Visitor counters in parks: management practice for counter calibration

Julian Ross

DEPARTMENT OF CONSERVATION TECHNICAL SERIES 33

Published by
Department of Conservation
PO Box 10–420
Wellington, New Zealand

Department of Conservation Technical Series presents instructional guide books and data sets, aimed at the conservation officer in the field. Publications in this series are reviewed to ensure they represent standards of current best practice in the subject area.
Individual copies are printed, and are also available from the departmental website in pdf form. Titles are listed in our catalogue on the website, refer www.doc.govt.nz under Publications, then Science and research.

ISSN 1172-6873
ISBN 0-478-14043-6

This report was prepared for publication by Science & Technical Publishing; editing and layout by Sue Hallas. Publication was approved by the Chief Scientist (Research, Development & Improvement Division), Department of Conservation, Wellington, New Zealand.

In the interest of forest conservation, we support paperless electronic publishing. When printing, recycled paper is used wherever possible.

CONTENTS

Visitor counters in parks: management practice for counter calibration

Julian Ross

Science & Research Unit, Department of Conservation, PO Box 10–420, Wellington, New Zealand

ABSTRACT

There are numerous reasons why visitor counting instruments systematically under- or over-count. 'Calibration' involves adjusting counters so that they reflect estimates of numbers of visits. This review identified effective methods for calibration of pedestrian and vehicle counting instruments in a countryside recreation environment, and made various recommendations. Counters should be tested before being taken into the field, immediately after installation and before each calibration exercise. Counter data should be stored and processed centrally, and validated. Counter calibration should be compulsory, repeated regularly and applied before data analysis or reporting. Calibration should be effected with agreed, standard fields of information and clear distinctions must be made between the number of 'visits' being measured by a counter and the total number of 'visitors'. Visitor surveys can supplement counter data, to allow data interpretation and extrapolation. The Department of Conservation, New Zealand, will use this information as a guide to develop Standard Operating Procedures for counter calibration.

Keywords: visitor surveys, counters, calibration, data management, validation, Department of Conservation, New Zealand

Ross, J. 2005: Visitor counters in parks: management practice for counter calibration. *Department of Conservation Technical Series 33*. Department of Conservation, Wellington. 34 p.

1. Introduction

1.1 BACKGROUND

The use of automatic counting instruments for monitoring numbers of visits to countryside recreation areas is now widespread. Park and land-management organisations around the world use a wide range of systems to record levels of visits. The technologies applied in ‘sensing’ devices are increasingly advanced, as are the systems for recording, collecting and analysing counter data.

The Department of Conservation (DOC) has been using automatic counting instruments for many years. During this period a variety of counters have been purchased and several counter designs have been developed in-house. To improve the quality of visitor data gathered, DOC is now standardising its methods for counting and reporting numbers of visits. This will include standardising the methods used for correcting the data error that is present in most counter results. Whatever the technology used, visitor counting instruments usually systematically under- or over-count visits. There are numerous reasons for this. For example, under-counting can be caused by child visitors who are too small to be detected by beam counters or by visitors being recorded twice when taking an ‘out and back’ route on the same path. Appendix 1 lists specific sources of error for visitor counting instruments used by DOC.

To correct data error, every visitor counter needs to be ‘calibrated’ (Cope et al. 1999; Dixon 2004; Wardell & Moore 2004). In its most basic form, counter calibration involves observing and recording the number of visitors passing a counter during a specific period, and relating this to the number recorded by the instrument over the same time. The difference between these figures shows the amount of error in the counter results, and is referred to as a ‘calibration multiplier’. If calculated accurately, this multiplier can be applied to counter readings on an on-going basis to produce more reliable estimates of the numbers of visits.

However there are a number of variables to consider when planning calibration work. These relate to method of observation used, how calibration fieldwork is scheduled, what calibration data are collected, and the systems used for data storage and analysis.

1.2 RESEARCH APPROACH

The objective of this review is to identify effective methods for calibration of pedestrian and vehicle counting instruments in a countryside recreation environment. The project reviews literature published on counter calibration, as well as the practices used by other park and land-management organisations around the world. The investigation addresses four research questions, each with a specific rationale.

1. How is observation fieldwork set up for track counters and vehicle counters? *To ensure staff participation, fieldwork methods must be straightforward to set up*.
2. When should calibration work be conducted? *To be credible and accepted by staff, fieldwork schedules must be practical to implement*.
3. How should visitor counter data be processed and stored? *To be accessible and usable, counter data must be processed and stored in a consistent format*.
4. How can calibration work be combined with visitor surveys? *To improve efficiency and quality of visitor monitoring, calibration work can be linked with visitor surveys*.

The project has focused on calibration practices that have been tested and implemented 'in the field', rather than theoretical approaches.

The literature review includes content from academic research, operational reports and conference papers. Particular attention has been paid to case studies and examples of good practice relating to calibration. These documents also identified organisations using visitor monitoring systems but not publishing details of their work. These formed the basis of a list of organisations to contact in the second stage of the research. A copy of this list is included as Appendix 2.

A covering letter introducing the project and outlining research objectives was emailed to each organisation. A feedback form was included with a set of structured questions regarding visitor monitoring systems and calibration methods. Where individual contacts had not been identified, the covering email requested that the letter and feedback form be forwarded to the most appropriate person. A copy of the letter and feedback form are included as Appendices 3 and 4, respectively.

A total of 32 organisations were contacted. Often, copies of recent visitor monitoring reports were sent back in place of the feedback form. Most of these are 'internal' documents that were not identified in the literature review. This information has been included in the findings and all unpublished documents have been referenced.

2. Calibration observation methods

To measure and correct counter error, it is necessary to conduct an observation study at each site. There are a number of methods that can be used for this fieldwork, and differing perspectives on the type of information that should be recorded.

2.1 OBSERVATION METHODS FOR TRACK COUNTER CALIBRATION

A useful starting point is to consider the minimum amount of information that needs to be collected during observation fieldwork. A good example is set out in a DOC visitor monitoring manual published in 1992 (summarised in Table 1).

In this case, the calibration multiplier is referred to as a 'weighting factor' and 0.65 would be used to convert counter readings into estimates of actual visitor numbers. This example shows the core principle for calculating a correction factor, and illustrates DOC guidelines in this area. However, methods used by other organisations highlight a number of additional considerations relating to calibration fieldwork.

Scottish Natural Heritage (SNH) states that each counter must be carefully tested before any observation studies begin (2002). It suggests that a 'walk test' should be conducted at each site before a counter is calibrated. This involves deliberately passing the counter 50 times at a normal pace. If the counter records the correct number ± 10%, the observation study can be conducted. If the counter is less accurate, managers are advised to alter the setup of the counter before calibration work can begin (SNH 2002: 2).

In a report on three monitoring cases studied in the UK, Cope et al. (1999) also suggests that counter testing should occur before calibration begins. 'The first phase of calibration consists of assessment of operational accuracy. The

TABLE 1. BASIC TRACK COUNTER CALIBRATION METHOD, AS USED* IN NEW ZEALAND.

STEP	DESCRIPTION	EXAMPLE
1	Record the counter reading at start of the observation period	245
2	Record the number of visitors using the track for a set period (only count each person once, even if they do the track twice)	63
3	Record the number registered by the track counter at the end of the observation period	342
4	Subtract counter reading (1) from (3) to calculate the counts for the observation period	97
5	Divide the number of visitors observed by the number registered by the track counter	63/97 = 0.64948
6	Round to two significant digits for the weighting factor	0.65

* DOC (1992: 58).

accuracy of the unit can be measured by observing its success in recording a known number of artificially stimulated counts. The second calibrative phase involves manual observation of real world incidences' (Cope et al. 1999: 233).

It is clearly important to check that the counter is functioning correctly before it is taken into the field for installation, and then subsequently before any calibration work is undertaken.

In addition to counting the number of people who move through the area of study during an observation survey, it is also possible to record profile information about the visitors. In a study from the US Forest Service (USFS), Watson et al. (2000) shows how visual observation can be used to record group size, gender, approximate age, method of travel and approximate length of stay (overnight versus day-use, based on equipment carried). This approach has been adopted at British Waterways (BW) where fieldworkers gather information on visitor age and gender, as well as information on activity type (Table 2). A new row is used for each group of visitors. Scottish Natural Heritage uses a similar approach but recommends a coding system to record visitor characteristics (Table 3).

By collecting this level of detail, individual weighting factors can be calculated for each activity and profile group. This means that raw data can be converted into estimates of use for each user group, as well as overall numbers of visits.

TABLE 2. LAYOUT OF BRITISH WATERWAYS' OBSERVATION FIELDWORK FORM.*

SITE NAME .... DATE ....
ACCESS POINT .... STAFF NAME ....

TIME	COUNTER READING	ADULT		CHILD		BABY	JOGGER/ RUNNER	CYCLE	DOG
		MALE	FEMALE	MALE	FEMALE				
...	....	..	..	..	..	...	...	...	...
...	....	..	..	..	..	...	...	...	...
...	....	..	..	..	..	...	...	...	...

* BW (2002).

TABLE 3. LAYOUT OF OBSERVATION FIELDWORK FORM USED BY SCOTTISH NATURAL HERITAGE.*

LOCATION OF COUNTER...................... FORM NUMBER.......................................
OBSERVER.. START TIME...
DATE.. FINISH TIME..

TIME	NUMBER OF PERSONS	COUNTER READING	DESCRIPTION OF PERSONS†	DIRECTION OF MOVEMENT	PASSED CLOSE TO COUNTER?	NOTES
...	...	...	...	...	...	...
...	...	...	...	...	...	...
...	...	...	...	...	...	...

* SNH (2002: 9).
† Use codes, e.g. A = Adults, B = Bicycle, C = Child, D = Dog.

The SNH guidelines also recommend adding a code to show any movements of staff that are included in the data. Staff movements are considered ‘ineligible’ as visitor counts and should therefore be discounted when the calibration multiplier is calculated. This is an important consideration whenever counters are being calibrated and a place to record this information should be included on all fieldwork forms. Recording direction of travel of a group raises an issue regarding how the form should be completed for visitors who take an ‘out and back’ route on the same track, thereby passing the counter in both directions during a single day visit.

DOC has recently conducted fieldwork (Catchpool Valley field study, unpub. data) to test whether this double counting problem can be measured. The trials showed that observation staff can usually remember when groups pass a counter twice during one day. By making a note every time this occurs, the proportion of double counting can be estimated. At sites where a lot of visitors make return day trips it is therefore important to conduct fieldwork for the full length of the day.

Recording this type of information, along with data on visitor profile and staff movements, provides more detailed results; however it also increases the complexity of the data collection process. There is evidence that more complicated fieldwork methods are prone to data collection errors, and often lead to less accurate results (Hornback & Eagles 1998; Wardell & Moore 2004). It is therefore important to design fieldwork methods that are straightforward to set up and that provide the specific information required for data analysis (Stichel 1999). (It is possible to collect additional information such as trip pattern data through visitor surveys, see Section 5. These data can be used to support calibration calculations as well as the interpretation of counter results in relation to other tracks and sites in the area.)

A final consideration regarding track counter calibration relates to the use of video cameras for observation work. By setting up concealed cameras close to a counter location, it is possible to capture the same information that is usually recorded by fieldworkers. DOC tested this method in 1999 during development trials for their pressure/vibration-sensitive step counter (DOC 1999). The aim of the trials was to observe typical stride patterns of visitors ascending or descending steps in a forest track. Table 4 shows a sample of the data collected.

TABLE 4. ONE DAY’S RESULTS FROM VIDEO OBSERVATION TRIALS.*

PEOPLE UP	PEOPLE DOWN	MISSED STEP	BIKES	DOGS	TOTAL VIDEO	TOTAL LOGGER	% ERROR
53					53	50	–5.6%
	20				20	25	+25%
		4			4	0	
			1		1	2	–
				5	5	3	–
Total					**83**	**80**	**–3.6%**

* DOC (1999: appendix 1).

A video is able to record the number of people passing the counter, the direction they are travelling in and information on their type of activity. Once the camera is installed, observation can be continued over an extended period as long as videotapes and batteries are changed as required. The tapes are then reviewed on a high-speed setting to identify the time and characteristics of each visitor movement.

This system enables observation work to be conducted over extended periods; however, it still requires significant staff time. As reported in a more recent DOC study (Mooney et al. 2003), there can be high labour costs associated with reviewing continuous video footage owing to the large number of data that are collected. There are also issues of threats to equipment from public discovery and possible tampering, vandalism or theft. However, recent field trials undertaken by DOC (Catchpool Valley field study, unpubl. data) have demonstrated that, with discreet positioning, the counters are invisible to the public and provide an effective way of gathering observation information. This method is most efficient if good quality filming equipment is used and improves as staff develop expertise setting up the cameras.

It is also important to recognise legal restrictions on the use of video equipment in public areas. In New Zealand it is a requirement of various privacy laws that individuals cannot be identified from this type of footage (Privacy Act 1993). Watson et al. (2000) suggests that the privacy of individuals is safeguarded by operating filming equipment slightly out of focus and ensuring that recordings are destroyed after observations have been captured. In some countries it may be necessary to post a notice alerting the public to video monitoring activities in the area. Appendix 5 contains further details on privacy laws relating to camera use in New Zealand.

2.2 OBSERVATION METHODS FOR VEHICLE COUNTER CALIBRATION

Vehicle counting instruments also require calibration; however fieldwork methods differ from those used with track counters.

Vehicle counters are usually located on the main access road into a park or forest. In many cases they record traffic on only one side of the road to avoid double-counting vehicles making a return journey. Data from vehicle counters show the number of vehicles recorded, rather than the number of occupants. To calculate numbers of visits occurring, counter data therefore needs to be 'corrected' to reflect the average number of people in each vehicle. Average occupancy figures are usually calculated by counting the number of people in each vehicle during an observation survey. Some recent counter designs can also differentiate between vehicle-types, which can be important owing to the large variation in passenger capacities.

The United States National Park Service (USNPS) has been using vehicle counters to measure visits to parks for many years. Its experience shows that average vehicle occupancy figures can vary significantly between sites; therefore every counter location is calibrated individually. In many fee-collection booths staff record the number of people in every vehicle for a sample period. For sites where booths are not present, staff undertake a specific observation study to record vehicle occupancy levels (USNPS 2000).

Vehicle occupancy studies are more complicated for counters that differentiate between vehicle types. Table 5 shows how Conservation and Land Management (CALM, Western Australia) use their counters to record vehicles in four different categories.

For accurate data analysis, individual vehicle occupancy rates are required for each of the four categories. Fieldworkers therefore record 'vehicle class', as well as 'number of occupants' during observation surveys. The CALM's data analysis software is designed to apply the appropriate correction factor to each section of the counter data. This removes the risk of using overall averages that may be biased by vehicles with very high or low occupancy levels. The method can also be used with standard counters to provide an indication of the proportion of each vehicle class being recorded at individual sites.

Calibration of vehicle counters also involves removing readings caused by 'non-visitor' traffic. This includes vehicles travelling into the area for business purposes or, in situations where a counter is located on a 'through road', vehicles passing the area without stopping. Movements of staff vehicles also need to be removed for accurate data analysis (AALC 1995; USNPS 2000).

While it is not normally possible to identify where a counter has recorded non-visitor traffic, specific fieldwork can be conducted to estimate the proportions

TABLE 5. VEHICLE COUNTER CLASSIFICATIONS, WESTERN AUSTRALIA.*

CLASS	VEHICLE TYPE
1	Sedan, wagon, four-wheel drive, utility, light van, motorcycle
2	Towing trailer, caravan and boat
3	Two-axle buses and trucks
4	Three-axle buses and trucks

* CALM (2004), quoted in Wardell & Moore (2004: 23).

TABLE 6. WEATHER-BASED METHOD FOR CALCULATING NON-RECREATION TRAFFIC.*

CODE	TRAFFIC DESCRIPTION
1	Traffic levels are recorded on a sample of days with particularly bad weather (the assumption is that very few recreation visits will occur on these days).
2	Park staff visit popular recreation areas during the same period to confirm that visitor levels are very low.
3	Traffic movements recorded on these days are therefore assumed to be for non-recreational purposes.
4	Estimates of staff vehicle movements are added to this number to provide a total estimate of daily non-recreational vehicle movements.
5	This number is then subtracted from the total results for a 'normal' day to identify the number of additional movements made up by genuine recreational visitors.

* USNPS (2000).

of visitor versus non-visitor readings. The USNPS analyses the relationship between counter readings and weather conditions to estimate the proportion of 'non-recreation' traffic at each site. This useful method enables estimates of non-recreation traffic to be made without stopping vehicles for a survey. Table 6 lists the stages involved in this process.

Video cameras have also been trialled for calibration of vehicle counters by DOC (Catchpool Valley field study, unpubl. data). Trials demonstrated that it was difficult to set the camera up to capture the number of people in each car or van. Problems with the speed of vehicles and the reflection of light from vehicle windscreens prevented collection of any useful data during the trials.

3. Calibration planning

Having established a standard methodology for collecting calibration data, the main issue becomes when to do the calibration fieldwork. There are two aspects to be considered here. The first relates to how long each individual fieldwork exercise should last, and the second relates to how often the fieldwork should be repeated at each site. Calibration scheduling is a trade-off between the accuracy required, and the staff time available for fieldwork. This section reviews methods used by organisations to plan their calibration exercises.

3.1 PLANNING A CALIBRATION EXERCISE

A 'calibration exercise' relates to the amount of observation work necessary to calculate the correction factor for a counter at any selected time.

A common element in the practices reviewed is that fieldwork usually includes more than one day of observation. This is because visitor behaviour and vehicle occupancy may vary between different days of the week (Anon. 1996). The ideal number of days to sample is not easy to determine and different organisations use different approaches. A straightforward method used by BW is to conduct observation work at each of its track counter sites on one weekday and one weekend day for each calibration exercise. A minimum of 6 hours of counting occurs on each day, providing a total sample of at least 12 hours (BW 2003). This method is developed further in guidelines produced by the 'Paths for All Partnership' in Scotland (PfAP 2002). The Partnership advises that one weekday and one weekend day should be selected, but that counting should occur on these days over a period of 2 or 3 weeks. This increases chances of observing differences in weekly use over a longer sampling period.

Scottish Natural Heritage also uses this approach, and records the impact of weather conditions on visitation, by planning fieldwork to occur in a range of conditions. Table 7 shows an example fieldwork timetable provided in the SNH guidelines.

TABLE 7. EXAMPLE OF A FIELDWORK TIMETABLE, FROM SCOTTISH NATURAL HERITAGE.

DAY	WEATHER	OBSERVATION PERIOD
Saturday 1	Cloudy	10 am–12 pm
Sunday 1	Wet	2 pm–4 pm
Sunday 2	Sunny	4 pm–6 pm
Weekday 1	Sunny	1 pm–2 pm
Weekday 2	Cloudy	11 am–1 pm

* SNH (2002: 9).

This method of sampling increases the accuracy of calibration results but requires significant investment of staff time. Where staff resources are limited, it may not be possible to undertake observation work for more than a couple of days. In such cases, managers will need guidance on the minimum level of sampling required to produce accurate calibration results.

One form of guidance is to establish a minimum number of observations for each fieldwork session. In the example above, SNH advises that movements of at least 100 visitors should be recorded to produce the minimum reliable sample size. Statistical models can be used to estimate the accuracy of different sample sizes; however practical considerations are also important. For sites with low foot traffic it may be necessary to reduce target samples and deliberately schedule fieldwork for the busiest periods. This makes efficient use of staff time by reducing the likelihood of sampling when visitor levels are very low (SNH 2002).

Guidance on this issue is also provided by an Australian Alps Liaison Committee report (AALC 1995). The report advises that fieldwork exercises should include both weekdays and weekend days, but that the total number of sessions required depends on the level of consistency in the results. Where there is a large variation in the results, more fieldwork sessions are required to calculate an accurate average. DOC's guidelines support this approach, suggesting that, where visitor behaviour is considered to be stable over time, one day of observation may be sufficient, if that day is randomly selected (DOC 1992).

3.2 PLANNING CALIBRATION UPDATES

Calibration exercises will identify the current calibration multiplier for each counter. However these multipliers can change over time. It is therefore necessary to repeat observation fieldwork periodically at each site. The ideal frequency for repeating observation surveys is not easy to determine. In a major study for the World Conservation Union, Hornback & Eagles (1998) advise that sites should be calibrated every 3–4 years if patterns of use are considered to be stable. Scottish Natural Heritage also use a 3–4 year schedule and emphasises that the first fieldwork exercise should take place within 6–12 weeks of a new counter being installed (SNH 2002). These approaches will produce useful calibration information. However accuracy can be greatly increased by repeating calibration fieldwork on a more regular basis.

Track counters on canal towpaths in Birmingham are calibrated annually. Fieldwork is undertaken on similar dates each year and results often remain consistent, as shown by calibration results of 1.04 (for 1999), 0.96 (for 2000) and 1.12 (for 2001) (Sustrans 2000, 2001, 2002). In contrast, fieldwork is conducted several times a year in Nitmiluk Park in Australia's Northern Territories to measure differences between the tourist seasons. Vehicle occupancy levels were clearly different between 'low' (seasonal calibration result of 2.21), 'shoulder' (2.78) and 'peak' (2.84) season periods (PWCNT 2002a, b, c). An even more comprehensive calibration schedule, based on monthly fieldwork, is used by the US National Park Service (Table 8). These data from George Washington Memorial Parkway show how vehicle occupancy levels vary throughout the year, and is detailed enough to identify trends between months.

These examples show that calibration multipliers change over time and that organisations use a range of different fieldwork schedules. Where very accurate data are required, significant staff time will be spent on calibration work. Where this level of accuracy is not practical or necessary, fieldwork sessions can be scheduled less frequently. Fieldwork scheduling depends on an organisation's information needs, as well as the resources available.

An important final point is that regardless of how recently a calibration estimate has been made, the estimate should not be used if significant changes have been made to the site since the fieldwork was conducted. Changes in elements such as site layout, access locations or signage can all impact on calibration multipliers, meaning counters should be recalibrated after this kind of work has taken place (Hornback & Eagles 1998; Sustrans 2003). Additional calibration updates may also be required if counter data are required for a high-priority report. It is advisable to update calibration data at these times to maximise the accuracy and validity of the information reported.

TABLE 8. RESULTS FROM MONTHLY VEHICLE COUNTER CALIBRATION FOR AVERAGE VEHICLE OCCUPANCY, GEORGE WASHINGTON MEMORIAL PARKWAY, UNITED STATES.*

MONTH	SOUTH ENTRANCE	DESERT VIEW ENTRANCE
March	2.74	2.76
April	3.05	2.83
May	2.73	2.49
June	3.05	2.84
July	3.30	3.15
August	3.20	3.20
September	2.74	2.45
October	2.62	2.34
November	2.88	2.53
December	2.81	2.60

* USNPS (2004).

4. Counter data management

Processing and storing data from visitor counters and calibration surveys are major components of any visitor monitoring system. In a study from Australia, Wardell & Moore (2004) emphasise the importance of designing a suitable database for the management of visitor data: 'A storage and retrieval system is the vital link between raw data and its ultimate use by managers. After putting significant effort into collecting accurate data, the value of the data can either be enhanced or diminished by the design of the storage system' (2004: 45).

Hornback & Eagles (1998) state that using a centralised computer system will enable standardisation of important tasks including data collection, conversion of data to reportable statistics, correction of erroneous entries and archiving of information. To carry out such tasks, specific data management systems are often developed 'in house' according to an organisation's information needs. The structure and functionality of specific counter data systems may vary; however they are all likely to include:

- Data validation—Checking and explaining anomalies in the counter data
- Data calibration—Applying calibration multipliers to convert counter data into estimates of visits

4.1 DATA VALIDATION

Automatic counters may record false readings for a number of reasons, such as those mentioned in the Introduction that cause under-counting. Other causes of under-counting include technical problems such as power failure or vandalism (Cope & Doxford 1997; Watson et al. 2000). Causes of over-counted listed by Cessford & Muhar (2003) include problems with beam counters recording moving foliage, and track counters detecting animal movements. High figures may also be caused by visitors deliberately triggering counting devices (Dixon 2004).

Unusually high or low readings can occur with all visitor counters, therefore it is important that data are 'checked' or 'validated' for anomalies before the results are analysed. This process should also identify where unusual readings are genuine and have been caused by abnormal visitor movements. Scottish Natural Heritage emphasises that data must be checked by someone with local knowledge to ensure that valid counts are not accidentally removed from the results.

> 'It is important not to automatically assume all anomalous hourly counts are incorrect—it is not unknown for troops of army cadets to be on night exercises, or walking holiday tours to disgorge 100 people onto a path at 6 am. Local knowledge is therefore invaluable at interpreting which counts may be spurious.' (SNH 2002: 2)

Recent tests with DOC's step counters in Catchpool Valley near Wellington have shown the importance of data validation (unpubl. data). Figure 1 shows how bad weather on the night of Wednesday 18 August affected counter readings. No readings were made on Thursday 19 August owing to closure of the track for maintenance work. The track was re-opened Saturday 21 August (the small numbers of 20 August are attributable to the public ignoring closure signs and staff). It was essential that the monitoring team were aware of this closure to ensure that this 'gap' in the data was not assumed to be caused by a technical problem. Figure 2 shows hourly data from another counter, on Five-mile Loop track, at Catchpool Valley on Wednesday 18 August, the day of the storm. The counter recorded 34 readings in one day, which is abnormally high for recreation visits in bad weather. However, the hourly breakdown shows that

Figure 1. Daily visitor counter readings from Orongorongo Track, Catchpool Valley.

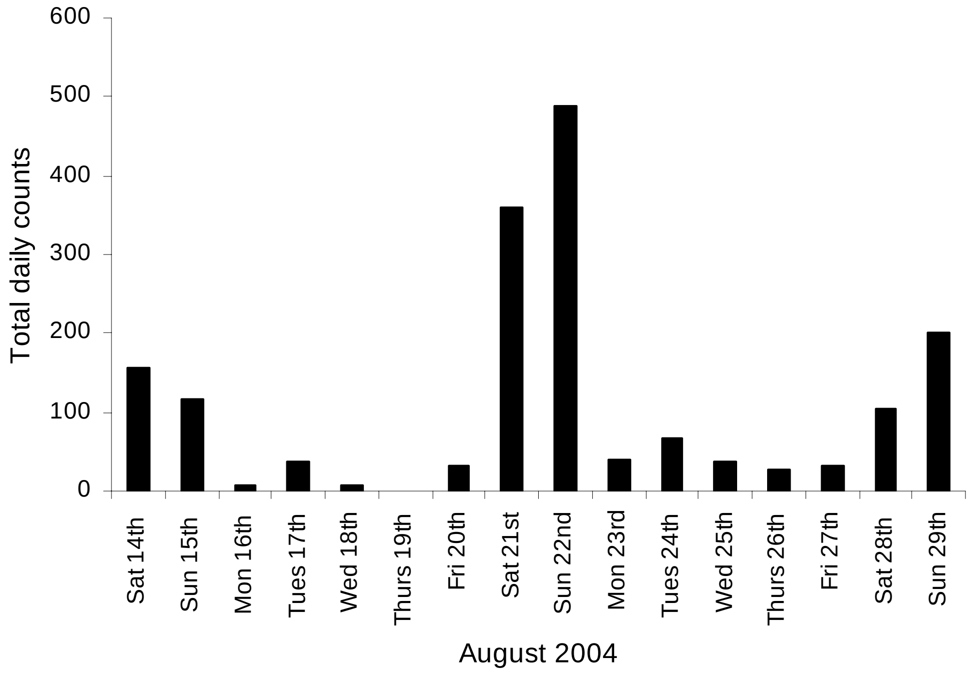
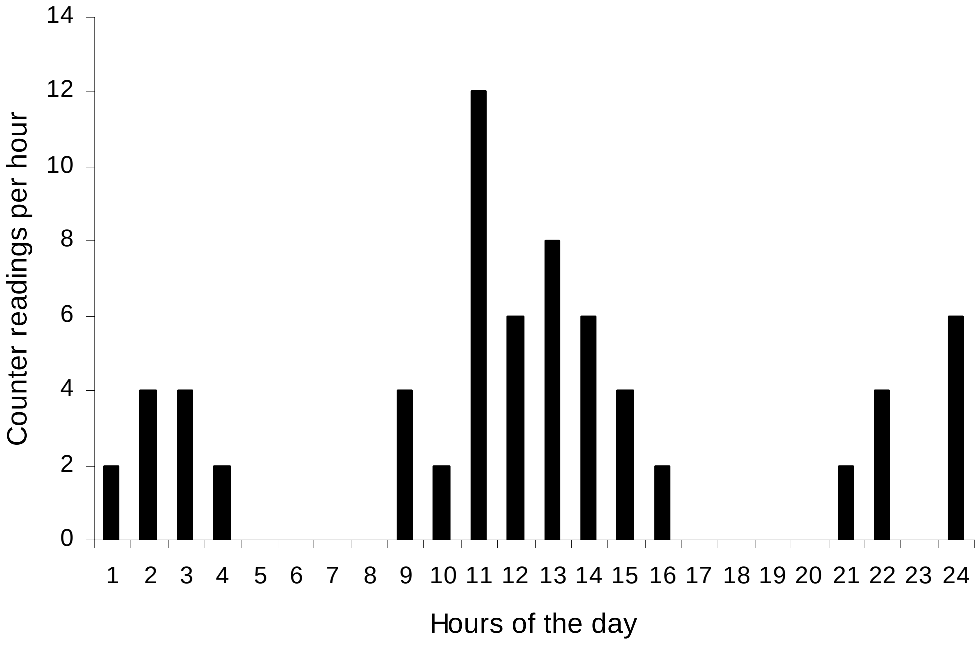


Figure 2. Hourly counter readings from Five-mile Loop track, Catchpool Valley. Data collected Wednesday 18 August 2004.



these figures were probably invalid owing to a technical problem caused by high winds and falling foliage. Appendix 6 contains further examples of data regenerated from the data validation trials at Catchpool Valley, including vehicle and pedestrian counting.

These examples illustrate the importance of keeping regular notes for each site on events or activities that may affect visitor counter data. These notes will be important when validating data to explain any periods showing abnormally high or low counter readings.

4.2 DATA CALIBRATION

Once counter data has been validated, the appropriate calibration multiplier needs to be applied to convert the information into estimates of visits. The calibration multiplier is calculated using methods discussed in sections 2 and 3 of this report.

The database system developed by DOC's Southland Conservancy uses a straightforward approach to apply calibration factors (Harbrow 2004). Counter data are checked for errors and anomalies as they are entered into the system. The information is then automatically weighted according to the calibration factor that has been entered into the database for the site in question. Only one calibration factor applies to each site and this figure is updated when new observation fieldwork is undertaken.

Where more detailed calibration data are available, a more advanced data adjustment function is required. The VISTAT database used by CALM in Western Australia is a good example of a system designed to incorporate more than one calibration factor. The organisation calculates average vehicle occupancy figures for each vehicle type (motorcycles: 1.27, private two-wheel-drive vehicles: 2.73 and private four-wheel-drive vehicles: 3.03), rather than using one adjustment figure for all vehicles (CALM 2004). The VISTAT system automatically applies the correct calibration factor to each category of vehicle count data. This simplifies data processing for users of the system and ensures that calibration factors are applied consistently across the organisation (CALM 2004, in Wardell & Moore 2004: 74).

In some cases, counter data will need to be stored in a 'raw' format until a calibration multiplier has been calculated. The data storage system must therefore clearly display whether information is held in a calibrated or uncalibrated form. This is important to minimise the chances of raw counter data being misinterpreted or used incorrectly in comparisons with data from other counters (Dixon 2004: 21). This principle also applies to data that are validated and unvalidated. The system should clearly identify whether the results have been checked and adjusted.

5. Visitor surveys and advanced calibration

As well as measuring visitor volumes with counting instruments, many organisations conduct surveys to establish visitors' socio-economic characteristics, attitudes and perceptions (Cope & Hill 1997). Sometimes this 'visitor profiling' research can be combined with calibration work on visitor counters, which can lead to savings in staff time as well as generate more advanced calibration results.

In a study of recreational use in England's Northumberland National Park, data on visitor numbers were recorded using passive infrared counters, and a visitor survey was used to investigate visitor profile and behaviour (Cope & Doxford 1997). To save staff time, calibration sessions were scheduled to correspond with visitor surveys. Fieldworkers successfully undertook an observation study for counter calibration while conducting interviews. This method was effective in a rural location, but may not be suitable for sites with very high visitor numbers. Fieldworkers may be unable to perform interviews, in addition to observation counts, if there are high numbers of visitors moving around the site.

In Tasmanian national parks, visitor exit surveys are deliberately conducted at locations where vehicle counters have been installed (Wardell & Moore 2004). The surveys gather information on visitor profile, behaviour and satisfaction, as well as recording the number of people in each vehicle. This removes the need to conduct observation studies for each counter and enables more detailed analysis of calibration results. For example, by combining profile and count data it is possible to investigate how visitor characteristics change between peak and off-peak periods.

Visitor surveys can also be used to support the calibration of track counting instruments. As discussed in section 2, visitors travelling out and back on the same route can bias track counter data. In the UK, Sustrans addresses this by asking specific questions on 'route taken' as part of their visitor survey programme (Sustrans 2003). This information can be combined with data from observation studies to calculate the amount of double counting occurring at each track counter site. These surveys do not need to be conducted at the same time as calibration exercises as the information can also be applied retrospectively.

For sites with counters located on a network of tracks, this information can also be used to interpret the relative level of counts on each instrument. Responses to the 'route taken' question will show common patterns of use, and identify the proportion of visitors that are likely to have been recorded on more than one counter. There are currently limited examples of this type of analysis; however DOC has established a trial site to develop this advanced calibration approach. Appendix 6 contains further details of the counter network developed at Catchpool Valley, near Wellington.

Visitor surveys can also be used to record how often people make visits to each site. This 'frequency of use' information is essential for converting data on the numbers of visits occurring at a site into estimates of total visitor numbers.

6. Conclusions and recommendations

This review has identified methods for calibration of pedestrian and vehicle counting instruments. Four research questions have been addressed:

1. How is observation fieldwork set up for track counters and vehicle counters?
2. When should calibration work be conducted?
3. How should visitor counter data be processed and stored?
4. How can calibration work be linked with visitor surveys?

6.1 CALIBRATION OBSERVATION METHODS

6.1.1 Track counter calibrations

The most basic information required to calculate a correction factor is a count of the number of people who walk past the instrument and the number of observations recorded by the counter for the same period.

Before any calibration work commences, it is important to check that the counting device is functioning correctly.

As well as counting the total number of visits, observation work can be used to record basic information on visitor profile and activity.

Movements of staff should be noted during observation work as staff do not represent 'visitors' to the site, and counts produced by them should be removed from the results.

A clear method should be established for recording visitors who pass a counter twice during a single visit. This is essential to calculate the level of double counting occurring at each site.

Complicated fieldwork methods should be avoided, to reduce the likelihood of errors occurring in data collection.

More advanced calibration data can be gathered through complementary research methods including visitor surveys.

Concealed video cameras can be used for observation studies over an extended period and are potentially a key complementary method in calibration systems. However reviewing video footage can be time consuming and this method also requires good quality filming equipment and staff familiarity with camera setup procedures.

6.1.2 Vehicle counter calibrations

Vehicle occupancy rates are usually calculated using field observations.

Average occupancy rates will vary between sites; therefore calibration fieldwork should be undertaken separately for every counter.

As well as counting vehicle occupants, observers can also record the type of vehicle. This will show the 'mix' of vehicle types visiting each location, and how occupancy rates differ for different classes of vehicles.

More advanced counters automatically record vehicle class, so separate occupancy rates can be applied to each section of the data for maximum accuracy.

It is important to remove observations of non-recreational vehicles, including staff vehicles, when calculating visitor estimates.

The proportions of non-visitor versus visitor traffic can be estimated by observing the number of vehicle movements occurring on days when recreational visits are very low owing to bad weather conditions

While potentially useful for calibrating pedestrian counters, video cameras have less application to vehicle counter calibration. This is because of problems with vehicle speed and reflection of light from vehicle windscreens.

6.2 CALIBRATION PLANNING

6.2.1 Planning a calibration exercise

Each calibration exercise should consist of observation on at least 2 days: one weekend day and one weekday.

Greater accuracy can be achieved by spreading fieldwork over several weeks.

A comprehensive fieldwork programme should include observation sessions over several weeks and in different weather conditions.

The length of fieldwork sessions can be determined by setting a target number of observations for each 'sitting'.

Statistical models can be used to calculate the accuracy provided by different sample sizes.

For sites with particularly low levels of foot traffic, fieldwork should be scheduled for periods when usage is highest.

If results vary considerably between fieldwork sessions, sampling should be extended to establish a more accurate average figure.

Sites with very 'stable' calibration results may be sampled for shorter periods of time.

6.2.2 Planning calibration updates

Calibration multipliers change over time, so fieldwork exercises should be repeated at each site periodically.

The frequency of repeat calibration fieldwork depends on an organisation's need for accurate trend data. The higher the accuracy required, the more fieldwork required.

The most accurate calibration data will result from very regular observation studies.

Sites with stable patterns of visitation do not need to be calibrated as regularly as those with variable patterns of use.

Existing calibration multipliers should not be used if significant site changes have occurred since the last fieldwork was conducted. New fieldwork should be undertaken to update calibration estimates.

It is advisable to update calibration multipliers if counter data are required for a high-priority report.

6.3 COUNTER DATA MANAGEMENT

A centralised database should be used to standardise methods for storage, processing and analysis of counter data.

Storage systems should be user-friendly to ensure managers can easily access information and make maximum use of the data.

Data storage systems should include a process for validating data to remove, or explain, erroneous values. This should be based on local knowledge of the site if possible.

Storage systems should be designed to incorporate calibration multipliers for each site and to apply these automatically once the information has been validated.

Data storage systems should clearly identify the difference between adjusted and unadjusted information on display (e.g. calibrated/uncalibrated, validated/unvalidated).

6.4 VISITOR SURVEYS AND ADVANCED CALIBRATION

At sites with low to moderate foot traffic, staff can undertake counter observation work at the same time as conducting visitor surveys.

Conducting visitor surveys at the same locations as vehicle counters can produce vehicle occupancy data, as well as profile and attitude information.

Linking visitor count data with information from visitor surveys will identify the characteristics and attitudes of visitors at peak and off-peak periods.

Accuracy of track counter calibrations can be increased by including a question on ‘route taken’ in on-site visitor surveys.

Information on ‘route taken’ is important when analysing data from multiple counters at a single site. It can increase the accuracy of calibration results and enable estimates of use to be made for other areas of the park or forest.

Visitor survey data can be collected independently from calibration work. The survey results can also be applied retrospectively to counter results.

Visitor surveys can be used to measure frequency of use, which enables data on numbers of visits to be converted into estimates of total visitor numbers.

6.5 RECOMMENDATIONS

Based on the key findings summarised above, the following recommendations are highlighted:

- Counter calibration should be a compulsory element in visitor counting systems.
- Standard fields of information should be agreed for all calibration work. These include group composition, direction of travel, time of passing and, where possible, profile and activity data.
- Non-visitor traffic should be identified and removed from calibration results.
- Every counter should be tested to ensure it is operating correctly before it is taken into the field. It should also be tested immediately after it is installed and before each calibration exercise.
- Every site should be calibrated before data analysis or reporting is undertaken. This will ensure that the data used are reliable and valid.
- Calibration results can be applied retrospectively; however this does not apply if patterns of use have changed at a site.
- Calibration results must be updated if patterns of use are considered to have changed significantly.
- Repeat calibration work should be planned for every site; however, the frequency of this must be based on the resources available.
- A centralised database should be used to store and process all counter data.
- The data storage system should apply calibration multipliers in a consistent manner for all sites.
- All counter data should be validated within the data storage system.
- Data managers should make a clear distinction between reports on the number of 'visits' being measured by the counter and the total number of 'visitors' using the area.
- Estimates of 'visitor' numbers should be based on 'frequency of use' information gathered through visitor surveys.
- Visitor surveys can also be used to gather advanced data on visitor profile and trip patterns.
- Trip pattern information can be used to interpret data from multiple counters as well as providing estimates of use in areas with no counting equipment.

DOC will use this information as a guide to develop Standard Operating Procedures for counter calibration.

7. References

AALC (Australian Alps Liaison Committee) 1995: Review of visitor monitoring in the Australian Alps. A review of techniques for counting visitors to the Australian Alps national parks and a computer-based recording system to monitor visitor use levels across the Australian Alps. By Leonie Wyld, Australian Alps Liaison Committee, September 1995.

Anon. 1996: National parks Visitor Monitoring System demonstration. Consultant's report prepared for the Department of Natural Resources and Environment, Melbourne, Vic., by R.J. Nairn and Partners, Traffic and Transport Surveys, and Serco Transport Systems. 49 p.

BW (British Waterways) 2002: Pedestrian counter calibration form. British Waterways, Watford, UK (unpublished).

BW (British Waterways) 2003: BW pedestrian counters—technical specifications and management issues. British Waterways, Watford, UK (unpublished).

CALM (Conservation and Land Management) 2004: Annual summary of vehicle counter results from Nambung National Park. Department of Conservation and Land Management, Western Australia, Perth, WA (unpublished).

Cessford, G.; Muhar, A. 2003: Monitoring options for visitor numbers in national parks and natural areas. *Journal for Nature Conservation 11*: 240–250.

Cope, A.; Doxford, D. 1997: Visitor monitoring: Otterburn Training Area. *Managing Leisure 2*: 217–229.

Cope, A.; Doxford, D.; Millar, G. 1999. Counting users of informal recreation facilities. *Managing Leisure 4*: 229–244.

Cope, A.; Hill, T. 1997: Monitoring the monitors. *Countryside Recreation News 5(2)*:10–11.

Dixon, T. 2004: People in the Scottish countryside and automatic people counters (APC's). *Countryside Recreation 12(2)*: 19–23.

DOC (Department of Conservation) 1992: Visitor monitoring manual: methods to count, record and analyse information about visitor numbers. Department of Conservation, Wellington (unpublished internal manual). 83 p.

DOC (Department of Conservation) 1999: Monitoring visitor numbers: status, methodologies and systems. Research Update: Investigation Number 2533. Department of Conservation, Wellington (unpublished status report). 16 p.

Harbrow, M. 2004: Southland visitor monitoring database: user manual. Department of Conservation, Southland Conservancy, Invercargil (unpublished internal report). 45 p.

Hornback, K.; Eagles, D. 1998: Guidelines for public use measurement and reporting at parks and protected areas. World Commission on Protected Areas. World Conservation Union (IUCN), Gland, Switzerland. 86 p.

Mooney, O.; Fairweather, S.; Kessels, G.; Christensen, B. 2003. Feasibility investigation of remote surveillance systems operating within a marine environment. *DOC Science Internal Series 136*. Department of Conservation, Wellington. 12 p.

PfAP (Paths for All Partnership) 2002: Monitoring path use. *Fact sheet 6.8*. Paths for All Partnership, Scotland, Alloa, Scotland. 7 p.

PWCNT (Parks and Wildlife Commission of the Northern Territory) 2002a: Nimtiluk National Park, counter data: off peak. Parks and Wildlife Commission of the Northern Territory, Palmerston, NT, Australia (unpublished).

PWCNT (Parks and Wildlife Commission of the Northern Territory) 2002b: Nimtiluk National Park, counter data: shoulder. Parks and Wildlife Commission of the Northern Territory, Palmerston, NT, Australia (unpublished).

PWCNT (Parks and Wildlife Commission of the Northern Territory) 2002c: Nimtiluk National Park, counter data: peak. Parks and Wildlife Commission of the Northern Territory, Palmerston, NT, Australia (unpublished).

SNH (Scottish Natural Heritage) 1999: Monitoring visitors to national nature reserves in Scotland. System three. Scottish Natural Heritage, Edinburgh.

SNH (Scottish Natural Heritage) 2002: Calibration factors for automatic people counters—guidance for site managers. Scottish Natural Heritage, Edinburgh, UK (unpublished).

Stichel, H. 1999: Training the South Australian Parks Service: visitor data service project overview. Pp. 38–53 in Visitor monitoring in National Parks: Notes from a workshop, 27–29 April 1999, Beechworth, Victoria. Environment ACT, Victoria.

Sustrans 2000: Report of the Birmingham and Black Country Canal Towpath Network Monitoring Programme 1999. Sustrans Research and Monitoring Unit, Newcastle, UK.

Sustrans 2001: Report of the Birmingham and Black Country Canal Towpath Network Monitoring Programme 2000. Sustrans Research and Monitoring Unit, Newcastle, UK.

Sustrans 2002: Report of the Birmingham and Black Country Canal Towpath Network Monitoring Programme 2001. Sustrans Research and Monitoring Unit, Newcastle, UK.

Sustrans 2003: Report of the Birmingham and Black Country Canal Towpath Network Monitoring Programme 2002. Sustrans Research and Monitoring Unit, Newcastle, UK.

USNPS (United States National Park Service) 2000: Director's Order 82: public use data collecting and reporting program. www2.nature.nps.gov/stats/do_82.pdf (viewed 22 Feb 2005).

USNPS (United States National Park Service) 2004: Traffic data report: George Washington Memorial Parkway, vehicle counter calibration results. United States National Park Service, Washington, DC (unpublished).

Wardell, M.; Moore, S. 2004: Collection, storage and application of visitor use data in protected areas: guiding principles and case studies. Murdoch University, Perth, WA.

Watson, A.E.; Cole, D.N.; Turner, D.L.; Reynolds, P.S. 2000: Wilderness recreation use estimation: a handbook of methods and systems. *General Technical Report RMRS-GTR-56*. Rocky Mountain Research Station, Forest Service, USDA, Ogden, UT. 198 p.

8. Additional sources

AALC (Australian Alps Liaison Committee) 1994: Visitor Monitoring Strategy. A report on approaches and systems for monitoring visitor numbers and attitudes in the Australian Alps national parks. By David Pitts, Environment Science and Services, for Australian Alps Liaison Committee, March 1994. Australian Alps Liaison Committee, Canberra, ACT.

AALC (Australian Alps Liaison Committee) 2000: Visitor monitoring in National Parks. Best practice workshop notes from a workshop, 27–29 April 2000, Beechworth, Victoria. Australian Alps Liaison Committee. 86 p.

ANZECC (Australia and New Zealand Environment and Conservation Council) 1999: ANZECC Working group on national parks and protected area management. Australia and New Zealand Environment and Conservation Council.

DOC (Department of Conservation) 1988: A review of visitor monitoring in the Department of Conservation. Department of Conservation, Wellington (unpublished internal report).

DOC (Department of Conservation) 1998: Visitor monitoring plan, visitor use and impacts. Department of Conservation, Wellington (unpublished internal report).

Gasvoda, D. 2004: Trail traffic counters. *Revised guide on Trail Traffic Counters 9E92A46*. Forest Service Technology and Development Program, Forest Service, USDA, Missoula, MT and Federal Highway Administration, USDT. www.fhwa.dot.gov/environment/fspubs/99232835/ (viewed 16 Nov 2005).

Gregoire, T.; Buhyoff, G. 1999: Sampling and estimating recreational use. *General Technical Report, PNW-TGR-456*. Pacific Northwest Research Station, Forest Service, USDA, Portland, OR. 39 p.

McIntyre, N. 1999: Towards best practice in visitor use monitoring processes: a case study of Australian protected areas. *Parks and Leisure Australia, September*: 24–29.

New Zealand Office of the Privacy Commissioner. www.privacy.org.nz/top.html (viewed 22 Feb 2005).

New Zealand Research Archive: www.knowledge-basket.co.nz (viewed 22 Feb 2005).

NPW (National Parks and Wildlife) 1999: Visitor data system—project overview. National Parks and Wildlife, South Australia, Adelaide, SA (unpublished).

Parr, D. 2003: Abel Tasman National Park coast visitor research 2002/2003. Department of Conservation, Nelson, NZ (unpublished). 112 p.

SUSTRANS website: www.sustrans.org.uk (viewed 22 Feb 2005).

SUSTRANS 2004: The National Cycle Network, route user monitoring report—to end of 2003. Sustrans Research and Monitoring Unit, Newcastle, UK.

Zanon, D. 2002: Mornington Peninsula National Park, visitor monitoring project, visitor and asset strategy. Parks Victoria, Melbourne, Australia.

9. Glossary and abbreviations

9.1 GLOSSARY

Average vehicle occupancy	The average number of people in each vehicle.
Calibration exercise	The process of observing the number of visits to a counter site over a set period, and comparing the results with the numbers recorded by a visitor counter. It shows how much the instrument is under- or over-counting, and provides the basis for a calibration multiplier.
Calibration multiplier	The adjustment figure used to convert raw counter data into accurate estimates of visits. It reflects the level of error identified during counter calibration.
Data validation	The process of checking and explaining abnormal counter results.
Visit numbers	The number of individual visits made to a site. Counting instruments provide data on the number of visits to an area, rather than the number of visitors.

9.2 ABBREVIATIONS

AALC	Australian Alps Liaison Committee
ANZECC	Australia and New Zealand Environment and Conservation Council
DOC	Department of Conservation, New Zealand
BW	British Waterways
SNH	Scottish Natural Heritage
CALM	Conservation and Land Management, Western Australia
SUSTRANS	Sustainable Transport Charity, UK
USDA FS	United States Department of Agriculture Forest Service
USNPS	National Park Service, United States
PfAP	Parks for All Partnership, Scotland
PWCNT	Parks and Wildlife Commission of the Northern Territory, Australia
VISTAT	Visitor Information Statistics Database, CALM, Australia

Appendix 1

DOC COUNTERS AND ERROR ISSUES

Testing of new counting instruments commenced at the start of August 2004 and initial trials have been successful. DOC plans to use four standard types of visitor counter. Three of these are designed for use on tracks, and the fourth is a vehicle counter for use in car parks and road access points.

COUNTER TYPE AND DESCRIPTION	POTENTIAL CAUSES OF DATA ERROR
Step counter (tracks) Designed to look like a normal step. Records visitors by detecting vibrations caused when they stand on, or near, the instrument.	Over-counting causes Visitors may be counted twice if they walk out and back on the same route, because they will pass the counter twice, for one visit. Applies to all track counters. Counter cannot distinguish between movements of the staff and those of the public. Under-counting causes Visitors with a very long stride may step over the instrument and be 'missed'. When a group of visitors passes the instrument quickly, the counter may not register every individual. Particularly a problem with large groups.
Passive infra-red counter (tracks) Installed in a discrete location next to the track. Sensor is fixed c. 1.5 m above ground and records visitors by detecting temperature change they cause when they walk past.	Over-counting causes Visitors may be counted twice if they walk out and back on the same route. Counter may detect changes in temperature caused by moving vegetation. Cannot distinguish between staff and members of the public. Under-counting causes Counter may not register visitors wearing heavy winter clothing owing to insulation of their body heat. Small children may walk under the counter beam without being detected. Visitors who pass side-by-side or in groups may not be counted as individuals. Counter may not register visitors moving very quickly such as runners and cyclists.
Pressure pad counter (tracks) Consists of a pressure-sensitive pad buried beneath the track surface. Records visitors when they stand on the pad.	Over-counting causes Visitors may be counted twice if they walk out and back on the same route. Counter cannot distinguish between staff and members of the public. Under-counting causes Visitors with a very long stride may step over the instrument and be 'missed'. Visitors who walk over the counter side-by-side or in groups may not be counted as individuals. Counter may become less sensitive if the soil above it becomes frozen or compacted.
Vehicle counter (vehicle access routes) Uses a metal loop buried just beneath the surface of the road. Records vehicles by detecting the magnetic signal created.	Over-counting causes Vehicles may be counted twice if they are driven out and back on the same route. Counter cannot distinguish between staff vehicles and those of the public. Under-counting causes Records only each vehicle that passes, rather than the number of occupants. Many vehicles will contain more than one visitor. Vans and buses carrying large numbers of people will generally be recorded in the same way as smaller capacity vehicles such as cars.

Appendix 2

ORGANISATIONS CONTACTED

United States

Rocky Mountain Research Centre
University of Arizona
US Army Corps of Engineers
US Department of Agriculture, Forest Service
US National Park Service

Canada

Parks Canada

Australia

New South Wales National Park and Wildlife Service
Northern Territories, Parks and Wildlife Service
Parks Victoria
South Australia, National Parks and Wildlife
Western Australia, Conservation and Land Management
Queensland Parks and Wildlife Service

United Kingdom

British Waterways
Brecon Beacons National Park
Cairngorms National Park
Exmoor National Park
Lake District National Park
Loch Lomond National Park
New Forest National Park
North Yorkshire Moors National Park
Northumberland National Park
Peak District National Park
Scottish Natural Heritage
Snowdownia National Park
South Downs National Park
Sustrans
Yorkshire Dales National Park

Other

China Parks Trust
Europarc
Metsāhallitus (Finland)

Appendix 3

COVERING LETTER

August 2004

Dear Sirs,

I am currently working on a Visitor Monitoring project for the Department of Conservation (DOC) in New Zealand. DOC is the national management agency that looks after New Zealand's network of protected public lands and national parks. These comprise over 30% of New Zealand's land area and include an extensive portfolio of visitor facilities (refer www.doc.govt.nz). Like any similar park management or visitor service agency, we have a priority need for reliable information on visitor numbers and distribution, and we have been developing visitor counting systems to achieve this.

The objective of the project I am working on in this context is to review and standardise the way the organisation's visitor counting instruments are installed and managed.

As part of this study the project team will undertake the following work:

1. A review of existing counting equipment and data management systems on land managed by DOC
2. A programme of site selection and installation for new counting instruments
3. Updating systems for the download, storage and analysis of counter data
4. Development of a standard method for the calibration of visitor counters

My focus is on stage 4 - methods used to calculate calibration multipliers. This work is required to correct the error that exists in counter data from occurrences of systematic over and under counting. As part of my review of management practice in this area, I am interested in the calibration methods used by other organisations that are operating visitor counting instruments. I would therefore appreciate any information on how this is managed within your organisation. The specific issues I am interested in are as follows:

1. A brief description of the following:
    - The type and number of visitor counting instruments your organisation manages
    - The way in which data collection is managed
    - The way in which data storage and analysis is managed

2. A more detailed description of the following:
    - The method used to calculate 'calibration' or 'adjustment' multipliers to correct error in counter readings
    - Any methods used to gather information on visitor profile and activity (associated with counter calibrations)
    - Details of how frequently calibration 'surveys' are conducted
    - Details of who is responsible for setting up and conducting calibration work

It would be greatly appreciated if you could send me information of this type. If it will help, you could use the attached form to frame your response. Ideally, please email your response to jross@doc.govt.nz, or post it to me at the address below. Alternatively, if you would rather discuss this on the phone, I will be happy to call you at a convenient time. Please email me to arrange a time if this is the case.

I will be circulating a report of my findings to all organisations involved in the review and hope that you will find a copy of this useful for your future work in this area. Please don't hesitate to contact me if you have any questions about this project, or if you wish to pass on contact details of colleagues who also work in this field.

Yours sincerely,

Julian Ross
Visitor Monitoring Developer
Science and Research Unit
Department of Conservation
PO Box 10420
Wellington
+64 (0)4 471 324104

Appendix 4

CALIBRATION METHOD FEEDBACK FORM

Thank you for completing this form with information on how your organisation manages calibration work for visitor counting instruments. Please provide answers in the spaces provided:

Please continue answers on a separate page if necessary

1. What type of visitor counting instruments does your organisation use and how many of them do you currently have operational?
2. Who is responsible for collection of data from your counters and how is the information collected?
3. How is information from your counters stored and analysed?
4. What method do you use to calculate 'calibration' or 'adjustment' multipliers to correct error in counter readings?
5. Do you gather information on visitor profile and activity during calibration studies? If so how is this done?
6. How frequently are calibration surveys conducted at each of your counter sites?
7. Who is responsible for setting up and conducting calibration fieldwork?

Thank you for taking time to complete this form. Please email it to me at the following address:

jross@doc.govt.nz

Appendix 5

REGULATIONS REGARDING VIDEO CAMERA USE IN PUBLIC AREAS IN NEW ZEALAND

The following information was provided by an advisor from the New Zealand Office of the Privacy Commissioner on Wednesday, 22 September 2004.

The 1993 Privacy Act is primarily concerned with the protection of personal information. This includes any information from which an individual can be identified. Video cameras used for calibration purposes should therefore be set up slightly out of focus if possible.

If identification is possible from the video footage, measures should be taken to inform visitors that filming is underway. However, this does not apply if the use of a sign will alter the information that is collected (see section 6, principle 3 of the Act).

DOC should not store video footage any longer than necessary. Once the required information has been gathered from the video, all footage should be deleted.

A full copy of the Information Privacy Principles is available from www.privacy.org.nz/people/peotop.html (viewed 22 Feb 2005).

A full copy of the 1993 Privacy Act is available from www.knowledge-basket.co.nz/privacy/legislation/1993028/toc.html (viewed 22 Feb 2005).

Appendix 6

A DOC VISITOR COUNTER TRIAL, CATCHPOOL VALLEY

DOC visitor counter trials were set up at Catchpool Valley, near Wellington, at the end of July 2004. Five step counters were installed at the locations shown in Fig. A5.1. The counters were located to provide information on relative levels of use on the main track and associated side tracks. Information from the counters was downloaded on a weekly basis and stored in a trial version of DOC's VAMS database. The configuration of the database was developed to process and store counter data during the course of this project.

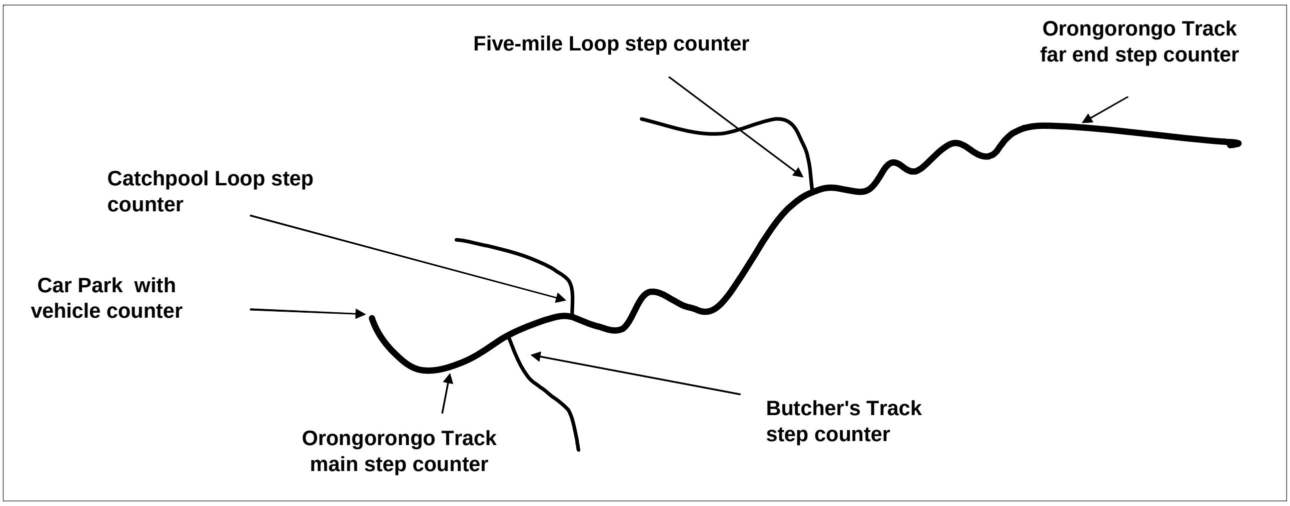


Figure A5.1. Layout of Catchpool Valley visitor counter network.

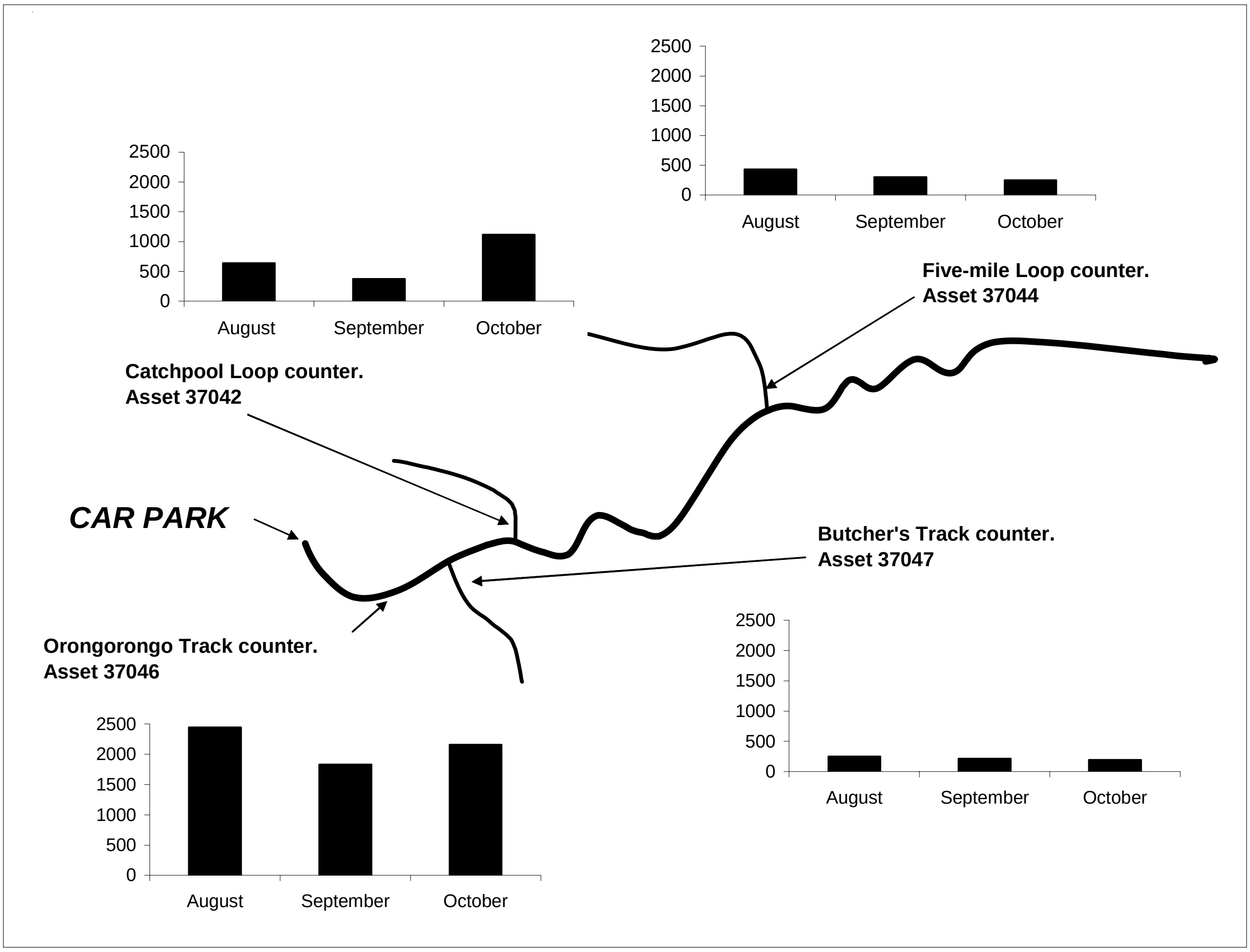


Figure A5.2. Monthly totals for counters at Catchpool Valley, August–October 2004. Counter at the far end of Orongorongo Track is excluded because of insufficient data.

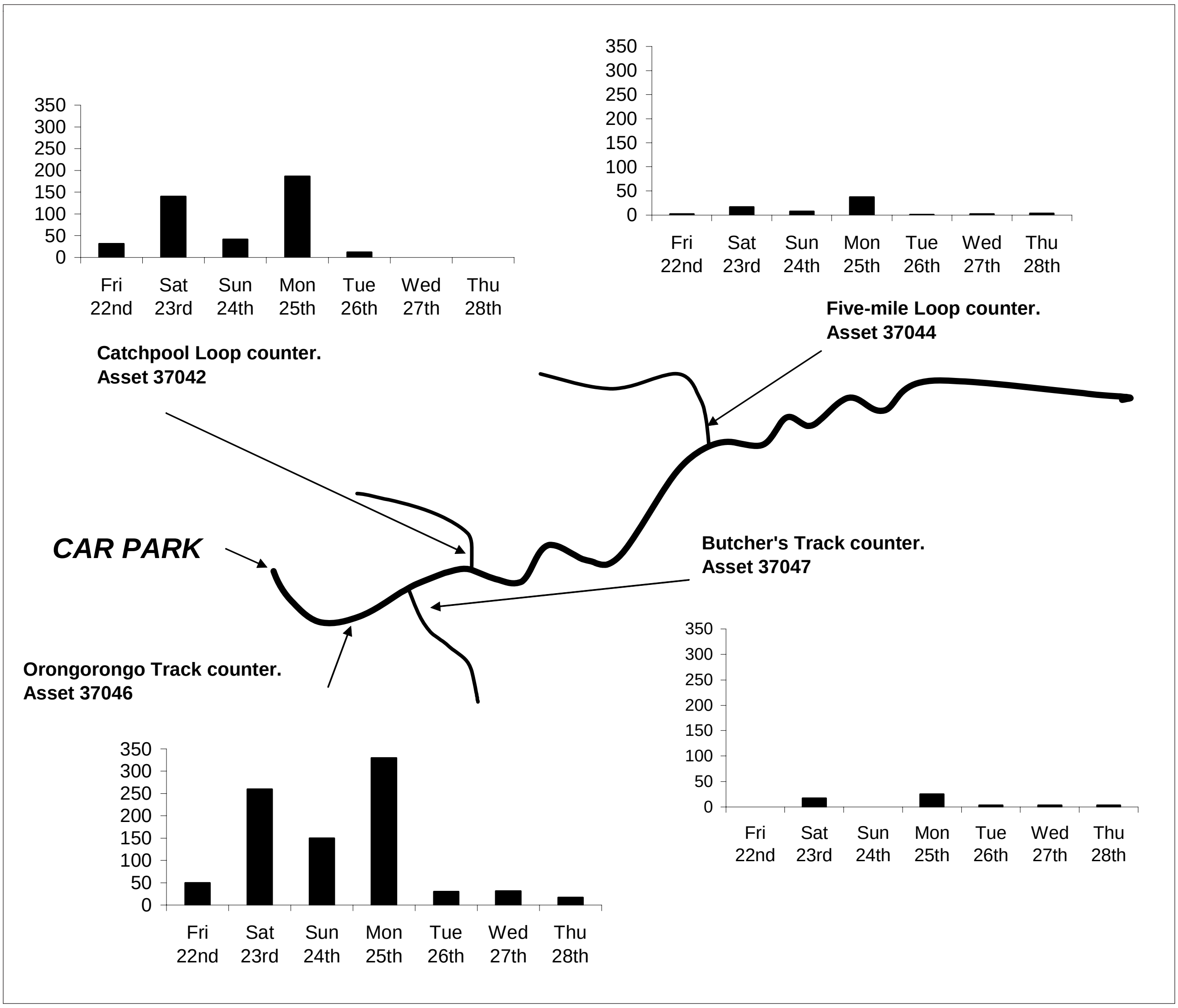


Figure A5.3. Daily totals for counters at Catchpool Valley, 22–28 October 2004 (including Labour Weekend).

Figure A5.4. Daily totals for vehicle and main track counters at Catchpool Valley, 30 August–9 September 2004 (all data are uncalibrated).