1						1
Ponkapoag Golf Course					1				1
Pope John Paul II Park			1			1			2
Purgatory Chasm			1						1

SR									
Quabbin Reservoir Watershed			1						1
Quincy Shores				1		1			2
Quinsigamond State Park			1						1
Revere Beach						1			1
Robinson State Park			1						1
Roxbury Heritage State Park			1			1			2
Rutland State Park			1						1
Salisbury Beach State Reservation				1		1			2
Sandisfield State Forest			1						1
Sandy Point State Reservation				1		1			2
Savoy Mountain State Forest			1		1				2
Schooner Ernestina					1				1

Scusset Beach State Reservation			1						1
Shawme-Crowell State Forest					1		1		1
Skinner State Park			1						1
South Cape Beach State Park			1						1
Southwest Corridor Park						1			1
Spencer State Forest			1						1
Squantum Point			1						1
Stodder's Neck			1						1
Stony Brook				1					1
Streeter Point Recreation Area			1		1				2
Tolland State Forest			1		1		1		2
Upton State Forest			1						1
Wachusett Mountain State Reservation			1						1
Wachusett			1						1

Reservoir Watershed									
Wahconah Falls State Park			1						1
Waquoit Bay National Estuarine Research Reserve			1			1	1		2
Watson Pond State Park			1						1
Webb Memorial			1			1			2
Wells State Park			1		1		1		2
Wendell State Forest			1						1
Western Gateway Heritage SP			1		1				2
Whitehall State Park			1						1
Willard Brook State Forest			1						1
Willowdale State Forest			1						1
Windsor State Forest			1						1
Winthrop Shore				1		1			2

Wompatuck State Park			1				1		1
Pleasure Bay, Carson Beach				1		1			
TOTALS	131		85	32	25	52	19	-	63

Table 5 - Categorization of DCR Parks

CATEGORY TOTALS		
Category	**# of Parks**	**%**
CVA /CPA	14	11%
CVA/DPA	19	15%
DVA/CPA	3	2%
DVA/DPA	27	21%
CVA	51	39%
DVA	3	2%
CPA	8	6%
DPA	6	5%

Basic Categories		
Category	**# of parks**	**%**
CVA	85	65%
DVA	33	25%
CPA	25	19%
DPA	52	40%

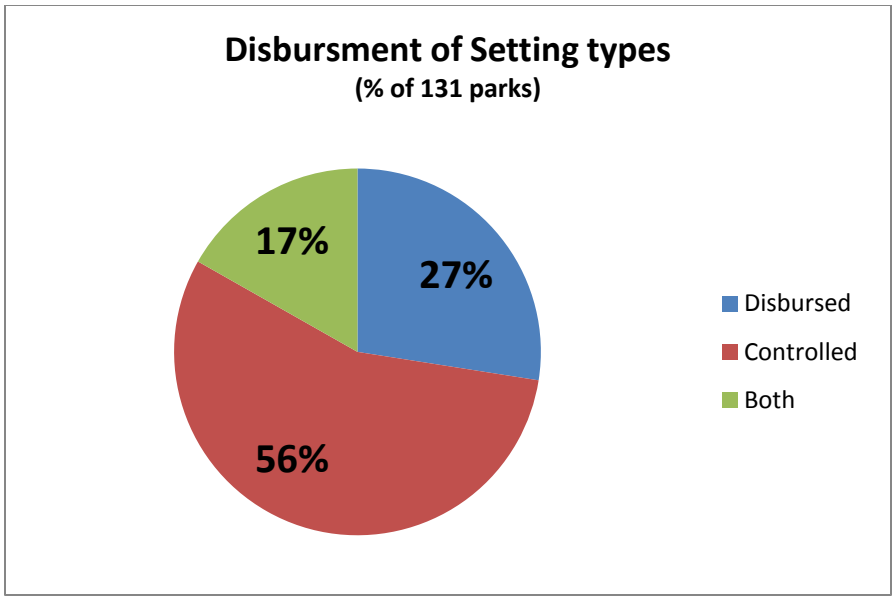
parks belong to

48% more than one

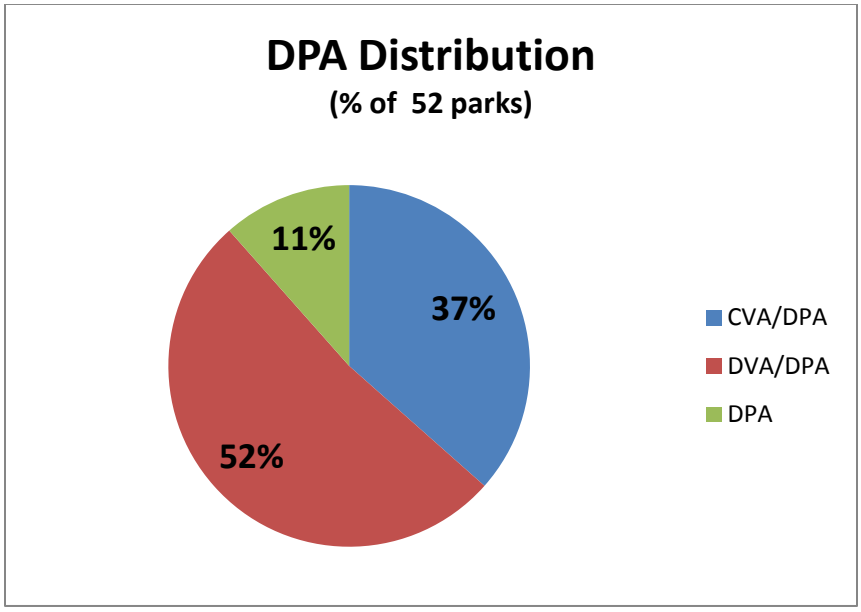
category

Disbursed	36	27%
Controlled	73	56%
Both	22	17%

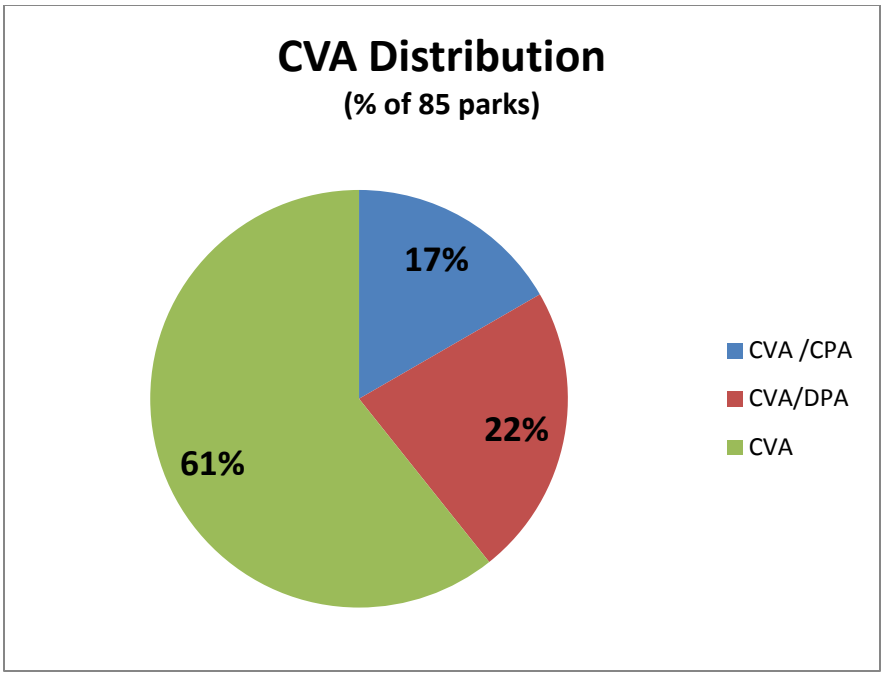
Table 6 - Category Totals



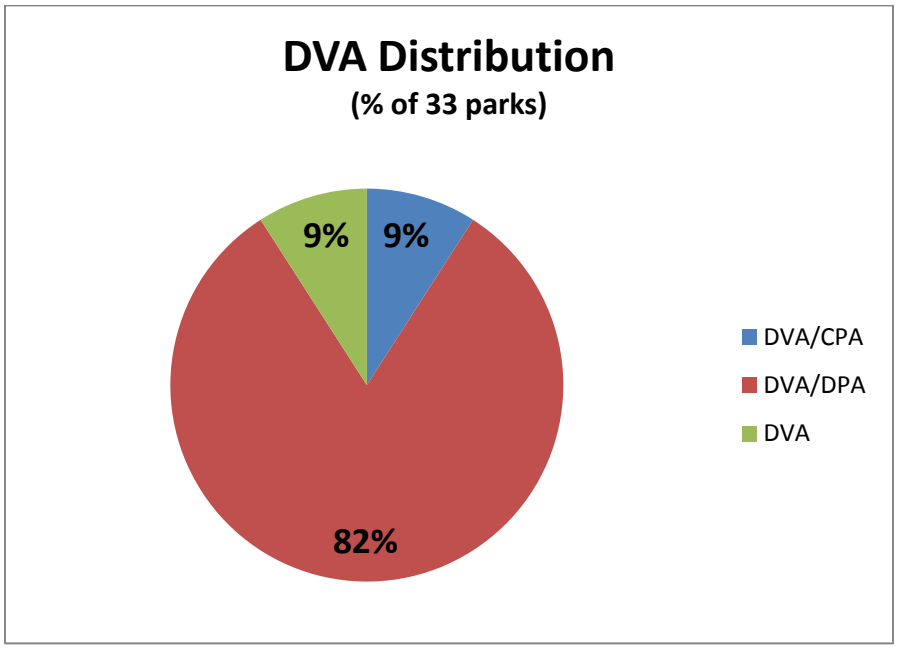
Graph 3 - Disbursment of Setting Types



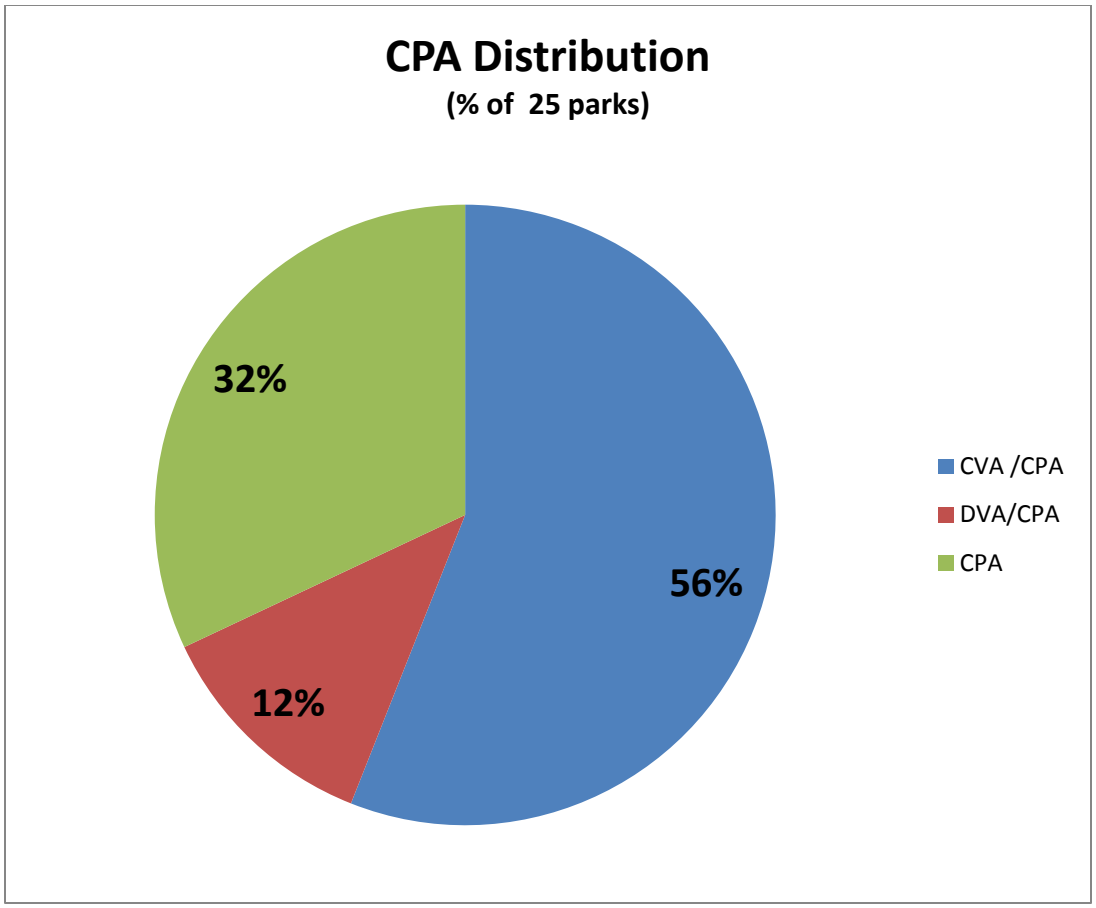
Graph 4- Dispersed Pedestrian Access Distribtion



Graph 5- Controlled Vehicular Access Distribution



Graph 6- Dispersed Vehicular Access Distribution



Graph 7- Controlled Pedestrian Access Distribution

Appendix S – Interview with EcoCounter

This is the interview with the technology company, EcoCounter. The sales representative we spoke with is Ryan Whitney.

- Eco-multi
  - Counts pedestrians and cyclists (possibly equestrians)
  - Could count directional movement as well
  - Uses inductive loops for bikes
  - Uses higher Pyro for horses
- Blue tooth on laptop for collecting data OR AT&T sends directly to you
  - AT&T costs more (modem $130 per modem, $30 per month)
- Battery
  - Life time is usually 10 years
  - Pyro – 10 years
  - Loops – 1 year ($70, easy)
    - Contractor required
- Bike plus pedestrian counter ~$4000 (not including installation)
- Plus the horse counter ~$5140
- Pyro sensor
  - Could be a post like the multi or could be a box attached to tree
  - 10 years
  - Waterproof
  - Just counter ~$3350-2085

- ZELT
    - Mostly for bicycles but can be used for cars
    - Inductive loop or tubes
    - Tubes = 10 years, ZELT = 1 year
- Eco-Visio
    - Online based software
    - Free with a counter purchase
    - AT&T uploads straight to site or with laptop upload yourself automatically

Appendix T – Interview with MetroCount

The sales representative the team spoke with from the technology company MetroCount is Pat Corridon.

- Piezo needs to be the correct type of material
- Cars cannot stop on top of the sensors
- 5805 loop counter
  - Individual loop
- Loops last forever
- Piezo 7-10 years
  - Can be connected to electrical line or solar panel
  - Internal batter could be used as only back up while connected to electrical line
- Battery
  - All the same for the products
  - 4 D cell battery pack
    - Made specifically for their counters
  - 2.5 to 3 years (300 days if used constantly)
  - Cost: $20
  - Easy replacement
  - Can check battery life (gives battery life in number of days)
- Piezo
  - ~$400 (depends on the length)

        - Need two per lane to get the data
        - Resin ARS475(winter mix) PU200(summer mix)
            - 2 cans of resin per sensor
            - PU200 ~$85 per can
            - ARS475 ~$140 per can
        - Housing
            - Inexpensive usually ($80-100)
        - Wiring
        - Conduit
        - Installation
            - $2000-2500
            - Could be more or less
            - Loop installation cost is a little less than Piezo
        - Need contractors
    - Ease of Use
        - Laptop connection or take counter with you for the data
        - Could be wireless
        - Would cost a bit more for the wireless
        - Holds up to one month of data
        - Software does all the analysis and counter only holds raw data

Appendix U – Vehicular Access Methodologies

Alberta Provincial Parks and Recreation Areas (Canada) 2004/2005

The providence of Alberta, Canada uses an estimation to gather attendance data at their parks and recreational facilities. The methodology behind Alberta's visitation counts is by using traffic counters to determine the number of cars that enter their parks. This number is then multiplied by an adjustment number that includes a ratio of day use vehicles to all other vehicles entering and exiting a park, as well as determining the average party size in a car. They gather the later numbers by conducting a survey on 20 random days during the peak season. This survey is completed by stopping cars and conducting brief interviews to determine if they are day use visitors and how many people are in the car. In conclusion, Alberta multiplies the number of cars gathered by the automatic traffic counters with the person per vehicle and the day use ratio determined by the adjustment interviews.

National Parks Service

Most other national parks controlled by NPS are accessed by vehicle. This scenario creates a good example for both controlled and dispersed pedestrian access. The method that NPS uses is the same for both the controlled and dispersed pedestrian access. On all of the access roads to the parks and parking lots, they place an inductive loop counter. This inductive loop counter collects how many cars passed over that roadway. Then they use a person per a vehicle number and multiply that by how many cars passed over the counter. The person per vehicle number varies with each park in the NPS, but the number stays in a range between 2 and 4.

Pennsylvania State Parks- Separating Day Use and Overnight Use

(http://www.dcnr.state.pa.us/stateparks/economicimpact/economic_impact_full_report.pdf)

Pennsylvania State Parks collects their visitation data by using traffic counters and multiplying the total number of vehicles by a person per vehicle factor; their estimated party size is 2.5 people per vehicle. Then to separate the day users by the overnight users they subtract the overnight users from the total visitation for the day. The overnight users have registered their stay so the parks know the exact number of how many there are. The parks also account for re-entry in their vehicle counts. They do not expect for the day users to re-enter, however overnight users would. So they estimate that overnight users will re-enter typically once a day. Additional adjustments are completed on a park to park basis.

Maryland Park Service

Maryland Park service created a formula for estimating attendance that each park in the system should use. The actual formula for estimation is **Daily Visitation = Vehicle Count x Turnover Coefficient x Average Visitors per Vehicle.** Using this type of estimation requires intensive data collection, but after the turnover coefficient is found and the person per vehicle number is found, the estimation becomes rather easy for a day. In order to determine the person per vehicle number, the park employees will conduct 30 minute samples throughout one month. The employees will count the number of vehicles and the number of visitors that arrive for those 30 minutes. Then the average number of people per car can be determined using **Average = Total # of People / Total # of Vehicles.** The turnover coefficient is determined by conducting a spot count of vehicles in a parking lot every hour and using a vehicle counter to count the number of cars that have entered the park in a day. The equation is as follows, **Turnover Coefficient = Total Daily Count / Spot Count.**

Appendix V – Pedestrian Access Methodologies

National Park Service

The National Park Service (NPS) was the most informative and detailed on how they gather attendance information in their parks. The NPS seems to represent all four of the categories that we have created. For example, the National Mall in Washington D.C. represents a dispersed pedestrian access. At each of the sites in the National Mall, the staffing counts the number of visitors at one of the memorials for 15 minutes. This is done six times a day, each done in a different predetermined time period. These six counts are then averaged together and are multiplied by sixty four to estimate the number of visitors at the memorial for the day. This is done at each of the memorials. For controlled pedestrian access parks, it varies for the type of facility. The Washington Monument counts their controlled pedestrian access attendance by counting how many people enter the elevator inside the monument.

New York's Central Park

Central Park conducted a massive data collection effort between summer of 2008 and spring of 2009. The data collection was to see how many visitors attended the parks, survey and interview about features of the park, and observe the area's most visitors were using. Their methodology for their attendance collection was completed as follows, in each season, there was a Saturday, Sunday, Tuesday (excluded in winter) and Thursday allotted to collecting information. A group of volunteers would be covering all entrances in two hour shifts between 8:00AM and 6:00PM. In each of these two hour shifts, the volunteers would count the number of visitors entering the park for ten minutes. These numbers were then averaged for the day and calculated accordingly to generate a number for visitation in the year. The last time an attendance count was completed in this fashion was 1973, and a count slightly different in 1980. Additional

information that was used for the attendance estimate was information such as large event estimates, weather statics, population statistics and other related surveys.

Minnesota Metropolitan Regional Parks

The Metropolitan Council in Minnesota did four years of counting to estimate the annual use in their parks. This was done in four years to get a significant number of samples as well as averaging out any weather problems that one particular summer may have to affect visitation counts. They did this by counting bikers, pedestrians, horse-riders, boats, vehicles and charter buses that enter their parks in the summer season. These counts were done in every single park 16 times each year, 8 on weekdays and 8 on weekends. The entrances and times that a count takes place is randomized for two hour samples. The number of people in the vehicles and charter buses were not counted individually, but were multiplied by a person per vehicle average derived from the *Metropolitan Council Regional Parks and Trails Survey 2008*. The fall, winter and spring seasons were derived from the same publication as the person per vehicle average.

Appendix W – Explanation of Performance Characteristic Scale

1. Creating the performance characteristic scales

With the use of the fundamental objectives hierarchy three main objectives were identified: maximize accuracy, minimize cost, and to maximize reliability. Next means objectives network were identified as features that methods could have in order to achieve the three chosen objectives.

1.1. Reliability

The reliability of a method was calculated by its lifetime and its simplicity of use. The Lifetime category measures the time in years that system might provide service for DCR. Base on research of different technologies and the necessities of DCR it was determined that the best case scenario would be those methods that have a lifetime of 10 or more years. Further it was determined that any method that would provide less than 5 years of services was not in the interest of DCR. Further methods that did not include technology but rather are based on staff were calculated on the assumption of a 5 year lifetime. This was chosen because although staff based methodologies can work forever advancement in technology which can provide the same information and therefore staff based methods should not be relied on for more than 5 years.

Simplicity of use was defined as the amount of training or experience that each staff member would require in order to be able to manage the system without error. This was added because DCR requires a system that can be run by staff members without difficulty. This is important because if a system is difficult to run staff member might either make mistakes or they will not be willing to run it because it's too much work. The scale for simplicity is described by three scenarios; thorough training required with a score of 1, additional training require score of 3 and no training required with a score of 5. The score of 1 would be given to a system that required

training and needs experience to run at its full capacity. The score of three is defined as needing some training, such as reading an extensive manual or attending a short training session with no additional adjustment period. A score of 5 is given to a method where short instructions are needed and no additional adjustment period is needed. The scores of 2 and 4 may also be given if seen fit.

1.2. Cost

Cost was measured with scale of the capital investment and the costs of operation required. In this study capital investment was defined as the cost of purchasing a system, the cost of any installation and any other onetime costs that would be required in order to implement the system. In this study it is assumed that multipliers are previously made and no cost is associated. In this study cost of operation is defined as costs required for operating and maintaining the system for one year. This includes but is not limited to the cost of staff member, replacement of batteries, and electricity cost. The cost of staff members makes the assumption that the staff member is only focusing data collection. These two means objectives were selected because they represent the majority of the required expenses associated with implementing a system. The research on technologies and hourly pay for DCR staff was used to make the cost assumptions.

1.3. Accuracy

Accuracy was rated based on three different characteristics, how often a system recorded data, if it was affected by weather or other environmental factors, and if it required a multiplier.

The frequency of data collection is an important factor in determining the accuracy of a system. Methods that base counts on sampling make assumptions and the longer the time between samples are take the higher the error in the count. Therefore having a continuous data collection has a sore of 5, this means that data is being collected at all times with no interruption

therefore the system getting an exact count with no assumptions. The worst case scenario would be sampling less than monthly, this is because this could mean that seasons are not being differentiated. No differentiation between seasons is necessary since visitation may sky rocket at one time of the year and decline severely another time, therefore using the data from one season for all year can cause a sever margin of error.

In this study the effect of weather and environmental factors is defined by systems that can be erroneously triggered by its surroundings and give an incorrect count. Environmental factors may include but are not limited to flora and fauna. Weather and environmental factors were only given a scale from 1 to 3 this is because this does change the accuracy as much as the frequency of data collection does. Yet for some technologies, these are big factors in the accuracy and it is important that it is included in the comparison. The maximum score of three is given to systems that are not affected by weather or environmental factors. A score of one is given to a system that is sensitive and therefore can by affect thoroughly by outside factor. A score of 2 is given to a system that may be affected by outside factors but is not quite as sensitive.

Finally when a system requires a multiplier, like a car factor, there will be some error for a car factor is an assumption. Although the accuracy of multipliers can vary and therefore either reduce or increase the overall accuracy this does not depend on the system itself but on additional effort. For the sake of simplicity this study will only look at the need of a multiplier. Further a multiplier does change the accuracy of a system yet because it is constant it is still considered a reliable method and therefore is only given a sore difference of 1 point. If a system requires a multiplier it is given a core of 1 and if it does not require a multiplier it is given a score of 2.

Appendix X – Results for Performance Characteristics Scale

Method	Capital Investment	Operation Cost	Average	Score
CVA				
Sampling	2	5	0.7	0.28
Piezoelectric	1	4	0.5	0.2
Road Tubes	4	4	0.8	0.32
Inductive Loops	2	4	0.6	0.24
Tickets/Clicker	1	5	0.6	0.24
CPA				
Light Beam Sensor	3	4	0.7	0.28
Heat Sensor	3	4	0.7	0.28
Radio Sensor	3	4	0.7	0.28
Log Book/Clicker	1	5	0.6	0.24
Sampling	2	5	0.7	0.28
DVA				
Sampling	2	5	0.7	0.28
Human Formula	3	5	0.8	0.32
Technology Formula	4	4	0.8	0.32
DPA				
Daily Sampling	2	5	0.7	0.28
Weekly Sampling	3	5	0.8	0.32
Monthly Sampling	4	5	0.9	0.36
Seasonal Sampling	3	5	0.8	0.32
Visual Camera	4	4	0.8	0.32
Focal Point	3	4	0.7	0.245

Table 7 - Results for Cost

Method	Simplicity	Lifetime	Average	Score
CVA				
Sampling	5	3	0.8	0.28
Piezoelectric	3	5	0.8	0.28
Road Tubes	3	4	0.7	0.245
Inductive Loops	3	5	0.8	0.28
Tickets/Clicker	3	3	0.6	0.21
CPA				
Light Beam Sensor	3	5	0.8	0.28
Heat Sensor	3	5	0.8	0.28
Radio Sensor	3	5	0.8	0.28
Log Book/Clicker	3	3	0.6	0.21
Sampling	5	3	0.8	0.28
DVA				
Sampling	4	3	0.7	0.245
Human Formula	4	3	0.7	0.245
Technology Formula	3	2	0.5	0.175
DPA				
Daily Sampling	5	3	0.8	0.28
Weekly Sampling	5	3	0.8	0.28
Monthly Sampling	5	3	0.8	0.28
Seasonal Sampling	5	3	0.8	0.28
Visual Camera	3	3	0.6	0.21
Focal Point	5	2	0.7	0.245

Table 8 - Results for Accuracy

Method	Simplicity	Lifetime	Average	Score
CVA				
Sampling	5	3	0.8	0.28
Piezoelectric	3	5	0.8	0.28
Road Tubes	3	4	0.7	0.245
Inductive Loops	3	5	0.8	0.28
Tickets/Clicker	3	3	0.6	0.21
CPA				
Light Beam Sensor	3	5	0.8	0.28
Heat Sensor	3	5	0.8	0.28
Radio Sensor	3	5	0.8	0.28
Log Book/Clicker	3	3	0.6	0.21
Sampling	5	3	0.8	0.28
DVA				
Sampling	4	3	0.7	0.245
Human Formula	4	3	0.7	0.245
Technology Formula	3	2	0.5	0.175
DPA				
Daily Sampling	5	3	0.8	0.28
Weekly Sampling	5	3	0.8	0.28
Monthly Sampling	5	3	0.8	0.28
Seasonal Sampling	5	3	0.8	0.28
Visual Camera	3	3	0.6	0.21
Focal Point	5	2	0.7	0.245

Table 9 - Results for Reliability