# DETERMINING CAVE VISITATION LEVELS: A PRESSURE ACTIVATED COUNTER

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Abstract: The description of a counter that can be used to determine cave visitor levels is given.

The preliminary results of visitor numbers determined using the pressure counters are presented for Giants Cave (WI-21) and Calgardup Cave (WI-49).

## INTRODUCTION

Cave visitation rates are a very important factor in making informed management decisions relating to caves. A previous visitor book study combined with on-site visitor counting produced crude, though valuable, estimates of cave visitor levels to Giants Cave (WI-21) in the South-West of Western Australia (Webb 1989).

These estimates were used to convince the management authority, the Department of Conservation and Land Management (CALM), that the visitation rates to this and other caves in the region were unacceptably high. However the visitation rates to other caves were unknown and very poorly studied.

In an attempt to monitor the rates and levels of cave visitation to Adventure and Wild caves in the Leeuwin-Naturaliste National Park (LNNP) the Cave Management Advisory Committee (CMAC) proposed the use of foot counters. These pressure counters were being trialed on tracks in the National Park in an attempt to determine Park visitor numbers.

### The Counter

The counter, shown in Figure 1, was constructed as follows. A marine plywood board (A) was used to back the pressure contact device (B,C,D). This contact device (B,C,D) was purchased commercially as a roll of plastic (B) containing a horizontal matrix of metal contacts (C) held apart with a thin layer of foam. These metal contacts are connected by a thin vertical strip of metal (C).

The plastic was attached to the marine ply with Sylastic and tacks. Wires (E) were soldered to the ends of the vertical metal strips and then soldered to the leads from the electronic counter (F). This completed the circuit so that every foot placed on the contact device (B) incremented the electronic counter (F). If the contact device was held closed the counter would not be incremented multiple times unless the contacts were opened and closed multiple times. This is likely to occur if cavers jump up and down on the counter!

The electronic counter contains a 9V battery which the vendors claim has a life of up to three years. In the cave the counter was housed in an air-tight tin with the wires entering the tin through a hole in the top that was filled with Sylastic.

A small amount of Silica Gel was placed in the containers to reduce water vapour. The entire board and plastic pressure device was covered with canvas to protect it.

The major problem with the counters was corrosion at soldering points. In all cases if the joint was open to the atmosphere then corrosion occurred. In several cases this caused the counter to stop registering.

### Placing the Counters

Giants Cave (WI-21) is known to have high visitation and previous results to compare the results of the counter and hence this was chosen as the first site. The counter was placed some 200m into the cave at the base of the first upward staircase. This location was chosen as a point where all visitors were likely to traverse as the staircase is the easiest route onwards.

Due to the large number of visitors passing this point the soil was so heavily compacted that after digging it up with a shovel it lifted in slabs and had to be cut and broken up with the shovel. At first the counter was placed some 8 cm below the surface as it appeared to work perfectly at this depth. However after 1 to 2 months the counter became erratic as the soil had become compacted and was acting as a large plate.

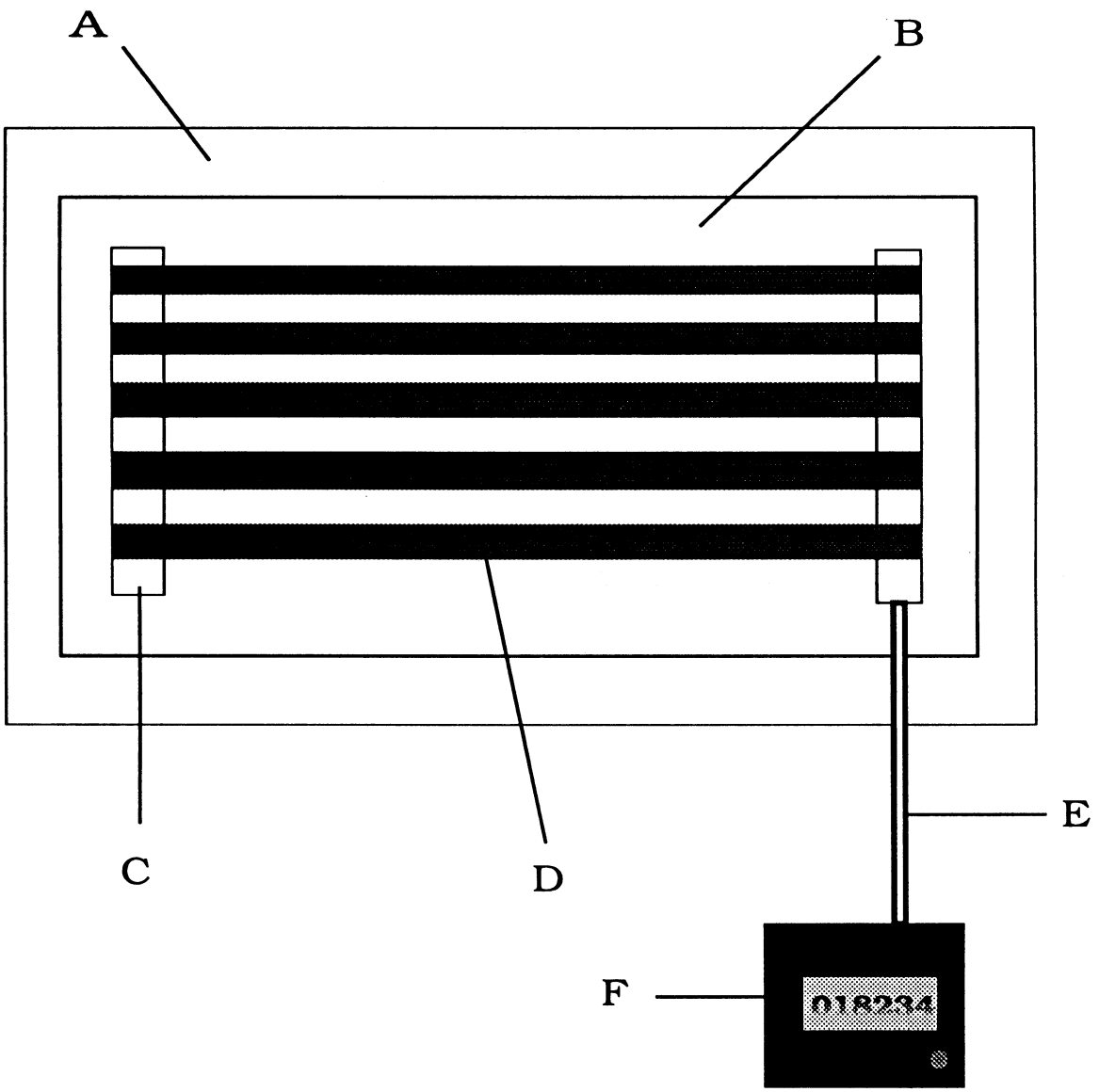


Figure 1
(The Pressure Pad Counter)

Digging up the counter required breaking up the "slab" of compacted soil, loosening the soil, and then raising the level of the counter to only a few centimeters below the surface. At this depth the counter was more obvious as the "ground" sounded hollow at that point. It did in fact draw attention and on one occasion was found uncovered on a reading trip.

Similar experiences occurred in Calgardup Cave (WI-49) where two counters were placed in the cave. The cave has two major extensions from the entrance and one counter was placed in each extension. One location was more likely to count all visitors as it was in a passage constriction that visitors were likely to traverse (Counter 2 in Table 1). However in the second case visitors were likely to bypass the counter by traversing it on the other side of the passage (Counter 1 in Table 1). Counter 1 was in fact uncovered by visitors and found in pieces by the Ranger. After repair the counter was returned to the cave but the electronic counter was stolen within one month.

**The Results**

The counter in Giants Cave was installed just prior to Easter 1990 and the very large figure of 2710 (Table 1) after only 14 days clearly indicates the high level of visitation that occurs over the Easter holidays.

The figures shown in Table 1 clearly indicate the steady increase in visitor numbers when the counters are read on a regular basis. Over the period from September to early December the counters were read almost every seven days by Rob Klok (CALM - Caves Ranger). These figures indicate a consistent count on a weekly basis.

**Actual and Estimate Counts**

The actual counts from the counter are labelled Actual Count while an Estimate Count of 70% of the Actual has been used to reduce errors noted in the counters when multiple counts are made by one person. This effect is somewhat counteracted by the counter failing to count some people at all. Controls are yet to be performed. Once a period of actuals versus counted have been observed then the Estimate Count will be more accurate.

**Daily and Annual Estimates**

The daily estimates are a calculation based on the Estimate Count divided by the number of days of recording. The Annual Estimates are the Daily Estimate multiplied by 365. In general the Annual Estimates appear consistent throughout the period of regular recordings.

The Average Daily Estimates for Giants Cave over the period of Nov-Dev 1990 provides an estimated annual visitation rate of approximately 15000. This figure is believed to be on the low side given the use of the conservative 70% estimate. If this is true then the figure corresponds well with the annual estimates of 17000 to 18000 proposed by Webb (1989) as a result of visitor book and on-site studies.

It should be noted that these estimates are certainly low as they DO NOT take into consideration the peaks such as that observed Easter. Furthermore the busiest two months of the year, January and February, are yet to be counted!

Hence annual estimates of 25000 plus are very likely.

Giants Cave (WI-21)
Counter Figures
Percentage Estimate 70%

| Date Read | No of Days | Actual Count | Estimate Count | Daily Estimate | Annual Estimate |
|---|---|---|---|---|---|
| 10/03/1990 | 0 | | | | |
| 24/03/1990 | 14 | 2710 | 1897 | 135 | 49457 |
| 01/04/1990 | 22 | 3113 | 2179 | 99 | 36153 |
| 21/04/1990 | 42 | 6078 | 4255 | 101 | 36974 |
| 02/09/1990 | 176 | 10171 | 7120 | 40.5 | 14765 |
| 08/09/1990 | 182 | 10447 | 7313 | 40.2 | 14666 |
| 14/09/1990 | 188 | 10700 | 7490 | 39.8 | 14542 |
| 22/09/1990 | 196 | 11087 | 7761 | 39.6 | 14453 |
| 29/09/1990 | 203 | 11640 | 8148 | 40.1 | 14650 |
| 06/10/1990 | 210 | 12232 | 8562 | 40.8 | 14882 |
| 13/10/1990 | 217 | 12918 | 9043 | 41.7 | 15210 |
| 20/10/1990 | 224 | 13451 | 9416 | 42.0 | 15343 |
| 28/10/1990 | 232 | 13908 | 9736 | 42.0 | 15317 |
| 01/11/1990 | 236 | 13931 | 9752 | 41.3 | 15082 |
| 11/11/1990 | 246 | 14314 | 10020 | 40.7 | 14867 |
| 18/11/1990 | 253 | 14690 | 10283 | 40.6 | 14835 |
| 23/11/1990 | 258 | 15082 | 10557 | 40.9 | 14936 |
| 24/11/1990 | 259 | 15143 | 10600 | 40.9 | 14938 |
| 30/11/1990 | 265 | 15643 | 10950 | 41.3 | 15082 |
| 08/12/1990 | 273 | 16116 | 11281 | 41.3 | 15083 |
| 10/03/1991 | 365 | 21547 | 15083 | 41.3 | 15083 |
| Average Daily for Sept-Nov 1990 => | | | | 41 | 14926 |

Table 1

Calgardup Cave (WI-49) Counter No 1
Counter Figures
Percentage Estimate 70%

| Date Read | No of Days | Actual Count | Estimate Count | Daily Estimate | Annual Estimate |
|---|---|---|---|---|---|
| 24/03/1990 | 0 | | | | |
| 31/03/1990 | 7 | 162 | 113 | 16 | 5913 |
| 21/04/1990 | 28 | 536 | 375 | 13 | 4891 |
| 18/08/1990 | 147 | 6391 | 4474 | 30 | 11108 |
| 02/09/1990 | 162 | 6554 | 4588 | 28 | 10337 |
| 24/03/1991 | 365 | 14767 | 10337 | 22 | 8062 |
| Average Daily for Sept-Nov 1990 => | | | | 29 | 10722 |

Calgardup Cave (WI-49) Counter No 2
Counter Figures
Percentage Estimate 70%

| Date Read | No of Days | Actual Count | Estimate Count | Daily Estimate | Annual Estimate |
|---|---|---|---|---|---|
| 24/03/1990 | 0 | | | | |
| 31/03/1990 | 7 | 254 | 178 | 25 | 9271 |
| 21/04/1990 | 28 | 1705 | 1194 | 43 | 15558 |
| 02/09/1990 | 162 | 6716 | 4701 | 29.0 | 10592 |
| 28/10/1990 | 218 | 10628 | 7440 | 34.1 | 12456 |
| 01/11/1990 | 222 | 10717 | 7502 | 33.8 | 12334 |
| 11/11/1990 | 232 | 11245 | 7871 | 33.9 | 12384 |
| 18/11/1990 | 239 | 11544 | 8081 | 33.8 | 12341 |
| 25/11/1990 | 246 | 11828 | 8280 | 33.7 | 12285 |
| 30/11/1990 | 251 | 12220 | 8554 | 34.1 | 12439 |
| 09/12/1990 | 260 | 12979 | 9085 | 34.9 | 12754 |
| 24/03/1991 | 365 | 17795 | 12456 | 32.8 | 11969 |
| Average Daily for Sept-Nov 1990 => | | | | 33 | 12173 |

Table 1 (Continued)

**Future Counters**

These counters are not perfect and certainly not the best method of counting cave visitors. However at approximately $120 per counter they are relatively cheap compared to other electronic means.

Having said they are cheap it is proposed to trial a more reliable and expensive counter, an infrared beam counter, which can be incorporated into a set of stairways in the near future.

**Using the Results**

It is the authors sincere hope that the CMAC is able to use these and future estimates to propose management initiatives that result in a reduction of this level of visitation. If conference delegates visit Giants and Calgardup caves they should be appalled by the severe vandalism and degradation that has occurred in both caves. It is now in the hands of the management authority to put in place management policies that ensure further severe degradation of these and other caves does not occur.

**References**

Webb, R. (1989) Proceedings of the Australasian Cave Management Association, Punaukaiki, New Zealand.