Social Carrying Capacities at the 12 Apostles, Port Campbell National Park

Hamish Webb
(The University of Melbourne)

Kathryn Williams
(The University of Melbourne)
(Supervisor)
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Abstract

Management of the 12 Apostles site, Australia, needs to consider the impact that crowding has on the satisfaction of a visitor’s leisure experience as well as the conservation of the site. The concept of leisure is complex and draws upon demographic characteristics, such as gender and age cycle, as well as past life experiences and knowledge. These features influence the leisure choices we make and the satisfaction we derive. A major issue of leisure experiences and leisure management is crowding, which is dependent upon the site as well as the individuals. This paper reports on an interpretative study of the impact of crowding and the influence of demographics and past experiences at the 12 Apostles site. This was achieved using interview-based questionnaires with photographic aides combined with a visitor tracking system. The results were analysed using simple descriptive statistics and some non-parametric tests of association. It shows that there are some differences between recommended and preferred (or socially accepted) visitor numbers, and that the extent of this difference varied across the three physical locations assessed. The study examined the association between visitor characteristics and preferred visitor numbers and found no evidence for reliable relationships. The behaviour of other visitors to the site was found to make only a small contribution to experience of crowding, and the experience of crowding was found to have little association with duration of visit. Generalisation of results is significantly restricted by unique characteristics of this site and of the season in which the study was undertaken.
1: Introduction

The 12 Apostles is one of Australia’s most spectacular natural wonders and a feature of the internationally renowned Great Ocean Road on Victoria’s rugged southwest coast. Only 3 hours from Melbourne, the site attracts over 2.5 million visitors each year and is a major part of the local economy. The site is an extremely fragile environment under constant pressure from the natural ocean forces and the weight of visitors. Successful park management strategies have to balance site protection and maximise the visitor experience. To achieve this balance, the park’s management strategy must be dynamic and continually assess the condition of the site and the satisfaction of the visitors.
It is vitally important that park management understands the factors affecting the site, both environmentally and socially. Environmental assessment is carried out using a monitoring system, which looks at ecosystem health. The assessment of the social status is more complex, and the focus of this study.

In regards to visitors, the aim of management is to maximise the leisure experience and satisfaction of each visitor, while not degrading the site for future generations. Achievement of this requires a good understanding of what the visitor wants from their experience, which is a complex issue. The aim of this study is to examine the factors that affect and influence the leisure experience that an individual wants and has. In particular, this study will focus on the issue of crowding and the reactions of individuals to crowds. This involves exploring the differences in features such as perceptions, ideals and expectations that affect the leisure experience, and testing their importance. A large part of this study involves developing an understanding of the leisure experience, crowding norms and demographic idiosyncrasies in the context of an outdoors recreational setting.

This project forms part of a broader study that has been instigated by Parks Victoria. The aim of the larger study is to develop a computer based management program that simulates the movement of visitors within the 12 Apostle site, in varying crowd sizes (Itami et al., 2001). This part of the project examines whether different demographic groups need to be treated as different agents within the simulation, and if so, how. A second part of this study involves the mapping of visitor movements within the site and developing the computer simulation program in conjunction with Parks Victoria. This is being carried out by the Geomatics department of The University of Melbourne.
1.1: Study Site Description
The 12 Apostles site is part of the Port Campbell National Park, approximately 250km south west of Melbourne, Australia (Map 1), and is one of the feature attractions of Victoria’s Great Ocean Road. In 2000, the site underwent a major redevelopment, with the installation of a new car park across the highway and a new visitor centre, shelter and upgrade of the boardwalk.
Location of the 12 Apostles Site, Port Campbell National Park

Map 1

Aerial View of the 12 Apostles Site with Pathways

Figure 3
1.2: The Leisure Experience

To ensure that any management plan is relevant to its intended site, it is important that managers have an understanding of what constitutes a leisure experience. Numerous books, journals, articles, discussion papers and presentations have analysed, discussed, described and attempted to define ‘Recreation’ and ‘Leisure’. The end result of the majority of this literature (e.g., Neulinger (1978), Mercer (1980) and Driver et al (1991)) is that there is no clear definition of leisure or what drives an individual’s or a group’s leisure choices. Similar uncertainty surrounds what people enjoy in a leisure experience or what the governing factor is. Hill et al. (1996) found that time at leisure was the most important factor, or equally as important as the activity or the setting. Stewart and Cole (2001) found that encounters with other visitors was the most important factor, yet the influence of this factor was small. Other studies have stated that other demographics, such as gender (Wearing (1984); Australian Bureau of Statistics (1986)), life cycle or age grouping (Mercer 1980; Carr, N., (2001)), or group type (Veal, 1991), culture (Kozak (2002), as well as income. A person’s expectations of the leisure experience have also been shown to be important. Factors that effect an individual’s experience and the benefit of leisure include health (Hill, et al. 1996), exercise and socialising (Stewart and Cole, 2001), privacy, solitude and intimacy (Manning, 1985), type of user group (Inglis et al. 1999), quality and nature of settings (Hill et al. 1996).

The question of benefits of leisure is just as complex, Hamilton-Smith (1994) found that leisure reduces psychological and physiological stress and improves our ability to manage stress, while Labone and Wearing (1994) identified the increased social interaction as another benefit. The conclusion one can make from these studies is that an individual or groups’ leisure choice or experience is not governed or driven by one factor or feature, but a combination of all the above as well as other issues. This is a similar conclusion to that of Pitt and Woodside (1986), who identified that leisure or travel behaviour may be differentiated on the basis of an individual’s personal values.
Definitions of leisure have varied from philosophic, psychological, physiological, social to historic. For this study, the most appropriate definition of leisure is that of Craig (1977), who loosely describes leisure and outdoor recreation as ‘those activities that people enjoy out of doors during their leisure time’ combined with a description of leisure time being ‘time that you are not at work’. In the present work climate, this definition becomes hazier, especially as the line between leisure and work is no longer clearly defined. However, this definition captures the essence of most other definitions and is suitable for this study.

As described above, the factors driving leisure experiences and the rewards an individual receives from a leisure experience are complex and differ according to numerous features (mainly demographic). However, there are a couple of benefits from leisure that are tangible. Hamilton-Smith (1994) describes studies, which have found that being exposed to the natural environment leads to a reduction of psychological and physiological stress and enables enhanced management of stress.

1.3: The Crowding Concept
Management of natural areas involves planning for both the conservation of the ecological resource and the possible opportunities that they provide for tourism and nature-based recreation. The aim of site managers is to maintain a quality level of service at the site. Quality of service refers to the satisfaction that each individual derives from his or her leisure experience. The aim of all management plans is to ensure that this quality of service and therefore visitor satisfaction is high. Strategies such as controlling visitor numbers and behaviour are examples of maintaining quality of service and ensuring that the experience is not diminished. This is especially important for visitors seeking more specialised recreational experiences that may involve feelings of solitude and intimacy with nature (Manning, 1985). For many people, the issue of crowding can have a significant impact on their nature-based recreational experience. The magnitude of this effect is dependent upon an individual’s expectation of a particular experience.
There is much debate surrounding the definition of crowding, its relevance to management decisions and its impact on an individual's experience. West (1982) used the following definitions of crowding and density:

“Crowding: the negative evaluation of a density that exceeds a certain point, where density is the number of individuals in a particular setting and their distribution.”

Many past studies, such as Stewart and Wagor (1964), Shelby and Herberlein (1986) and Cole (2001), have focused on crowding as being related to density, with an increase in density resulting in a decrease in the overall experience for an individual.

However, other studies have recognised that density is not the only important factor in determining the impact of crowding on a leisure experience. Inglis et al. (1999) acknowledges that the type of user group is vital in determining the impact of crowding on an individual’s experience. In their study of the Great Barrier Reef, Inglis et al. (1999) divided individuals into user groups depending on their familiarity with the specific site:

1. Experienced recreational group (local scuba diving club)
2. Locals (not specialists, occasional visitors)
3. Tourists
4. Novices

Their results showed that previous site experience was an important factor in crowd level tolerance. The Experienced group showed the greatest dislike for crowds and held stronger views of what is an adequate crowd size. These results are in line with other studies which show that as experience levels in a site increase, so does the desire for privacy and solitude (Harper, 1981, Inglis et al. 1996, Stewart and Cole, 2001). Other cognitive factors such as crowd behaviour have been identified as equally important as crowd density (Gramann, 1982, West, 1982, Shelby et al., 1983). West (1982) focused on the view that objectionable behaviour affects a person’s perception of crowding, not just density and number of encounters. In particular, West (1982) looked at behaviour that violates the norms of wilderness behaviour, which is especially salient with the expectations of wilderness experts. Badger (1975) found that 71% of campers felt that the behaviour of others was the most critical factor affecting their wilderness experience,
while only 13% felt that the number of encounters was the most critical factor. Manning, (1995) found that occasional encounters with other groups of similar behaviour and use, does not detract from a visitors experience and may even improve it. In terms of behaviour, activities such as littering (Stanley, 1973), excessive noise and non-compliance with park regulations (Lee, 1975) had the greatest impact on a persons experience. It is therefore important when developing management strategies for crowd control and crowding to consider the influence of past experiences, expectations and behaviour as well as density.

An important aspect of carrying capacity studies is to group individual responses together with similar patterns and look for any social pattern or norms. This is achieved by gathering information about people’s preferences with respect to the provision of various needs, and is referred to as Crowding Norm research. Manning et al. (2001) examined the viability of developing and using crowding norms as a crowd management tool. Their findings showed that it is important to develop social norms as they give a good indication of what is occurring at a site and provide a viable estimate.

A key component of such research is the demographical data relating the visitors to the site. The main demographic characteristics associated with an individual’s leisure experience are gender, age or life cycle, culture and travel type. Wearing (1984) examined the issue of gender and found that there are differences in the expectations and leisure requirements of males and females. Females were found to prefer activities that are non-competitive and socially orientated. Kozak (2002) examined the issue of cultural differences in regards to different nationalities and found that there were differences in the motives of visitors from different nationalities. However, this study also acknowledged that this result varied significantly depending on the site. Age and life cycle have long been described as the most influential factor affecting an individual’s leisure choice and experience. ‘Young’ people are thought to prefer more active participation in their leisure pursuits compared to the ‘Mature’ grouping, who prefer more passive experiences (Mercer, (1980); Neulinger, (1978)). However, these findings do vary depending on the site and type of leisure experience.
Travel type is generally defined by the type of group in which an individual travels and it has been shown that there is an association between travel group and the number of people perceived. For example Veal (1991) identifies visitors travelling alone, with a partner or spouse, in a family or friendship group or as an organised tour as the most common travel types visiting national parks and has compared differences in leisure experiences. The study by Veal (1991) found that there is a strong linkage between these travel types and differences in perceptions, expectations and maximum acceptable number of visitors. Traditionally visitors travelling alone have been found to want a more secluded and intimate experience than those in groups do (Stewart and Cole (2001)). However, since most studies focus on the individuals and not larger groups, there is less information available on the features of the larger groups.

1.4: The Visitor
While crowding may be defined as a function of density or behaviour, it is reliant on an individual’s perception of these features. A key theme among many past crowding and leisure studies is the importance of recognising the different wants, needs and characteristics of individual visitors. It is also important to understand the difference in perceptions and expectations for individuals and the major demographic groups. Past studies have shown that this perception varies for different users, especially at the demographic and user type levels (Kozak (2002); Labone and Wearing (1994); Veal (1991); Mercer (1980)). A similar pattern is observed for a person’s expectation, especially in regards to crowd size. Perception and expectation are vitally important facets of crowding, as it has been found that people will feel most crowded when they encounter more people than they expected (Shelby et al. (1983); Ditton et al. (1983); Bultnece et al (1981)). Therefore, it is important to consider whether different demographic groupings perceive or expect smaller or larger numbers of visitors.

1.5: The Site
While expectations of the visitor are important, characteristics of the site will be an important influence on a visitor’s experience. A common theme throughout the issues
above, and in past studies is that they are all site dependent (Kozak, 2002). In many instances the nature of the site determines the type of leisure experience a visitor has. The way in which the site is managed can also influence the types of leisure experiences available. Therefore, it is important to understand the nature of the site and the main attractions when examining crowding norms. For example, the expected experience for a hike in the wilderness is very different to a visit to a major landmark (Hull et al., 1996).

At many sites, especially high use or fragile sites, it is necessary to ensure that the site can be fully appreciated by visitors, without causing undue damage. This may require substantial infrastructure developments, such as walkways, shelters, picnic facilities, toilets as well as interpretative signage. However, man-made obstacles, such as buildings and roads have been shown to impact on an individual’s leisure experience (Inglis et al., 1999). Therefore, while these infrastructure developments are important for management, they must be designed properly to ensure that they do not actually detract from an individual’s experience of the site.

An area of particular importance is the design and carrying capacity of walkways. The carrying capacity of a walkway refers not only to the structural capacity (ie the number of people that fit into an area), but also to the flow capacity (ie the number of people that can fit into an area while maintaining movement through this space) (Rouphail et al., 1998). The structural capacity refers to the area dimensions, which is more applicable to stationary situations, such as lifts. The flow capacity takes into account pedestrian characteristics, such as body buffer zones (‘personal space’), pedestrian walking speeds and nature of the walkway (ie flat, sloped, stairs) to create a capacity (Itami, 2002). Any walkway system must be designed with both these capacities in mind, to ensure that it functions as desired. An inadequately designed walkway may act as a bottleneck and thus create an artificial increase in the number of people. The importance of infrastructure development, in particular walkway development is of particular interest in this study.
In this study, we drew heavily on Itami’s (2002) report, which estimated capacities for pedestrian platforms and viewing platforms at the 12 Apostles site. In this report, Itami calculates the flow capacity of the main viewing platform, and a section of stairway and walkway that lead to this platform. Itami went further by inferring quality of experience at each of these sections based on different visitor numbers. This was referred to as the Level of Service (LOS) of the site. The LOS is described as a quantitative measure used to determine the quality of service from a user’s perspective and is based on the following criteria:

- Freedom to choose desired speeds
- Freedom to pass slower pedestrians
- Ability to cross a stream of pedestrians
- Ability to walk in the reverse direction to a stream of pedestrians
- Ability to manoeuvre without conflicts
- Delay at signalised intersections
- Delay at unsignalised intersections
- Freedom to stop*
- Ability to view and experience nature with unimpeded views (man-made structures and/or other visitors)*

* Added due to nature of the 12 Apostles site
(Source: Itami 2002, pp 3).

Using these criteria and flow capacity parameters described earlier, Itami devised 6 Levels of Service for the Stairway, Walkway and Platform at the 12 Apostle site (Table 1). Itami also identified the critical visitor number size, where any visitor number larger than this point would decrease the LOS to below an acceptable level. This structural maximum is indicated with an asterisk in Table 1. However, these LOS’s are based only on physical data and broad social data. Social acceptance of these LOS’s is not known and is part of what is tested in this study.
Table 1: Levels of Service defined in Itami (2002)

<table>
<thead>
<tr>
<th>Level of Service</th>
<th>Platform</th>
<th>Walkway</th>
<th>Stairway</th>
</tr>
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<tbody>
<tr>
<td>A</td>
<td>&lt;10</td>
<td>&lt;13</td>
<td>&lt;/</td>
</tr>
<tr>
<td>B</td>
<td>10-15</td>
<td>13-19</td>
<td>7-8</td>
</tr>
<tr>
<td>C</td>
<td>15-25</td>
<td>19-32</td>
<td>8-11*</td>
</tr>
<tr>
<td>D</td>
<td>25-40*</td>
<td>32-50*</td>
<td>11-18</td>
</tr>
<tr>
<td>E</td>
<td>40-74</td>
<td>50-93</td>
<td>18-25</td>
</tr>
<tr>
<td>F</td>
<td>&gt;74</td>
<td>&gt;93</td>
<td>&gt;25</td>
</tr>
</tbody>
</table>

* indicates the LOS recommended in Itami (2002) for day-use in Victorian National Parks

The Stairway, Walkway and Platform of the West Viewing Platform

Figure 4: Platform and walkway, 12 Apostles

1.6: Management Implications

It is important for park managers to assess and understand the crowding issues at their particular site. It is neither feasible nor practical to devise an overall strategy for all sites in a region, each site needs to be examined individually. All management plans should
be designed to maximise the typical leisure experiences associated with their site. It is important not to implement a management plan that decreases the benefits associated with the site (Parks Victoria, unpublished 2002; Wagor, 1964).

The possible strategies for management are dependent upon the nature of their site. In sites of high use, such as the 12 Apostles site, it is necessary to manage crowd flow and movements around the site. Properly managed sites will maximise the experience for visitors, while limiting the damage done to the site. This is achieved by developing adequate walkway systems, but is only possible at smaller sites, which have a feature attraction, such as the 12 Apostles.

In lower use sites, such as wilderness areas, managers face different scenarios. Unlike high use areas, where the majority of visitors to the site visit a particular area, visitors to low use sites tend to use the whole site. In most cases, this is a large area and it is impractical to provide walkways, toilets, rubbish bins and other infrastructure typical of high use sites. Instead, management is more about managing the number of people in the site and where they spend longer periods of time, such as camp sites. It is also important to understand the leisure experience being sought by visitors to low use sites. Activities such as hiking and camping are common in low use sites, with visitors often looking for a more intimate leisure experience (Stewart and Cole, 2001). Therefore, management plans generally focus on managing the number of visitors to the site, through use limits and permits (Wagor, 1964).

There has also been much conjecture surrounding past studies of crowding, its impact, relevance and implications for management. Shelby and Herberlein (1986) believe that science can provide an empirical basis for carrying capacity decisions, while Burch (1984) and Becker et al. (1984) consider interpretations of many carrying capacity studies to be irresponsible and dishonest in that they are used to promote managers ideals. The aim of the LOS management strategy is to overcome the deficiencies of carrying capacity based management by acknowledging the importance of behaviour (Itami, 2002).
Currently, Parks Victoria monitors visitor satisfaction using an on-site visitor survey, the Visitor Satisfaction Monitor (VSM), with the objective of providing a reliable qualitative measure of visitor experience (Parks Victoria, unpublished, 2002). The key objective of the VSM is “to monitor the overall level of visitor satisfaction with facilities and services within the park… and provide visitor feedback to guide the improved performance of park management’ (Parks Victoria, unpublished 2002, pp. 2). The results of the survey are ranked in accordance to satisfaction and then statistically analysed to devise a Visitor Satisfaction Index (VSI), which shows the overall visitor satisfaction at a site. The VSI is a vital management tool as it gives a guide to the effectiveness of the management plans being implemented. A more detailed description of the mathematics involved in calculating the VSI and the components involved can be found in Parks Victoria (2002, unpublished).

1.9: Investigating Crowding

The main form of research has involved ‘after the event’ appraisals of a recreation experience, and therefore analyses the satisfaction level of that experience. This has mainly used post-experience questionaries, with questions relating to perceived crowding, such as ‘how many encounters with other groups did you have?”’, “was the site crowded?”, as well as questions relating to other user’s behaviour (West, 1982). Inglis et al (1996) combined the use of the questionnaire with a series of photographs in a bid to ascertain the impact of crowding. The photographs consisted of a range of varying crowd densities, as well as another set of photographs relating to a specific site. Respondents were asked two questions, the first involved the choice of a photograph that best equates to the number of visitors that they perceived during their leisure experience. The second question asked the respondents to choose a photograph that had a density of visitors that they felt was tolerable. These questions were repeated for the photographs relating to the specific site, which included pictures of man-made objects that are present at the site.

Photographs are often used as a visual description of particular scenarios as an alternative to the written or narrative descriptions used in the past. A number of recent studies such as Hof et al.(1994) and Manning et al. (1996) have highly recommended the use of
photographs after they both successfully used photographs as a visual simulation of situations. Manning et al.’s (1999) study was particularly important as it tested the viability of visual simulation and found that the visual representation provided more accurate reflections of crowding norms than the traditional method of written or narrative descriptions. Other studies by Zube and Pitt (1981) and Coetereir (1983) had similar findings, indicating that the use of photographs as a surrogate for landscape experience was valid. The other benefits of photography for landscape perception research include the ease of administration and the relatively low cost.

The problem with these the questionnaire and photograph methods is that they are retrospective and relate more to an individual’s level of post-event satisfaction more than their feelings at the time (Driver, et al. 1991). Stewart and Cole (2001) and Gimblett (2000) have attempted to solve this problem by using a ‘diary’ method, which allows respondents to fill in a questionnaire after every day or experience. This method also acts to control for personal bias effects, especially those associated with different user groups with differing expectations (Stewart and Cole, 2001). However, at simple sites, such as the 12 Apostles it is possible to use questionaries as they have been shown to adequately represent the visitor’s experience at such sites (Manning et al. 2001).

When assessing crowding norms and demographic patterns it is important to remember the complexities associated with the issue. Responses about perception, maximums, ideals, behaviours, expectations, benefits and leisure need to be carefully examined in regards to their context. Factors such as the nature of the site, type of leisure experience sought, experience or knowledge of the site and the influence of the different demographic characteristics all need to be considered. The following study attempts to examine the influence and importance of all these factors and characteristics on the leisure experience of visitors to the 12 Apostles in Port Campbell National Park.
2: Method

Due to the diverse nature of this study, a number of different data collection methods were employed. The social data was collected using a questionnaire combined with photographic aides filled out during an interview. Visitor movements throughout the site were mapped using the Alge tracking system, which also provided an estimation of overall crowd size. Visitor number data was also obtained from a car counter device administered by Parks Victoria. Third party observations were also used to capture visitor-visitor interaction data and behavioural data as well as an independent assessment of visitor numbers for the three sections of interest; the stairway, the walkway and the platform.

An advantage of the 12 Apostle site is that there is only one track leading in and out of the site. This made it easier to seek the participation of visitors in the study as well as to keep track of the equipment being used. As visitors entered the site they were alerted to the study that was occurring and asked to participate. Participation at this point involved the wearing of a tracking band and the recording of demographic details as well as the signing of ethical forms. On completion of their tour, participants either simply returned their bands or took part in the short 5-minute interview.
Interview Process

2.1: The Stairway, Walkway and Platform Sections

This study focussed on three particular sections within the 12 Apostles site; the main viewing platform, the west walkway and the stairs leading down to the west walkway (Figures 4 and 6). Previous studies within the 12 Apostles site had labelled these three sections as areas of heavy use (Itami, 2002). Itami focussed on these sections in his report on carrying capacities and Level of Service.

These sections were also chosen for this study due to their high use, structural and design differences and their ease in identification.
2.2: Survey

The use of a questionnaire was important because of the need to capture the views and responses of the people visiting the site in relation to crowding norms. This was best achieved through the medium of a personal interview, where the questionnaire ensured that all participants were sampled in the same way. The use of questionnaires is common practice in social research (eg Hull et al., 1996) and has been proven to be an adequate, accurate and reliable tool for capturing social-based data (Manning et al. (2001). There were two main aims of the questionnaire, to collect the demographic data of visitors, and to capture the views of visitors in regards to crowding norm issues associated with the 12 Apostle site. A copy of the questionnaire used is in appendix 1.

Information collected for the demographics included gender, age, travel type, transport mode and origin. This data was collected using direct questions to the visitors. Gathering the responses to the crowding norm issues was more complex.

The style of survey used closed structured questions with a range of answers for the respondent to select from. This process was aided by the use of photographs depicting different crowding levels for the three different sections. This style of surveying has been used in other similar studies, including Fairweather and Swaffield (2000), Manning et al. (1996) and Inglis et al.(1999). The photographic series depicted the three study
sections; the stairway, walkway and platform with varying crowd sizes, based on Itami’s (2002) estimates of Level of Service. A template photograph was chosen for each of the three sections, which were then digitally edited to alter the number of people in each photograph. The use of the same template photograph meant that the only difference between two photographs for a section was the number of people. The decision to use photographs was based on evidence from past studies, such as Inglis et al (1996) and Manning et al. (1999), which highlighted the value of photographs as visual aides, as well as the practical issues such as cost and ease of use. It was also important to use photographs in this study to successfully represent the desired visitor numbers and the differences between them, as it enabled the results to be related to other studies, for example the Level of Services discussed in Itami (2002). The actual number of visitors shown in each photograph is shown in Table 2. These are based on the lower values for each LOS as defined by Itami (2002).

<table>
<thead>
<tr>
<th>Table 2: Number of people shown in visualisations</th>
<th>Number of people represented in each image</th>
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<tbody>
<tr>
<td>Level of Service</td>
<td>Platform</td>
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<tr>
<td>A</td>
<td>5</td>
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<td>B</td>
<td>10</td>
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<td>C</td>
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<td>E</td>
<td>40</td>
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</table>

For each of the three sections, the stairway, walkway and platform, the survey respondents were asked to nominate the picture that best represented their answer for a series of questions relating to the visitor number they encountered (perceived), the maximum visitor number they would find acceptable, the minimum visitor number they would find acceptable and their ideal visitor number. The photos used for each section at the different visitor levels are shown in figures 7, 8 and 9 on the following pages. Another set of questions, without the aide of photographs looked at the issue of expectations and the impact of other visitor’s behaviour.
An issue that arose during the development of the questionnaire was the impact of starting point bias. Starting point bias refers to the impact that the order of the questions or the timing of the survey have on the responses given. There were concerns that the questions being asked would lead the survey participants to un-naturally focus on the issue of crowding norms, and thus give tainted responses. However, a study by Manning et al (1998) examined the issue of starting point bias in recreational crowding norm research and found that it did not have a significant effect on the responses returned by survey participants. The issue was also partly alleviated by the order of the questions and by conducting the interviews after the participant had been through the site. The questionnaire was conducted during a 5-minute interview at the end of the visitor’s trip through the site. The format of the questionnaire involved the interviewer showing the interviewee the relevant photographic series and asking the associated questions. The second part of the questionnaire looked at the impact of other visitors’ behaviour, the difference between the encountered crowd and the expected crowd sizes as well as general demographic details.

2.3: Observations

Systematic observations provide a useful side tool in recreation research, because they provide a third party description of the site and any activities within it, as well as making up for the short falls of the questionnaire. Ely (1981) characterises observations as being the ‘systematic and unobtrusive observation and recording of overt behaviour as it occurs in the recreational settings’. He describes the shortfalls of questionnaires as the following:

- The survey may intrude on a person's experience and have a negative impact.
- Surveys are dependent upon a participant’s recall ability.
- Questionnaires are designed for individual responses, which may be a problem with groups, as it is often found that similar people (ie the male head of a family) dominate the responses, thus giving a skewed outcome.

While these problems can be overcome, in particular the dependence on participant recall ability for accurate responses, which has been proven inaccurate (Manning et al. 2001),
Ely (1981) raises the valid point that outdoor recreation research should not be entirely questionnaire based.

The advantage of including an observation segment is that it is possible to focus on certain aspects of behaviour or interaction within a site. Traits that are commonly assessed using observation analysis include queue formation, littering, loitering, turnover, resource abuse, acrimony, mobility constraints and accidents (Ely, 1981). Observing such traits allows the formation of a behavioural map, where potential or existing ‘hot-spots’ and bottlenecks can be identified.

The issue of observer bias can effect the viability of data gained from observations. This arises when the observer is not impartial and places a personal impression on the observations they are making.

There are two aims for the observation part of the survey. The first was to have an independent count of people numbers at each of the three sections. This was achieved by approximate head counts every minute. The second aim was to obtain a third party perspective of how visitors reacted in different situations. This was designed to test the impact of other visitors’ behaviour and also examine if any triggers for unusual behaviour existed.

**2.4: Visitor Tracking**

Visitor movements were mapped using the Alge timing system, which records the time when a person crosses a sensor pad. The system involves the study participants wearing an ankle band, which contains a uniquely coded microchip, and passing over sensor pads place around the site. As the ankle band passes over the sensor pad, its number and the time is recorded. The information from the sensor is then combined to show an individuals pattern of movement around the site. It is important to synchronise the time within the recording boxes as the pattern of movement is mapped as a feature of time. An advantage of this system is that it is easily downloaded and movement patterns can quickly be determined.
Figure 10: Couple walking across sensor mat.
Photographs used for Stairway

Figure 7.1: Stairway LOS A

Figure 7.2: Stairway LOS B

Figure 7.3: Stairway LOS C

Figure 7.4: Stairway LOS D

Figure 7.5: Stairway LOS E
Photographs used for Walkway.

Figure 8.1: Walkway LOS A
Figure 8.2: Walkway LOS B
Figure 8.3: Walkway LOS C
Figure 8.4: Walkway LOS D
Photographs used for Platform

Figure 9.1: Platform LOS A

Figure 9.2: Platform LOS B

Figure 9.3: Platform LOS C

Figure 9.4: Platform LOS D

Figure 9.5: Platform LOS E
3: Results

The purpose of this section of the report is to identify and explain significant results or patterns in regards to the research questions for the stairway, walkway and platform, and overall site. The general aim of this study was to examine social attitudes towards visitor numbers at the 12 Apostles site. It specifically examines visitors’ perceptions of visitor numbers, maximum acceptable visitor numbers and ideal visitor numbers, as well as the impact that behaviour and experience has on an individual’s leisure experience. The influence of visitor characteristics, such as demographics, on the responses to these parameters was also tested.

3.1: Visitor Numbers
There is a distinctive peak and off-peak pattern associated with visitor numbers to the 12 Apostle site. This survey was conducted on the 18th, 19th and 20th of July 2002, which is during the winter low season, as shown in graph 1.

Graph 1: Visitor Numbers 12 Apostles
Three sets of data were used to estimate the actual crowd sizes during each of the studies. The most important set was the traffic counts courtesy of Parks Victoria. These were calculated estimations based on the number of cars that entered the 12 Apostles car park. The second recording of crowd size used the information gathered by the tagging system. Using this information it was possible to gain an estimate of the crowd size, which was then compared to the traffic count to check participation rates. These estimations were also supported by the observation data, which gave an approximation of the crowd size at the three sections focused on in this report. The crowd sizes for each of the three days are illustrated in graph 2.

Graph 2: Visitor numbers 12 Apostles on study days

3.1.1: Number of people surveyed
A total of 288 people were surveyed during the three days, with 201 complete surveys available for use in the data analysis. 129 were collected on Thursday 18th, with 65 complete interviews, 123 were collected on the 19th, with 101 complete interviews and 35 of the 36 collected on the 20th were available to use. The discrepancy between the number of people surveyed and the number of data sets involved an error in the initial interview process. When a group of visitors, such as a family group, were interviewed all
their band numbers were recorded. While this was useful for the tracking information, only the person responding to the questionnaire should have had their number recorded, or at least their number highlighted. This error mostly affected the Thursday data, but was rectified by cross checking the band numbers and questionnaire responses to the pre-existing demographic data collected at the beginning of the visit. Table 3 depicts the breakdown of the visitor’s characteristics, including the percentage of the total that each grouping represents.

**Table 3: Demographic characteristics of respondents**

<table>
<thead>
<tr>
<th>Origin</th>
<th>Gender</th>
<th>Age Code</th>
<th>Group Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>Male</td>
<td>A (1)</td>
<td>Alone (1)</td>
</tr>
<tr>
<td>100</td>
<td>106</td>
<td>6</td>
<td>15</td>
</tr>
<tr>
<td>52%</td>
<td>54%</td>
<td>3%</td>
<td>8%</td>
</tr>
<tr>
<td>Overseas</td>
<td>Female</td>
<td>B (2)</td>
<td>Couple (2)</td>
</tr>
<tr>
<td>93</td>
<td>91</td>
<td>6</td>
<td>56</td>
</tr>
<tr>
<td>48%</td>
<td>46%</td>
<td>3%</td>
<td>29%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>C (3)</td>
<td>Family (3)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>96</td>
<td>47</td>
</tr>
<tr>
<td></td>
<td></td>
<td>49%</td>
<td>24%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>D (4)</td>
<td>Friends (4)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>80</td>
<td>45</td>
</tr>
<tr>
<td></td>
<td></td>
<td>41%</td>
<td>23%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>E (5)</td>
<td>Tour (5)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>8</td>
<td>33</td>
</tr>
<tr>
<td>193</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Young</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mature</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>108</td>
<td></td>
<td>4%</td>
<td>17%</td>
</tr>
<tr>
<td>88</td>
<td></td>
<td>196</td>
<td>196</td>
</tr>
</tbody>
</table>

3.2: Overall attitudes towards visitor numbers at the site.

This section examines the trends for the perceived visitor numbers encountered, the maximum acceptable visitor numbers and the ideal visitor numbers for the stairway, walkway and platform. These responses are based on the LOS classes defined by Itami (2002) as described in section 2: Method.

3.2.1: Summary of Perceived Visitor Numbers

Table 4 contains the summary of the perceived visitor numbers for the stairway, walkway and platform. The percentage values represent the amount compared to the total, while the other figures represent the actual counts.
Table 4: Number (and %) of visitors who reported encountering each LOS on the stairway, platform and walkway during their visit to the 21 Apostles site.

<table>
<thead>
<tr>
<th>Level of Service</th>
<th>Platform</th>
<th>Walkway</th>
<th>Stairway</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>86 (44)</td>
<td>125 (63)</td>
<td>115 (58)</td>
</tr>
<tr>
<td>B</td>
<td>64 (33)</td>
<td>54 (27)</td>
<td>46 (23)</td>
</tr>
<tr>
<td>C</td>
<td>34 (17)</td>
<td>11 (6)</td>
<td>13 (7)</td>
</tr>
<tr>
<td>D</td>
<td>7 (4)</td>
<td>7 (4)</td>
<td>17 (9)</td>
</tr>
<tr>
<td>E</td>
<td>4 (2)</td>
<td>NA</td>
<td>7 (4)</td>
</tr>
<tr>
<td></td>
<td>195 (100)</td>
<td>197 (100)</td>
<td>198 (100)</td>
</tr>
</tbody>
</table>

Note: the key for the LOS classes is located in table 1 in section 2: Methods.

For all three sections, the majority of respondents reported perceiving crowd sizes of LOS B or less, which corresponds to a low visitor number. The similarity between the three sections indicates that similar patterns of crowd movement were occurring at the stairway, walkway and platform and that the function of these different structures was not influencing the perceived visitor numbers.

3.2.2: Summary of Maximum Acceptable Visitor Numbers

Table 5: Number (and %) of visitors who reported each LOS as maximum acceptable number of people to encounter

<table>
<thead>
<tr>
<th>Level of Service</th>
<th>Platform</th>
<th>Walkway</th>
<th>Stairway</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>12 (6)</td>
<td>23 (12)</td>
<td>19 (10)</td>
</tr>
<tr>
<td>B</td>
<td>28 (14)</td>
<td>71 (36)</td>
<td>22 (11)</td>
</tr>
<tr>
<td>C</td>
<td>106 (54)</td>
<td>79 (40)</td>
<td>53 (27)</td>
</tr>
<tr>
<td>D</td>
<td>41 (21)</td>
<td>23 (12)</td>
<td>78 (39)</td>
</tr>
<tr>
<td>E</td>
<td>8 (4)</td>
<td>NA</td>
<td>26 (13)</td>
</tr>
</tbody>
</table>

Table 5 relates to the largest visitor numbers that the respondents would accept without their experience being compromised. The walkway appears to have more people with a lower maximum acceptable visitor number than the stairway or platform. This may be a function of the structural limitations of the walkway, as it is long and narrow.
3.2.3: Summary of Ideal Visitor Numbers

The figures in table 6 represent the visitor numbers that the respondents would choose to encounter in a best-case scenario.

<table>
<thead>
<tr>
<th>Level of Service</th>
<th>Platform</th>
<th>Walkway</th>
<th>Stairway</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>109 (56)</td>
<td>16 (62)</td>
<td>112 (57)</td>
</tr>
<tr>
<td>B</td>
<td>46 (24)</td>
<td>122 (32)</td>
<td>47 (24)</td>
</tr>
<tr>
<td>C</td>
<td>33 (17)</td>
<td>9 (5)</td>
<td>25 (13)</td>
</tr>
<tr>
<td>D</td>
<td>5 (3)</td>
<td>2 (1)</td>
<td>8 (4)</td>
</tr>
<tr>
<td>E</td>
<td>1 (&lt;1)</td>
<td>NA</td>
<td>5 (3)</td>
</tr>
</tbody>
</table>

These results are similar to those observed in the maximum acceptable visitor numbers, with a larger percentage of people selecting a smaller ideal for the walkway than for the stairway or platform. This once more is likely due to the narrow and long nature of the walkway.

3.3: Visitor Characteristics and attitudes towards visitor numbers.

A number of chi square tests were undertaken to test for associations between visitor characteristics such as age group, group type, gender and country of origin (Australia or overseas) and the attitudes expressed towards visitor numbers. No reliable associations were found between these visitor characteristics and maximum acceptable level or service, nor visitor characteristics and ideal level of service.

3.5: Socially preferred LOS and Itami’s recommended LOS

Itami’s (2002) recommended LOS, based on structural characteristics of the site, have been described in sections one and two. The aim of this section is to test the fit between Itami’s recommendations and socially acceptable LOS as indicated through this study. The percentage of respondents who indicated a maximum acceptable LOS equal to or less than Itami’s recommended LOS is shown in graph 4.
Graph 4: Percentage of respondents reporting a maximum acceptable LOS less than the LOS recommended by Itami (2002) based on structural carrying capacity.

There was a significant discrepancy between recommended LOS and socially acceptable LOS. For the Walkway and the Platform, a high percentage of visitors indicated a maximum acceptable LOS that was below Itami’s (2002) recommendations. Around 80% of visitors are likely to find the recommended LOS unacceptable for both the walkway and the platform. Interestingly, attitudes towards the stairway are quite different. For the Stairway, the majority of participants indicated a maximum acceptable LOS that exceeded the level recommended by Itami. These results highlight the need to view crowding as both a function of behaviour as well as structure and density. This is also an example of the limitations of structural carrying capacities as a management tool.

3.6: Influence of Others’ Behaviour on Visitor Experience
Crowding is described as being caused by two main factors, density and behaviour. This section focuses on the influence that different behavioural issues have on a visitor’s leisure experience. In this study, the participants were asked to nominate whether other
visitors’ behaviour had had a negative or positive effect or no impact on their leisure experience at the 12 Apostles site. The respondents for each effect are shown in graph 5.

Graph 5: Percentage of respondents reporting positive, negative or no impact on own their experience by the behaviour of other visitors.

There are approximately equal numbers of visitors reporting positive and negative experiences, while over half the visitors were not affected by other visitor’s behaviour. Responses to open ended questions regarding the behaviour of others’ provide some understanding of the sources of annoyance for visitors. Reasons included people climbing fences, people smoking cigarettes, and people blocking the view when taking photographs. Some of these appear to have a link with crowding issues, in particular, the issue of blocking views for photographs as people sometimes had to wait for access to preferred photography locations. While the issue of people jumping the fence might be potentially related to number of people at the site, observations of visitor behaviour made during this study suggest this occurred even when visitor numbers were very low. Fence climbers appeared to be seeking a better camera angle rather than more room for photography. Overall, researchers felt that crowding issues were only a small component of annoyance behaviour during this study period.
The relationship between reported impact of others’ behaviour and the experience of crowding was examined in a two-stage process. First, we identified the respondents who were likely to have experienced a sense of crowding. These were reasoned to be those respondents who reported a maximum acceptable LOS that was lower than the reported LOS experienced. The percentage of people considered to ‘feel crowded’ is shown for each LOS in Table 7. Overall, around 25% of respondents could be considered to have experienced ‘crowding’ (number encountered higher than number perceived) at the site. This is a surprisingly high proportion given the very low visitor numbers on the study days.

<table>
<thead>
<tr>
<th>Level of Service</th>
<th>Platform</th>
<th>Walkway</th>
<th>Stairway</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. (% of respondents who encountered this LOS)</td>
<td>No. (% of these who ‘felt crowded’)</td>
<td>No. (% of respondents who encountered this LOS)</td>
</tr>
<tr>
<td>A</td>
<td>87 (44)</td>
<td>6 (7)</td>
<td>126 (64)</td>
</tr>
<tr>
<td>B</td>
<td>65 (33)</td>
<td>12 (19)</td>
<td>52 (27)</td>
</tr>
<tr>
<td>C</td>
<td>34 (17)</td>
<td>22 (65)</td>
<td>12 (6)</td>
</tr>
<tr>
<td>D</td>
<td>8 (4)</td>
<td>7 (86)</td>
<td>8 (4)</td>
</tr>
<tr>
<td>E</td>
<td>4 (2)</td>
<td>4 (100)</td>
<td>8 (4)</td>
</tr>
<tr>
<td>TOTAL</td>
<td>198</td>
<td>51 (26)</td>
<td>198</td>
</tr>
</tbody>
</table>

Next, we examined the association between ‘feeling crowded’ and the reported impact of behaviour of other visitors. Table 8 shows the number and percentage of respondents in each category. The association was tested using Chi Square analysis. A relatively higher proportion of respondents who reported the behaviour of others having a negative impact on their experience also reported a sense of ‘crowding’. However no significant association was found between the variables (Pearson’s Chi Square (df=2)=2.3, p>.05). This strengthens the observation that any negative impacts resulting from others’ behaviour were not directly related to issues of crowding.
Table 8: Association between ‘feeling crowded’ and the perceived impact of behaviour of other visitors.

<table>
<thead>
<tr>
<th>Perceived impact of behaviour of other visitors</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Negative impact</td>
<td>Positive impact</td>
<td>No impact</td>
</tr>
<tr>
<td>Didn’t feel crowded</td>
<td>Count 23</td>
<td>25</td>
<td>90</td>
</tr>
<tr>
<td></td>
<td>% 16.2%</td>
<td>20.4%</td>
<td>59.2%</td>
</tr>
<tr>
<td>Did feel crowded</td>
<td>Count 15</td>
<td>11</td>
<td>23</td>
</tr>
<tr>
<td></td>
<td>% 30.6%</td>
<td>22.4%</td>
<td>46.9%</td>
</tr>
</tbody>
</table>

3.8: Visitor experience and duration of visit

A common assumption in crowding studies is that different crowding experiences may impact on the duration of stay at a site. If a site is crowded, it is assumed that the duration times will be less than the duration times at the site when it is not crowded. To test the validity of this assumption at this site, the duration times for the ‘feeling crowded’ (perceived visitor number is greater than maximum acceptable visitor number) respondents were compared to the duration times of those respondents not feeling crowded (perceived visitor number is equal to or less than maximum acceptable visitor number). The same comparison was also used for the behavioural responses, with the negative respondent’s duration compared to the positive and no impact respondents. The results of this analysis are shown in graphs 6, 7 and 8 below.
Graph 6.

There are no significant differences between the average time spent at the site for the individuals that felt crowded and those individuals that did not feel crowded at any of the three sections. This indicates that the issue of feeling crowded (perceived visitor number is greater than their maximum acceptable visitor number) did not effect the duration of an individuals’ visit.

Similar results are seen in the duration of visit comparisons for the encountered and behavioural variables (Graphs 7 and 8). In both of these comparisons, the negative and more groupings have greater average time and maximum stay times when compared to the positive and less groupings, which is the opposite of what is expected.
Graph 7.

Duration time for Behavioural Groups

<table>
<thead>
<tr>
<th>Time (minutes)</th>
<th>Negative</th>
<th>Positive</th>
<th>No Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimum</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Graph 8.

Duration Time for Encountered Groups

<table>
<thead>
<tr>
<th>Time (Minutes)</th>
<th>More</th>
<th>Less</th>
<th>Same</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimum</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
4: Discussion

This report examines issues of social carrying capacity at the 12 Apostles site, particularly in the light of recommended carrying capacities based on structural and traffic flow limitations (Itami 2002). It shows that there are some differences between recommended and preferred (or socially accepted) visitor numbers, and that the extent of this difference varied across the three physical locations assessed. The study examined the association between visitor characteristics and preferred visitor numbers and found no evidence for reliable relationships. The behaviour of other visitors to the site was found to make only a small contribution to experience of crowding, and the experience of crowding was found to have little association with duration of visit.

The differences found between socially preferred and recommended LOS are important. The Level of Service (LOS) estimates used in this study were determined in Itami (2002). These values were calculated by considering the dimensions of each section, the personal space requirements of each individual and the difference in traffic flow rates for the various crowding levels. A change in the LOS represents a change in the quality of service and level of visitor satisfaction (full description of the calculations and the theory of Level of Service is available in Itami (2002)). Itami (2002) also identified the maximum crowd size for each section that will not significantly decrease the LOS. The maximum ideal structural LOS refers to the maximum crowd size that does not lower the quality or level of service below an arbitrary threshold. This threshold has been determined by identifying the maximum visitor number that will begin to cause a decrease in the level of service and therefore the visitor’s satisfaction. For example if the ideal maximum structural LOS is C, then any crowd over C will decrease the quality of service of that section, while all crowd sizes under C will offer an increased LOS. C has been determined as the maximum LOS acceptable according to the structural and traffic flow parameters, and acts as the threshold. Level of Service classification is a useful management tool for determining the carrying capacities of a site because it examines more than just the structural and basic social parameters, but also acknowledges the importance of behaviour and choice. For example, LOS acknowledges the importance of an individual’s ability to make decisions, such as moving at their own pace or changing
paths. This has not been recognised or catered for in many past social carrying capacity studies. For both the walkway and the platform, a vast majority of participants (88% and 75% respectively) had a maximum acceptable crowd that was lower than the ideal LOS, meaning that for these two sections the majority of people will feel crowded if they encounter the crowd size identified in Itami (2002) as being the ideal maximum crowd for the structural capacity of the sections. The significance of these different results is that they highlight the importance of recognising, identifying and computing the impact that the behavioural parameters have on the LOS. It also emphasises the importance of structure function and LOS. The stairway, walkway and platform are designed to provide different functions, and therefore the people using the site will act differently on these three sections. It is important that these different behavioural patterns and structural functions are recognised and used to develop more realistic LOS’s for these sites.

Crowding has been described as both a function of structure and density as well as behaviour. So far, most of the discussion has centred on the importance of the structural-density issue and not addressed the behavioural side. In this study, we were unable to demonstrate any relationship between behaviour of other visitors and the experience of crowding. It should be noted however that this study was undertaken on a single weekend during a time of exceptionally low visitor numbers. We therefore believe much further consideration and empirical work is required before such an association can be discounted. At the 12 Apostles site, a number of negative behaviours where reported and observed. These included jumping the fences, trampling vegetation, smoking, queuing for photographs, stopping for other people’s photographs and loud behaviour. A comprehensive list of behavioural actions and possible solutions at the 12 Apostles site is listed in the study Zanon and Ware (2002). The impact of this finding and those of Zanon and Ware (2002) is that it is important for management to identify the common behavioural problems at each specific site and devise appropriate management strategies. However, it is not a simple task as the actions that cause problems at one site may not at another, and may also be dependent upon the crowd size present at the site. An example of this is photography at the 12 Apostles site. During low crowd flows, people were
spending a great deal of time taking their photographs. This caused few problems, as there were not many people around. However, even in the medium flows that were observed during the study period, people were forced to queue and wait for other people to take photographs. Many people later stated that queuing and waiting negatively affected their experience.

An important feature that has been repeatedly raised during this study is the importance of specificity. This refers to the site, time of year and the leisure experience being sought. The 12 Apostles site is a simple site where the main experience being sought is sightseeing, which only requires visitors to make a few choices. There are no selective pressures, such as extended walks, picnic facilities or other interactive activities that an individual visitor can choose between. The result is that the majority of visitors will make the same choices and share the same experiences, which reduces the variability and produces homogenised experiences.

There is also the issue of temporal differences. The peak period of visitation at this site is in the summer time from December to February (refer figure of ‘day visitor’ data in results section), where up to 6,000 people visit the site per day. This is far greater than the visitation levels in the wintertime, June to July, where only 1,500 people visit the site per day. Since this study was conducted between July 18 and 20, the findings of this report are only relevant to the smaller crowd sizes that are associated with this time of year and can not be used as a guide for peak summer crowds.

It is important to recognise some of the limitations of the methods used in this study. The estimates participants make regarding acceptable visitor numbers are in response to a limited number of scenarios presented in the photographs. Context of assessment is an important factor in environmental evaluation; judgements made in the context of a wider range of scenarios (for example the walkway shown with no visitors at all, through to the walkway shown filled completely) might be different. Similarly, the validity of using photographs to elicit judgements made regarding crowding has not been fully established. It would be valuable to undertake further investigations using alternative methods (for
example on-site observations during seasons with high levels of crowding).

5: Conclusions
There are several conclusions that can be made from this study. The most important factor that affects all findings is that the results of this study are highly site and seasonal specific. They can only be used as a guide to the 12 Apostles site for the winter period. This conclusion is made due to the uniqueness of the site and the large seasonal variation in visitation levels.

The other conclusions relate to the classification of agents in the Rbsim. movement simulation program as well as a number of site management issues. The demographic influences on the variability of crowding acceptability are inconclusive and therefore not useful for agent modelling. Demographics may be useful in accounting for variation observed in other variables, such as movement through the site, which might be relevant to Rbsim.

In regards to management of the site, there are two implications that need to be considered. Firstly, it suggests no particular requirement to target or accommodate specific demographic groups in relation to crowding. Secondly, it is important to examine depreciative behaviour and develop strategies, where possible, to overcome the offending activities, as there is a link between negative behaviour and crowding at this site.

6: Further Study
There are two areas that require further study for this issue at this site. The first and most important is to repeat this study in the summer peak period to gain results that are valid to use at that time of year. I would expect the issue of crowding to be significantly greater at that time than during the winter off-peak period.

Another area that could be further examined is the relationship between perceived crowds
and actual crowds. It would be useful to test the accuracy of the visitor’s ability to perceive crowd sizes, especially for the individuals that perceived larger crowd sizes than the majority of the visitors. This would require more accurate estimates of crowd sizes at the various sections at regular time intervals. This was attempted in this study by using systematic observations, however the results were difficult to analyse.

Reference List


• Hull, RB and Stewart, WP. (1995). The landscape encountered and experienced while hiking. Environment and Behaviour, vol. 27 (3)


• Shelby, B and Herbelein, T. Carrying capacity in Recreation Settings. Corvallis, OR: Oregon State Uni Press


Thank you again for taking part in this study. Would you mind answering a few questions about your experience today? The interview takes approximately 5 minutes.

PART A: PERCEPTIONS OF THE SITE
I’d like to ask you about your experience at a number of places within the 12 Apostles site

QUESTION 1
First of all, I’d like you to think about your experience at the stairways leading down to the 12 Apostles viewing platform (Check familiarity – use photographs, map). Did you go to this part of the site? IF YES - CONTINUE QUESTION 1, IF NO GO TO QUESTION 2.

SHOW PHOTOGRAPHS

<table>
<thead>
<tr>
<th>Photograph</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a Which photograph best represents the number of people you encountered on the stairway?</td>
</tr>
<tr>
<td>1b Which photograph best represents the maximum number of people you would find acceptable to encounter on the stairway?</td>
</tr>
<tr>
<td>1c Which photograph best represents the minimum number of people you would find acceptable to encounter on the stairway?</td>
</tr>
<tr>
<td>1d Which photograph best represents what you consider to be the ideal number of people to encounter on the stairway?</td>
</tr>
</tbody>
</table>

QUESTION 2
Now I’d like you to think about your experience at the walkway leading to the 12 Apostles viewing platform (Check familiarity – use photographs, map). Did you go to this part of the site? IF YES - CONTINUE QUESTION 2, IF NO GO TO QUESTION 3.

SHOW PHOTOGRAPHS

<table>
<thead>
<tr>
<th>Photograph</th>
</tr>
</thead>
<tbody>
<tr>
<td>2a Which photograph best represents the number of people you encountered on the walkway?</td>
</tr>
<tr>
<td>2b Which photograph best represents the maximum number of people you would find acceptable to encounter on the walkway?</td>
</tr>
<tr>
<td>2c Which photograph best represents the minimum number of people you would find acceptable to encounter on the walkway?</td>
</tr>
<tr>
<td>2d Which photograph best represents what you consider to be the ideal number of people to encounter on the walkway?</td>
</tr>
</tbody>
</table>

QUESTION 3
Now I’d like you to think about your experience at the main 12 Apostles viewing platform. (Check familiarity – use photographs, map). Did you go to this part of the site? IF YES - CONTINUE QUESTION 3, IF NO GO TO QUESTION 4.

SHOW PHOTOGRAPHS

<table>
<thead>
<tr>
<th>Photograph</th>
</tr>
</thead>
<tbody>
<tr>
<td>3a Which photograph best represents the number of people you encountered on the viewing platform?</td>
</tr>
<tr>
<td>3b Which photograph best represents the maximum number of people you would find acceptable to encounter on the viewing platform?</td>
</tr>
<tr>
<td>3c Which photograph best represents the minimum number of people you would find acceptable to encounter on the viewing platform?</td>
</tr>
<tr>
<td>3d Which photograph best represents what you consider to be the ideal number of people to encounter on the viewing platform?</td>
</tr>
</tbody>
</table>
QUESTION 4
Now I’d like you to think about your experience at the 12 Apostles overall. Thinking about the number of people you encountered today, would say you encountered more, less or about the same number you expected to encounter? CIRCLE ONE ANSWER

1. More
2. Less
3. About the same

QUESTION 4
a) Did the behaviour Of visitors to the site affect your enjoyment of the park today - in any way, positive or negative? RECORD ANSWER VERBATIM. PROBE: In what ways?

PART A: BACKGROUND INFORMATION

Now I’d like to ask you some questions about your visit today

QUESTION 5
(a) Is this your first visit to this Park? CIRCLE ONE ANSWER
   1. YES
   2. NO

(b) ONLY ASK IF RESPONSE TO 5(a) is NO:
   How many times have you visited this Park in the last year? CIRCLE ONE ANSWER
   1. Not visited
   2. Once
   3. More than once

QUESTION 6
What is the main purpose of your visit to the park today? RECORD ANSWER VERBATIM

QUESTION 7
I’d like to ask a few questions about your background

Is your normal place of residence within Australia?

<table>
<thead>
<tr>
<th>IF YES</th>
<th>RECORD POSTCODE</th>
<th>IF NO</th>
<th>RECORD COUNTRY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Would you mind telling me the postcode of the area you live in?</td>
<td>What country do you come from?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

QUESTION 8
And which lifecycle category best describes you?
SHOW CARD - CIRCLE ONE ANSWER
A. YOUNG SINGLE       E. MATURE FAMILY
B. YOUNG COUPLE/NO CHILDREN  F. OLDER COUPLE/CHILDREN AT HOME
C. YOUNG FAMILY (youngest child <6)  G. MATURE SINGLE

QUESTION 9
Do you have any other comments about your experience today? RECORD SUMMARY OF ANSWER

Finally, would you mind if I record the number of your ankleband? This will help us correlate your perceptions of the site with information recorded by the sensors. RECORD NO. _______