6 Crowd Planning and Preparation

This chapter reviews planning methods and practices. Significant work has been published and used for long periods on planning methods. Preplanning is essential due to the life safety factors that a crowd can develop *in situ*. Planning can be considered in two phases. Information and background planning essential to communicate facts and identify risk areas in crowd management and operational planning. This then provides resourcing and contingency planning once the operation is in place. Like military operations both phases are important, however in many crowd situations operational and contingency planning is given less scrutiny. This is because the plans are normally scrutinised by authorities, councils, government, venue or land owners and they are more comfortable with pre-information type plans that inform them of the context background and communication flows. How the crowds are managed by security contractors is not usually an area they are experienced in, hence less attention is paid to these areas. The aim of this chapter is to provide enough knowledge for all event stakeholders to review and discuss practical implementation issues in security deployment and control.

Planning and preparation requires an increased focus for crowd management because the emerging behaviour from the collective requires more options to be considered and prepared for. As crowds can cause life safety issues and because agents and systems can interact to exaggerate interactions and responses quickly, preparation and contingency planning is vital. Crowd risk assessments have to be conducted to understand and communicate the magnitude of the problems that can occur. If the consequences of the crowd activity are significant to the risk appetite of the organiser then response methods and measures should be developed and implemented. An example of this would be preparing additional signage, barriers and guards to divert pedestrians away or around potential bottlenecks when the flow becomes too congested.

Theoretical capacity analysis

Many planning documents start with a spatial capacity calculation which estimates available square meters of useable space.

Theoretical capacity is based on a pure physical capacity. Human body shapes and sizes vary with crowd demographics, children, prams, young and old persons. These can never be calculated accurately however a guide to an upper capacity is a good starting point. The UK Green Guide (2018) is the benchmark document which declares the upper limit of persons per square metre is 47 per 10sqm or 4.7 persons per square metre. This is assuming they are all of average size (different nationalities differ in sizes) and they are static. In reality this is not a practical guide, just a notion to prevent any capacities exceeding a theoretical maximum. It is primarily as starting point to ensure emergency egress can be achieved within approved egress times; i.e. assumptions need to be made on egress time that require a total volume number to exit. The Green Guide capacity calculations also only apply to closed or sealed venues and cannot be applied to large free mass gatherings such as fireworks or city light shows where capacity cannot be controlled. Green Guide capacity estimations also do not consider crowd issues when flows exceed gateway or corridor capacity, however this chapter supports the empirical commencement of crowd planning with a capacity statement. It is good practice to start with a quantitative approach to define management process.

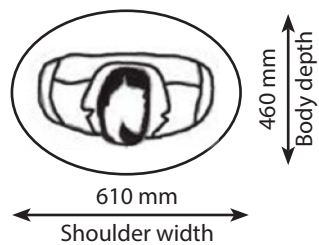

Figure 6.1: Pedestrian operating space and clearances

Body depth and shoulder width are the primary human measurements used by designers of pedestrian spaces and facilities, where shoulder breadth is the factor affecting the practical capacity. The plan view of the average adult male human body occupies an area (the body ellipse) of about 0.14 m2. However, a 460 mm by 610 mm body ellipse equivalent to an area of 0.21 m2 is used to determine practical standing capacity,

allowing for the fact that many pedestrians carry personal articles, natural psychological preferences to avoid bodily contact with others and body sway. Figure 6.1 *Pedestrian operating space and clearances* from the Government of Western Australia guidelines illustrates this.

An initial spatial maximum should be four persons per square metre provided this is never used as a final capacity as crowds do not average out spatially. Spatial capacity estimates are of limited value in crowd management situations.

Traditional crowd management planning

Even with the correct average number of people in an area, internal movements through bottlenecks, gateways and pathways can all become dangerous if too many people try to push through them.

DIM-ICE

The DIM-ICE tool was created by Prof G.K. Still in 2001, and referenced from his text book *Introduction to Crowd Science* (2013). It is a breakdown of the functional areas: Design, Information and Management; across the three periods of an event: Ingress, Circulation and Egress. It is derived from the origins of the functional areas involved across the periods of crowd movement in an event. It is essentially a time matrix, of the design factors, information and management opportunities that exist during the three periods of crowd flux. Police, council and host venues appreciate the breakdown as it provides them with the information they need to make resourcing and conditioning decisions. Normally promoted as a spreadsheet comparison, this limitation restricts the detail of information that can be provided, which is a weakness. Additional information has been included by practitioners, including crowds on approach and egress towards transport hubs. This method is still an effective tool to identify crowd risk areas and points over the period of the event.

International risk management standard

Crowd planning from a risk management approach is a consultation approach based on identifying risks and working with groups to implement agreed controls. T he international risk management standard ISO

31000 is applicable to all activities. Crowd management can benefit from this method. A crowd risk management approach requires consultation with all stakeholders to identify the things that can go wrong. Internal, external and internet research should be applied to cover all possibilities and create awareness of possible outcomes. This is the strongest feature of this methodology, because this also builds relationships with stakeholders and begins a working group approach. Risk management requires consultation throughout the process, including at the assessment and control development stage, which is often overlooked. The correct way to apply crowd risk assessment is to ensure that a group of seasoned, experienced and focused stakeholders discuss and agree on all stages of the decision making. Once an educated group is gathered and has considered the answers, risks and controls become easy. This method is now an internationally used process and good practice must include an application of this methodology.

Security risk assessment of crowd flows – what could go wrong?

An understanding of what risks can occur, and why risks precipitate to become incidents, is the fundamental basis of risk management. To determine if event objectives are achievable, detailed risk identification and causation needs to be considered and included. This research needs to include and outline the principles of crowd incident causation from bottlenecks to overcrowding to security interaction and communication with the crowd.

The foundation of all crowd management derives from the work of John J. Fruin (1971). Among his spatial calculations and level of service guides developed for the US highway capacity manual and his work on pedestrian movement he developed a F.I.S.T. model, which details the elements that affect crowds and crowd behaviour. Fruin was the first to clarify crowd risks revolved around:

1. **Force** or energy of the crowd which also included many factors such as crowd size, movement, motivation, peer group leadership and external influences.
2. **Information**, crowd visual perceptions signals messaging and precedent.
3. **Space**, how much physical room was available and the impact it had on other factors.