Crowd Behaviour and Associated Management
Comportement et contrôle des mouvements de foule
Verhalten und Kontrolle von Menschenmassen

Graham WANLESS
Graduate Engineer
Maunsell & Partners
Beckenham, UK
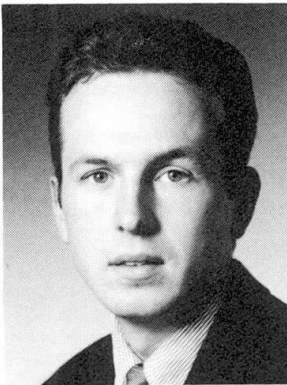
Graham Wanless, born in 1969, graduated from Manchester Univ. with a first class B. Engineer (Hons) degree in Civil Engineering in 1990, and an M.Sc entitled "Crowd Safety" in Spring 1992. Since this time he worked as a graduate engineer for G. Maunsell & Partners.

Richard STANTON
Senior Engineer
Maunsell & Partners
Beckenham, UK
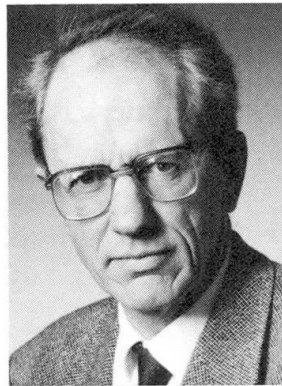
Richard Stanton, born in 1938, graduated from Imperial College, London Univ. with a B.Sc. (Eng.) in 1959. He is a European Engineer and has studied transport planning in all its forms, since joining G. Maunsell & Partners after graduation.

SUMMARY

The behaviour of a crowd will influence the way in which it is managed. This paper discusses factors which affect this behaviour and the techniques which must be implemented to cope successfully with crowds. A wide variety of events and activities have been cited throughout, in order to demonstrate a number of possible crowding scenarios.

RÉSUMÉ

Le comportement des foules influence le mode de contrôle à utiliser. Les auteurs exposent les facteurs actifs et les techniques à prévoir pour agir sur les mouvements de foule. Ils mentionnent un grand nombre d'événements et d'activités, et présentent une série de comportements possibles d'une masse humaine.

ZUSAMMENFASSUNG

Das Verhalten von Menschenmassen beeinflusst die Art ihrer Kontrolle. Der Beitrag diskutiert die wirksamen Faktoren und die anzuwendenden Techniken, um erfolgreich mit Menschenmassen umzugehen. Es wird auf eine Vielzahl von Ereignissen und Aktivitäten bezug genommen, um eine Reihe möglicher Verhaltensweisen von Menschenmassen zu demonstrieren.

1. INTRODUCTION

Crowds are a common occurrence. Each and every crowd will exhibit certain characteristics which depend upon the individual set of circumstances surrounding them. People attending a political rally or demonstration will act in a totally different manner to those leaving an operatic performance. It is not only the event which causes these differences; structural, physical and psychological aspects such as the facility design, patron mobility and personal expectation all influence the way in which the crowd will behave.

Crowds should be managed wherever possible. A facility, which has met the necessary requirements in terms of physical structure, may still provide an unacceptable level of crowd safety, if the operations team to complement it do not manage the crowd effectively. A crowd management plan should be created using a systematic approach. The way in which a crowd is managed will depend upon its components and characteristics. The management strategies created must be flexible so they can be adapted to fit the crowd. All possible factors which can influence a situation must be considered so that it can be managed safely. Critical levels of crowd density and triggering of rapid group movement must be avoided. Failure to achieve these basic requirements can result in serious incidents.

Throughout time there have been numerous crowd related incidents, both portents and fully blown tragedies. Although the overall safety of public places has increased, disasters which emanate from a small number of causes still arise. These causes can manifest themselves in emergency and normal situations (ingress and egress), by standing pressure and structural failure. Each individual crowd disaster has its own set of circumstances.

2. CROWD BEHAVIOUR

2.1 Movement

Crowd movement will exhibit different characteristics, depending upon the particular circumstances involved. Normal movement is encountered everyday in a variety of locations. Members of this type of crowd may or may not have a common objective. It may be uni- or multi-directional, move at different speeds and occur within a wide range of densities. Examples of this type of flow include strolling, window shopping, passage through a railway or underground station with crossing flows, movement into, within and out of public places such as airports, theatres, cinemas and stadia. In contrast, people in an emergency do have a common objective. This is to either enter or leave a certain area as a consequence of an action, such as an outbreak of fire or a bomb-scare. Emergency movement is not necessarily survival of the fittest; people often move in small units, for example, families.

2.2 Crowd Types

One tends to think of a crowd as having one particular personality or set of traits. This could range from a relatively calm crowd leaving a theatre, to a dense and expressive crowd at a pop concert. However, this is too simplistic. Each crowd will be made up from a number of sub-groups. Some of these groups may dominate others but differences will exist. One such group, which must not be ignored, are those with disabilities or restricted movement. These people, may be expected to be present in all types of crowd. Spectators are another type of crowd, which in turn will have sub-groups of its own. Different parts of the crowd could be passive, active, dancing or celebrating. Equally, part of a protesting crowd could comprise peaceful, calm, aggressive, hostile or even violent people.

2.3 Group Characteristics

The type of crowd refers to its physical composition and action. Crowd characteristics on the other hand are more to do with the state of mind. A commuter will act in a totally different way to a tourist whilst travelling by underground. The commuter is very positive in his or her actions. They will know precisely where they want to go, by which route and which platform. Their timing will often be calculated to optimise their travelling time. By contrast, the tourist needs guidance and instruction to use the same system effectively.

Some people lose their inhibitions, when in an aroused crowd, and find themselves doing things they would not normally allow themselves to do. This action could be in the form of shouting abusive material or becoming aggressive. There are numerous other crowd characteristics, which can be fuelled by emotion and desire. These can lead to a crowd exhibiting a certain degree of organisation, leadership or bonding. The characteristics are by no means exclusive to one type of crowd, or to each other. Every crowd will be different.

2.4 Building Types and Their Facilities

The potential for crowd build-up is not only apparent in locations termed "places of assembly". People can congregate away from these areas for activities such as shopping, demonstrations and fire-drills. Structures where crowd behaviour is an important consideration include offices, theatres, cinemas, public houses, night-clubs, concert halls, shopping malls, sports grounds, exhibition halls, railway stations and airports.

The suitability of a structure to cope with crowds will depend upon the patronage. Take the example of an underground station during an emergency evacuation, where there may be significant proportion of disabled or infirm people. The physical nature of underground stations mean that some will be more suited to dealing with this type of crowd than others. The facilities within a structure are also an important consideration when looking at crowd behaviour. Ease of passage should be ensured for all patrons in both the normal and emergency situation. Passageways, lifts, stairs and escalators should all interact where they occur. There should be sufficient facilities within a structure to ensure that the crowd can be effectively managed. Where this is not the case, it is possible for the mood of the crowd to alter. People can become frustrated, irritated and impatient if things do not run smoothly. Situations where crowd mood changes can be termed triggers.

2.5 Triggers

Certain events can influence or even alter the behaviour of a crowd. These can be grouped into three main categories: physical, natural and human. Physical influences can be defined as structural or service based. Structural failure, the temporary closure of pedestrian routes, restricted viewing of an event and the cancellation or inadequacy of a service all fall into this category. Excessive heat, humidity, rain, hail, earthquakes, flooding and fire are all natural effects. An example of a human effect is that it will react to the way it is managed or controlled. Confusion can occur if the crowd is not fed sufficient information to cope with its needs. A crowd can also be incited by gestures, whether it be by a performer or somebody managing them.

3. ASSOCIATED MANAGEMENT

3.1 Crowd Management and Control

The terms crowd management and crowd control are often misused. They are frequently mistaken to mean the same thing. The basic distinction between the two titles are the words management and control. The former is an active action, whereas the latter is reactive. Crowd management covers all actions taken (planning, supervision, monitoring the movement of people, provision of adequate refreshments and lavatories etc) to ensure the smooth running of an operation. The aim is to provide a pleasurable experience for the patron. The operation itself could be anything from the Harrods Sale to New Year celebrations in Trafalgar Square.

Once the potential crowd types and characteristics have been identified, the operations manager should create a crowd management plan which covers all foreseeable scenarios. The plan should take the form of a systems approach (as opposed to piecemeal), which links all aspects together. This task will be more difficult for a manager of a multi-purpose arena than, say, a theatre. The former might have to effectively manage a rap-concert and a boat show within the same physical structure. Following completion of the crowd management plan it should be reviewed at regular intervals to examine whether or not it is working effectively. Between reviews, crowd behaviour and operational experience should be monitored. Revisions can therefore be made from actual events.

A useful tool for crowd management has been developed by Fruin [1]. He has created a model to aid understanding of crowd disaster causes, means of prevention and possible mitigation of an ongoing incident. The model is called *"FIST"*, which stands for *Force* (of the crowd; pressure), *Information* (upon which the crowd reacts whether it be real, perceived, true or false) *Space* (involved in the incident; physical facilities) and *Time* (duration of the incident; scheduling; processing rate).

Crowd control is a reaction to a situation, which is not desirable. Measures of this type should ideally form part of the overall crowd management plan. However it is recognised that unforeseen circumstances do occur; in which case there could be a previously unplanned reaction to a problem. Crowd control should only be used as a last resort. It is far better to guide a situation, rather than oppose it with force. The aim is to revert to a policy of crowd management as soon as possible, with the minimum of disruption. Measures used in crowd control could include arrest, the use of force if necessary and the blocking of certain entrances and exits to alter the patterns of occupancy and movement. It should be noted that control procedures can dramatically increase the severity of a crowd incident if the adopted action is inappropriate. An example of such an incident is the crowd disaster which occurred in Lima, Peru in 1964, which claimed 318 lives [2].

3.2 Communications

The link, which is often missing in crowd management, is that of communication. Each member of a crowd will make decisions based upon the information they have to hand. A lack of information can lead to people making assumptions, which may not necessarily be correct. A clear example of this occurred the day New York's Brooklyn Bridge opened. A scream was interpreted by members of the crowd in such a way that they thought the bridge was about to collapse. As a consequence, 12 people were killed and a further 27 seriously injured, in the apparent emergency egress [3].

In many crowd incidents there has been a distinct lack of communication between people located at the heart of the problem and those elsewhere, who unwittingly contribute to the problem. An example of this is where someone has fallen on a stairway and people further

up carry on moving down the stair. This is often termed a lack of front to back communication. Crowd disasters at Bethnal Green Tube Station (1943), Ibrox (1971) and Hillsborough (1991) all exhibit this deficiency. Detailed case studies of these disasters have been presented in [2].

3.3 Evacuation

With regard to crowd management, an important aspect of emergency movement is the evacuation of patrons and staff. This should be documented within the crowd management plan. It should be remembered that, in the event of a fire (or other cause), certain escape routes might be blocked. Wherever possible, evacuation plans should reflect this.

Different ways of communicating with the public will result in different responses. This is particularly applicable to an evacuation procedure. Proulx and Sime [4] demonstrated how crowds responded to five separate evacuation exercises from an underground station. In each case the level of communication was altered, which affected the evacuation time. These ranged from a ringing bell to use of station staff in conjunction with directive public announcements from a control centre. Clarity is essential. Evacuation times stated in design standards do not generally include a start up time. Immediate movement is assumed. Sime [5] noted that the time to escape should include an additional factor, the "time to start to move". This factor may be split into two sub-factors; the warning time (for example the time from the outbreak of fire to members of the crowd knowing there is a problem) and the start up time (which ends when movement starts). At the Beverly Hills Supper Club, Kentucky, U.S.A. [6], there was a 20 minute delay between the outbreak of a small fire and certain patrons becoming aware of the danger: 165 people died. In addition, an apparent reluctance to move was reported in a fire at Woolworths, Manchester [7]: 11 deaths.

3.4 Operational Implications

A crowd management plan should be a flexible tool, which can be modified, expanded or contracted to fit the requirements of each particular event. There will probably be more than one basic plan for multi-purpose venues . There are a number of factors influencing the management plan for a particular event or activity, which can be placed into four broad categories: the event, the crowd, the location and the time. Berlonghi [8] has produced a paper which comprehensively covers planning for the spectator crowd.

4. CONCLUSION

Crowds should be managed, using a systems approach, wherever possible. The basic principles of crowd management are to provide an effective service and provide patrons with a pleasurable experience. Control should only be used as a last resort. Crowd control measures are occasionally implemented too soon, which can cause an adverse reaction. Whenever there is a necessity to use crowd control measures, these should form part of the predetermined management plan. In unforeseen circumstances, judgement must be based upon experience and an understanding of crowd behaviour.

Most crowd incidents can be prevented by clearly defined management strategies. Triggering rapid group movement and the occurrence of critical crowd densities should be avoided. Operations managers should have an understanding of previous crowd portents and disasters to appreciate how such occurrences can be avoided in the future. Crowd management procedures should be open to review at regular intervals. This review should be based upon experience.

Frequently, the weak link in a crowd management strategy is that of communication. Decisions can only be made on accumulated knowledge, real, perceived, true or false. This applies to both the crowd and those managing them. An increase in the use of smoke alarms, visual displays and public address systems could mean that, whilst providing the crowd with information enabling them to react rationally, warning times are reduced. In turn, this would reduce the need to implement crowd control procedures in certain instances.

Effective training of staff is a vital aspect of crowd management. Their skill will be relied upon to implement a management plan successfully. Each member of staff must have a clear understanding of their responsibilities and how they should react to certain sets of circumstances. It is staff members who come into contact with the patrons. The way in which they act can influence the crowd behaviour. Dissemination of knowledge and experience internally and externally between staff and managers is essential.

REFERENCES

1. FRUIN J.J., The Causes and Prevention of Crowd Disasters. Engineering for Crowd Safety, edited by R.A.Smith and J.F.Dickie, Elsevier Science Publishers. Amsterdam, The Netherlands. 1993.

2. WANLESS, G.K., Crowd Safety. M.Sc Thesis. Manchester University, Manchester. 1992.

3. THE TIMES. 1883. 1st June, p5.

4. PROULX G. & SIME J.D., To Prevent "Panic" in an Underground Emergency : Why Not Tell The Truth? Fire Safety Science : Third International Symposium, edited by G. Cox and B.Langford. Elsevier Applied Science. Amsterdam, The Netherlands. 1991.

5. SIME J.D., Crowd Psychology and Engineering : Designing for People or Ballbearings? Engineering for Crowd Safety, edited by R.A.Smith and J.F.Dickie, Elsevier Science Publishers. Amsterdam, The Netherlands. 1993.

6. SIME J.D., Crowd Safety Management and Communications in Disasters. Management of Safety, Health and Environment, Postgraduate Course. Module 2: Evaluation and Control, edited by L.H.J.Goossens. Manual 2, Chapter 9. Top Tech Studies / Delft University of Technology. 1992.

7. SIME J.D., Human Behaviour in Fires Summary Report. Report No.44. Fire Brigades Advisory Council. Joint Committee on Fire Research. Home Office, London. 1992.

8. BERLONGHI A.E., Understanding and Planning for Different Spectator Crowds. Engineering for Crowd Safety, edited by R.A.Smith and J.F.Dickie, Elsevier Science Publishers. Amsterdam, The Netherlands. 1993.