

Programs That Work

A Procedure for Improving the Accuracy of Visitor Counts at State Parks

Andrew T. Kaczynski
John L. Crompton
John E. Emerson

ABSTRACT: Visitation counts are the measures most widely used by park managers to demonstrate accountability and good stewardship of the public resources that legislatures invest in parks. Ostensibly, counting visitors may appear to be a simple task, but experienced park managers are aware that it is a complicated and difficult challenge with three dimensions: human, logistical, and technical. Part of the challenge has a human dimension in that pressure to demonstrate accountability may tempt managers to inflate visitation counts. However, much of the challenge is logistical and technical. The logistical dimension relates to the placement and maintenance of traffic axle counters, while the technical dimension refers to transposing axle counts into visitor numbers. In addition to providing an overview of the roles of the three dimensions, this paper describes a procedure implemented in Texas State Parks for addressing the technical dimension.

To transpose raw axle count numbers into visitation estimates, two parameters have to be calculated: (i) the proportion of axles attributable to visitors, as opposed to officials, vendors, or visitors re-entering the park on the same day (parameter A); and (ii) the average number of visitors per axle (parameter B). A study was conducted for a 12-month period in 92 Texas state parks, during which time observers recorded the data relating to parameters A and B. As a result of the study, these empirically derived parameters could be used by each park site to transpose its axle counts to visitation estimates.

Two major findings emerged from the study. First, the parameter estimates varied widely among the 92 parks, whereas the Texas Parks and Wildlife Department (TPWD) traditionally had used a single value system-wide for each parameter. The range for parameter A was 29% to 99%, while for parameter B the values ranged from 0.65 to 2.60. Second, the empirical values were substantially lower than those which traditionally had been used by the agency. Empirical verification of the parameter values used in visitor estimation formulas can improve the accuracy of patron counts and subsequently increase an agency's credibility in the eyes of legislators.

KEYWORDS: parks, visitor estimation procedures, natural resource areas, visitation numbers

AUTHORS: Andrew Kaczynski and John Crompton are with the Department of Recreation, Park and Tourism Sciences, Texas A&M University, 2261 TAMU, College Station, TX 77843-2261. E-mail: andyk1000@hotmail.com. John Emerson is with the Department of Rural Sociology at the same university.

Visitation numbers are a fundamental measure of accountability that many park systems are required to report. They are central to development of efficiency measures used to provide benchmarks against which a park agency's annual performance can be measured. Efficiency measures the relationship of outputs to inputs, and visitation numbers are one of the most easily accessible measures of output. Efficiency measures typically are comprised of ratios such as the number of visitations per employee hour, or per \$1,000 investment in the park. The integrity of visitation numbers is important for at least two other reasons. First, in some cases they are used as a basis for allocating resources. Second, they may be used to provide an indication of an agency's success in meeting constituents' needs.

Difficulties Associated with Obtaining an Accurate Visitor Count

Policymakers invariably regard acquiring an accurate visitation count as an elementary management task. Unfortunately it isn't! It is a complicated and difficult challenge. There are three elements to this challenge: human, logistical and technical. While much of the challenge is technical, and this element constitutes the focus of this paper, it would be naïve not to recognize that there are also human and logistical elements to the challenge of collecting accurate visitation numbers.

Human Element

The pressure on agencies and on individual parks within an agency to demonstrate accountability, unfortunately, may tempt managers to inflate visitation numbers. Park managers invariably feel a strong commitment to acquiring maximum resources for their parks and usually are a park's chief advocates. Over three decades ago, it was suggested that the typical response of administrators when making an annual budget presentation to a legislative body,

Is not one of developing an even-handed presentation of the successes and advantages vs. the failures and difficulties of a program, but rather one of collecting and displaying those things (with limited scrutiny of their validity) which show the program and its accomplishments in a favorable light. This is a situation and a process for which program administrators are not to blame. They know full well from past experience—or at least they believe it to be the case—that if they go before [their legislative body] with a report that their program is not working, they can expect a cry to go up for their scalp. An admission of program failure will be taken as an admission of personal failure (Evans, 1969, p. 569).

In the parks field, the human dimension challenge associated with visitation numbers similarly has long been recognized:

Although attendance data are a readily available quantitative measure, the use of these statistics is based on the assumption that they have been accurately reported. Unfortunately, it is a simple matter for agency personnel to inflate attendance data by spinning the turnstile, running park vehicles across traffic counters, or by counting several trips associated with a single visit as so many different attendances. Since attendance is used for evaluation and is frequently considered as a factor in the budgetary decision-making process, there is every incentive for managers to abuse the system (Howard & Crompton, 1980, p. 317-318).

Logistical Element

The logistical element of the estimation challenge relates to the problems of siting and maintaining traffic axle counters. Raw data from which visitation estimates are calculated is provided by traffic axle counters. Thus, reasonably accurate visitor estimates can only be forthcoming if the location and calibration of the axle counters is accurate. There appear to be three dimensions to this issue.

First, in cases where a park access road is also used by through traffic which is not park related, the axle counts are suspect. San Jacinto Battleground State Historical Park offers an example. The Texas Parks and Wildlife Department (TPWD) reported an annual visitation of 1.2 million (3,200 per day) in 2001. However, the axle counter is located on Battleground Road, which is the park's access road, but which is also used extensively by a considerable volume of through traffic using the Lynchburg Ferry to cross the Houston Ship Canal. In cases such as this, where it is not possible to move the counter to a location that would provide a more accurate count, sampling studies need to be undertaken to measure what proportion of the vehicles on the access road are visiting the park and what proportion is through traffic.

A second dimension of the logistical challenge associated with axle counts is that parks with multiple entrances often have counters at each access point. In these cases, individuals who access the park at different entrances during a single day are double-counted. This becomes an egregious problem at parks that are comprised of multiple geographic elements that are not physically juxtaposed; at longitudinal parks with no longitudinal road within them rendering access transactional and consequently requiring that multiple entrances be used to reach different areas of the park; or where it is merely expedient for users to visit a different region of a park by egressing and reentering, rather than by staying within the park's boundaries to drive to it.

Finally, the necessity to periodically check the accuracy of the counting mechanism also should be noted (Perales & Jackson, 1998). Most parks use

a pneumatic-hose metering system that detects impulses on vehicles passing over pneumatic (air) tubes. They are relatively inexpensive when compared to the alternative magnetic loop metering system. However, the hoses may be damaged if placed on gravel roads and they are susceptible to vandalism due to their visibility. Further, it is important they be placed on straight segments of the road where vehicles are unlikely to cross at an angle and that, especially on narrow roads, they not be placed across only the access lane if visitors tend to drive down the middle of the road since this inadvertently triggers the counter when they exit the park.

Technical Element

The technical element refers to how the raw data from the traffic axle counts are transformed into visitor estimates. This element is the focus of the work reported here which describes the results of a study commissioned by the State Parks Division of TPWD. Each park superintendent is required to report monthly visitation estimates to the Division's central administration. The protocol for doing this offers a standardized and relatively simple method of collecting and reporting visitation statistics. In essence, a formula is applied to numbers recorded by a vehicle axle counter located at access points to each facility during a given period. A "visit" is defined as a visitor (not staff, vendor, or other official personnel) entering a park for the first time on a given day. The formula is:

$$V_E = [(X_2 - X_1) / 2] * A * B + C$$

Where:

- V_E = estimated visitation;
- X_1 = axle count recorded from the end of previous period (e.g. day, month, etc.);
- X_2 = axle count recorded at the end of current period;
- $/2$ = adjustment for counting traffic entering and leaving the park (if access and egress is via the same lane);
- A = percentage of vehicles attributed to visitors, as opposed to official vehicles or visitors re-entering the park on the same day;
- B = average number of visitors per vehicle;
- C = visitation by large groups as recorded by park personnel.

Three of the variables within this formula, X_1 , X_2 , and C, are directly observed by park personnel. The other two variables, parameters A and B, must be estimated. Their estimation was the objective of this study. For as long as anyone in the agency could recall, standard estimates for these two variables had been used. The estimate used for parameter A, the percentage of traffic attributable to visitors was .90 (i.e. 90% of traffic was visitors entering the park for the first time that day). For parameter B, the average number of visitors per vehicle, an estimate of 3.5 was used. There were two

weaknesses in these estimates. First, it was unclear how the values attributed to parameters A and B had been derived. Even if originally they did have an empirical basis, it seems likely that the values would have changed in the decades since they were derived. A second weakness was that applying the same values for these variables across all parks was unreasonable, given the likelihood of wide variations in the profile of park visitors at different sites. The study reported here was commissioned to verify or revise the values assigned to parameters A and B in the visitor estimation formula.

Stimuli for Action

There were two stimuli that provoked this study. The first was a cumulative body of empirical evidence suggesting that reported visitation numbers were too high, while the second was a shift in agency culture.

The Empirical Evidence

The cumulative empirical evidence emerged from three studies commissioned by TPWD in the 1990s. In 1994, surveyors at Washington-on-the-Brazos State Historical Park evaluated the accuracy of the visitor estimation system as part of a study investigating the feasibility of expanding the park's array of services. On 35 days during a 90-day period, observers recorded by visual count the number of people per vehicle and the type of vehicle (visitor or official). Visitor numbers were then compared to those calculated using the park's standard visitor estimation procedure. The results showed that the standard procedure overstated attendance by approximately 25%. The sources of error were: (i) mechanical and operational errors in the counter itself; (ii) understatement of the percent of non-visitor traffic in the procedure; and (iii) overestimation in the formula of the number of people per car (Watt, Stribling & Currie, 1994).

Also in 1994, TPWD commissioned a study that examined the feasibility of changing from a per vehicle to a per person admission fee to Texas' state parks. As part of this study, projections were made of the additional income likely to accrue from this shift. These projections required that accurate attendance data be used. Using data from surveys of park visitors, camping transactions, and bus party transactions, the study suggested that TPWD's visitation numbers were overestimated by 28% (Wall & Crompton, 1995).

In 1998, an analysis of reported attendance was undertaken by outside consultants as part of their brief to develop a long-term strategic plan for the State Parks Division. This report concluded: "There is substantial evidence indicating that the daily attendance data collected in this way results in the reporting of substantially larger numbers of visitors at facilities than were actually there" (Crompton, 1998, p. 3). There were unexplainably wide fluctuations in the annual visitation levels of individual parks. For example, in the six year period 1995-2000, the reported annual day visitation figures for Garner State Park were: 238,000, not available (which thus counted as zero when the system wide park totals were aggregated!),

803,000, 227,000, 420,000, and 14,000, respectively. The study suggested that the extraordinary volatility of the attendance figures at individual parks from year-to-year

makes it difficult to accept the credibility of the data. The annual totals are reasonably consistent from year-to-year, but this overall picture is grossly misleading. Within the totals there are very large positive and negative fluctuations at individual parks which are partially self-canceling and this leads to the relatively stable totals (p. 4).

In May 1996, the State Parks Division implemented the shift from per-vehicle to per-person pricing. This enabled a surrogate audit procedure to be developed that offered an approximate assessment of the veracity of park visitation numbers. A review of monthly revenue from day admission fees reported by each park could be used to develop an approximation of the number of day visitors. For example, if the daily fee was \$3 and monthly revenue from a park came to \$9,000, then it suggested there were 3,000 day visitors to the park that month. This is an approximation because it ignores: (i) people who enter the parks at off-peak times when entrance fees are not collected; (ii) those who are legally exempted from paying fees or who pay less than the full fee (youth, seniors); and (iii) those who come in large groups such as bus parties or school groups. In addition, some visitors would be season pass holders who would appear on the traffic counter, but not on the park's monthly day admission revenue reports. Despite these limitations, the surrogate audit procedure highlighted many glaring examples of visitation overestimation. For example, one park reported an average monthly attendance of around 40,000, but revenues suggested there were only 1500 visitors per month, i.e. they accounted for fewer than 4% of all visitors. Clearly, this was unreasonable (Crompton, 1998).

Shift in Agency Culture

Although the empirical evidence suggested that the visitation numbers were too high, the adverse political consequences likely to be associated with substantially lower numbers meant that there was no culture in the agency supportive of rectifying the situation. Three events occurred whose aggregate impact was sufficient to provide the shift in political calculus needed to change this culture.

First, there was a change in leadership of both the State Parks Division director and the TPWD director. Both of the new leaders recognized that the lack of credibility of these numbers tarnished the agency's reputation with legislators and other stakeholders. Thus, they were both adamant that it was essential to initiate a process which would result in accurate visitation numbers. The process had to be transparent so all would recognize the integrity of the numbers when the new process was in place.

A second source of pressure to address the issue came from the popular press in the major metropolitan areas which expressed skepticism. For example, a headline in the *Houston Chronicle* read, "State park attendance count a hit-and-miss affair" (Tompkins, 2002). The article was scathingly skeptical in its review of TPWD's visitation numbers. Sample observations included: "Truth is, the San Jacinto Battle Ground State Historical Park sees nowhere near the million-plus visitors TPWD claims"; and "Davis Mountains State Park, a gorgeous park sporting wonderful Indian Lodge draws steady traffic. But there is no way the isolated park sees the 512,000 plus visitors (an average of more than 1,400 visitors *daily*) the agency claims visited there this past year".

The third source of pressure was the state legislature and its official auditing agency. TPWD's former director encountered considerable skepticism about the veracity of the state park visitation numbers when he appeared in front of the legislature's Appropriations Committee in 1999. In response, he committed to reviewing the process by which the numbers were derived. The legislature was, in effect, enforcing a finding of the State Auditor's Office which recommended in a September 1998 management audit that the Parks Division "develop more accurate measures of parks visitation data no later than August 2002, prior to the preliminary budget presentations to the Legislature and the Legislative Budget Board" (Bomer, 2001). The imperative to do this was reinforced by another management audit of TPWD's business practices, which was commissioned by the TPWD Commission, the policy board mandated by the legislature to oversee the department. Their evaluation was undertaken by a former legislator whose integrity and credibility were widely respected by the legislature. His report reiterated the need to develop a more accurate measure of visitation numbers (Bomer, 2001). Another recommendation of this report was that the Parks Division identify the economic impact of state parks on their local areas. A prerequisite for such estimates is that the estimate of the number of visitors to a park be accurate. If the visitation figure lacks credibility, then the economic impact figure also will lack credibility.

Research Procedures

A survey was conducted in 92 state parks from December 1999 through November 2000. During each month, data were collected for a one-hour period every second weekday throughout the month with the start time advancing by one hour in each successive survey period. Thus, for example, in the first week, surveying could be undertaken on Monday, Wednesday, and Friday at 8 a.m., 9 a.m., and 10 a.m., respectively, for a one-hour period. In week two, surveying could be on Tuesday and Thursday at 11 a.m. and 12 noon, respectively. This pattern would be continued for the first four weeks in each month and repeated every month for the 12 month period. A similar rotation could be enacted on weekends with observations being recorded for at least one hour a day on every

weekend day. Thus, at the end of each month for each park, surveys had been conducted on 10 weekdays and on 10 weekend days. This sampling approach to the project was intended to cover a “theoretical” entire weekday and a weekend day.

The surveys were undertaken by staff or volunteers at each park who were positioned at a park axle counter where they had a clear view of each entering vehicle and its occupants. Using a daily recording sheet, they counted the number of axles on each vehicle that entered the facility (including attached recreational vehicles, trailers, etc.) together with the number of adults and children within the vehicle. If the vehicle was a park staff vehicle, vendor, or other non-visitor vehicle, occupants in the vehicle were omitted from the count and “Dept” was recorded next to the number of axles. Similarly, if a visitor was re-entering the facility for a second (or more) time that same day, its occupants again were omitted from the count and “Reentry” was recorded next to the number of axles for that vehicle.

At the conclusion of each recording session, the data were summarized on the daily sheet and then were transferred to a single line on a monthly summary sheet. At the end of each month, the completed monthly summary sheet was faxed or e-mailed to the TPWD central office. Inevitably, some months were omitted by some parks, and there were some months for which only partial data were received, reflecting that vehicle counts were observed on fewer than the 20 days that were mandated. However, on the whole, the park superintendents were extraordinarily diligent in respecting the sampling procedures, so the data set provided a strong foundation for developing accurate values for the two parameters of interest.

The data were entered into the Statistical Package for the Social Sciences (SPSS) 11.0 computer software to facilitate analysis. Each park was represented by up to 240 hours of data (12 months × 20 days per month) and the database contained the following variables:

- **date** – Date on which the data were recorded.
- **park name** – Park at which the data were recorded.
- **time** – Start time of one hour recording session (possible values ranged from 8 a.m. to 6 p.m.).
- **visaxles** – Total number of axles attributed to legitimate visitors.
- **adults** – Total number of adult visitors.
- **children** – Total number of child visitors.
- **dept** – Total number of axles attributed to official vehicles.
- **reentry** – Total number of axles attributed to visitors re-entering the park on the same day.

The original formula used by TPWD estimated the percentage of vehicles attributed to visitors (parameter A) and the average number of visitors per vehicle (parameter B) on a *per-vehicle* rather than a *per-axle* basis. Per-axle parameter estimates were used in this study for three reasons.

First, as opposed to counting vehicles, the data collectors at each park recorded the number of *axles* entering the park for visitors and non-visitors. Second, defining how many axles on the traffic counter equate to a vehicle is especially problematic in state parks because of the substantial proportion of RVs, towed trailers, and other multi-axle vehicles. Third, future estimates of attendance will be derived by applying the revised parameters to the number of axles entering a park during a given period, as recorded by the axle counter at the park's entrance. Hence, parameter estimates made on a per-axle basis can more accurately be transposed into visit counts than those made on a per vehicle basis.

The percentage of axles attributable to visitors (parameter A) was calculated by dividing the total number of 'visitor' axles entering the park during a given period (excluding official vehicles or visitors reentering) into the number of total axles entering during that same period. Estimates of the average number of visitors per axle (parameter B) were derived by dividing the total number of visitors into the total number of visitor axles observed during the same time period.

Results

The study's results produced estimates of the percentage of axles attributable to visitors (parameter A) and the average number of visitors per axle (parameter B) for each park. The values for each parameter varied widely across parks. The range for parameter A was from 28% to 99%, while for parameter B the values ranged from 0.65 to 2.60.

Across all 92 parks, the average value of parameter A was 76%. In the existing formula all parks inserted a value of 90% for this parameter. This research indicated that this value was too high and that the practice of every park in the system using a common average value resulted in major inaccuracies in each park's visitation count because the values differed widely across parks.

In the original formula, parameter B measured visitors per vehicle rather than visitors per axle. Thus, a direct comparison is difficult between the traditional value of 3.50 persons per vehicle and the empirical per-axle values derived in this study. However, the average number of visitors per axle across all 92 parks was 1.11. Thus, if all of the vehicles were regular two-axle automobiles, the average number of occupants would be 2.22, while if they were all three-axle vehicles the average would be 3.33 occupants. Clearly, these occupancy rates are far below the 3.50 occupancy rate per vehicle which was used in the existing formula by every park in the system. Again, the wide range of values derived for parameter B indicated that the use of a single value for all parks also was a major source of error in the visitation numbers reported by each park.

For 2001, the officially reported annual aggregate visitation figure for all Texas State Parks was 17.54 million. Using the revised parameter values derived in this study, the authors estimated the aggregate visitation at all Texas State Parks in 2001 to be 11.74 million, a decrease of 33%.

Conclusions

This study makes at least three important contributions. First, it demonstrates the importance of using empirically derived values that are specific to each individual park site in formulas used to estimate visitation in parks based on axle counts. The use of a single value for these parameters for all parks will result in there being inherent inaccuracies in the reported data.

Second, a comprehensive sampling approach was described that was found to be workable in a field situation. Third, the study demonstrated the practicality of using park personnel to collect and subsequently analyze empirical data. This suggests empirical verification can be done periodically without incurring major costs in hiring external consultants. By empirically verifying these key parameters on a regular basis, say every seven years or so, shifts in the profiles of a park's visitors can be accurately captured in the visitor estimation formula.

This study demonstrated how to derive accurate values for the parameters in the visitor estimation formula. The empirically derived parameter estimates reported here will greatly increase the accuracy of visitor estimates, but several other logistical and technical issues remain to be resolved. The logistical problems are likely to result in overestimates, while the remaining technical problem is likely to result in underestimates of visitors. However, it would be erroneous to assume their effects serve are counterbalancing and can therefore be ignored!

Earlier in this paper, three logistical problems were identified that need to be addressed. First, studies should be undertaken at those parks with through roads traversing them to identify the proportion of traffic which actually visits the park. A sampling approach similar to that used in this study is likely to be appropriate. Second, at multiple entrance parks, studies are needed to identify the extent of double counting that occurs when visitors cross more than one traffic counter in a single day. This would involve interviewing samples of visitors. The third logistical problem is careful location of the counters and this can be resolved through inspections by agency managers.

The remaining technical problem is that the visitor estimation formula does not make provision for people who stayed for multiple nights within a park without reentering it. The axle count is of vehicles entering a park for the first time during a day. Thus, vehicles that are already in the park and never leave it are counted only once when they initially entered. For example, if a family of four camped in a park for three nights and never left so they did not reenter the park on days two and three, then the number of visitor days attributed to them is underestimated, being reported as four instead of twelve.

TPWD estimates the number of day visitors to a park by subtracting overnight visitors from total visits calculated by the visitor estimation formula based on traffic axle counts. Hence, estimates of day visitors are residuals. The overnight visits headcount is accurate because it is based on

an actual headcount of campers entered in TPWD's Central Reservation System (CRS) when each reservation is made. However, overnight campers' visitor days will be underrepresented in the total visits estimate due to the problem described above. Therefore, subtracting accurate overnight visits from underestimated total visits is likely to produce day visit residual estimates that are low.

In parks that host large numbers of overnight visitors, this underestimate is likely to be significant. For example, Garner State Park's total visitation estimate for FY 2001 was 244,000. The CRS confirmed there were 230,000 overnight visitor days. Thus, total annual day visitation was only 14,000. It is widely believed that this is a substantial underestimation of day visitors to this park.

To rectify this technical problem, surveys of overnight visitors at each park with camping facilities need to be undertaken to ascertain how many times during their stay they exit and reenter the park. Thus, an additional parameter, parameter D, needs to be included in the existing visitor estimation formula, where the additional D value is derived by: Total visitor days accounted for by overnight campers (according to the CRS) minus the number of overnight stay visitor days captured by the traffic counter.

Estimating the number of visitors to a park is a challenging managerial task. When the task is to estimate the aggregated visitation to all units in the Texas State Park system, then the challenge is multiplied 130 times. The intent of this paper has been to describe the complexity of the problem and to demonstrate procedures for addressing it. It is not a subject that heretofore has attracted interest from researchers, even though it is a widespread problem confronting most park managers. The visitation count is the measure most widely used by managers to demonstrate accountability for the resources allocated by legislators for investment in parks. Legislators are increasingly skeptical of numbers which, intuitively, they believe are unreasonably high. Periodic reviews of procedures, incorporating the type of empirical validation described in this paper, would appear to be essential to remove legislative skepticism and to reassure legislators of the integrity of the agency's managers.

References

- Bomer, E. (2001). *Texas Parks and Wildlife Department business practices evaluation*. Austin, TX: Texas Parks and Wildlife Department.
- Crompton, J.L. (1998). Analysis of reported attendance. In *Texas Outdoors: A vision for the future*. Austin, TX: Texas Parks and Wildlife Department.
- Evans, J.W. (1969). Evaluating social action programs. *Social Science Quarterly*, 50(3), 56-67.
- Howard, D.R., & Crompton, J.L. (1980). *Financing, managing and marketing recreation and park resources*. Dubuque, IA: Wm. C. Brown.
- Perales, M.K., & Jackson, R.S. (1998). *Recreation use estimation*. Report #1: Procedures for developing recreation areas. Vicksburg, MS: U.S. Army Corps of Engineers Waterways Experiment Station.
- Tompkins, S. (2002). State park attendance count a hit-and-miss affair. *Houston Chronicle*, June 28, p. 9B.

Wall, K., & Crompton, J.L. (1995). *The revenue implications of changing daily entrance fees to per-person pricing at Texas State Parks*. Austin, TX: Texas Parks and Wildlife Department.

Watt, C., Stribling, J., & Currie, R. (1994). *Final report: Barrington Farmstead Feasibility Study*. Texas A&M University: Department of Recreation, Park and Tourism Sciences.