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# Emergency Preparedness Guidelines For Mass, Crowd-Intensive Events

## **Acknowledgments**

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# **Introduction**

## BACKGROUND

- SCOPE
- SYNOPSIS

### **BACKGROUND**

This project was undertaken by Emergency Preparedness Canada in recognition of the numbers of deaths and injuries occurring world-wide as a result of mass public gatherings, many of which traditionally lack sufficient, or effective spectator control.

Multiple deaths and injuries at large public events have occurred consistently, over a wide spectrum of countries and types of events. Certain, highly competitive sports events, particularly soccer, and rock concerts and festivals consistently tend to produce spectator-generated incidents, while air shows and auto races tend to produce more participant-generated occurrences.

Such situations show no signs of abating. Even as the draft of this report was being prepared and finalized, three additional such incidents, involving loss of life, occurred.

While a number of sociological texts address the underlying causes of what might be termed crowd mentality, little definitive effort has been applied to capturing the lessons learned from such incidents, and providing the experiences in a form that can be used as a guide for planning for such events in the future. It is toward this goal that this project was directed.

A review for the more catastrophic of such events (chronicled in Appendix I) demonstrates that the phenomenon is widespread, and in fact a world-wide problem. Emergency Preparedness Canada has authorized this study as a further Canadian contribution to the United Nations proclaimed International Decade for Natural Disaster Reduction.

### **SCOPE**

The suggested guidelines in this study have been developed from a number of sources and most tend to be applicable to a wide range of mass public gatherings.

There has been significant focus on youth audiences attending large rock concerts, and competitive sporting events due to the difficulties and major incidents historically associated with such enterprises. Many of the guidelines derived from such experiences have applicability to a broad range of less challenging endeavours.

Certain specific types of events have, by their nature, an inherent capacity for management problems. While the general guidelines offered throughout this document apply, specific additional considerations are addressed for certain, high-risk events in the

section: "Contingency Plans for Specific High-risk Events."

In certain situations, such as visits by high-profile political figures or controversial activists, intensive security arrangements are necessary. Such procedures are outside the scope of this report, and, it would be inappropriate and counter-productive to provide them here, given the wide and unrestricted distribution of this document. Where such events are envisioned, contact between emergency planners and the appropriate security personnel should permit a meshing of the crowd management methods suggested here with the necessary security elements.

## **SYNOPSIS**

This document focusses on a number of major areas, which either singularly or collectively, have historically exacerbated the problems inherent in mass crowd-intensive events. These issues have included such aspects as physical layouts - site, structures, accesses, etc.; spectator management --crowd organization, flow, ingress/egress control; public safety - security, public health, medical care, etc.

In some instances historically, advance assessment of, and pre-planning for, the event failed to occur, or when it did, failed to identify the potential for disaster, and/or mitigating or coping strategies in the event of a major incident.

Experience has also proven that certain events, such as auto races and air shows, due to their nature, require particular planning in addition to the more generally applicable guidelines. As a result, these have been addressed in more specific terms in this document.

Finally, it is recognized that no two events or situations are identical. While this document is intended to provide an approach to planning for, and coping with, such events, it is not intended to suggest that the guidelines herein are universally applicable, nor without need of modification to the specifics of the particular event.

## **Acknowledgements**

- [OTHER SOURCES](#)
- [NOTE REGARDING REFERENCES](#)

The cooperation of the following agencies is gratefully acknowledged. While the material was provided for research being undertaken by the author prior to the commencement of this study, the material was accessed and analyzed in greater detail during the project, and thus it is appropriate to acknowledge the contributions of the following to the study.

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#### **OTHER SOURCES**

Also accessed were the Law Enforcement Reference Centre of the Canadian Police College, Ottawa, and the research files of Emergency Health Consulting Services, Oakville, Ontario.

Appreciation is expressed to Mark I. Edmonds for his kind permission to use photos 1 through 3.

All other photographs by the author.

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#### **NOTE REGARDING REFERENCES**

Material accessed during the study is listed at the end of this document under the heading "References and Bibliography," in alphabetical order by author, or in the case of newspapers, by date.

As a result, reference keys for attributed quotes in the body of this report will not be found in numerical sequence

## **Pre-Event Planning**

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- [SPECTATORS](#)
- [LEGISLATIVE ISSUES](#)
- [PUBLIC HEALTH ISSUES](#)
- [EMERGENCY HEALTH ISSUES](#)
- [POLICE, SECURITY, AND LAW ENFORCEMENT](#)
- [CONTINGENCY PLANS](#)

In the initial planning stages for major crowd events a number of considerations should be addressed in advance.

### **SITE**

1. Is the site location negotiable? (Can emergency planners recommend an alternate more appropriate site for the event, or is the event committed to a specific location?)
2. Has the proposed site (particularly outdoor) been surveyed for inherent hazards by the nature of its location, and have any been identified? (Is the site traversed by power lines which could be brought down by a severe storm; adjacent to a waterway subject to high water flooding, etc?)
3. Does the site have adequate access and staging area for large numbers of emergency vehicles in a major incident?
  - a. is access to, and road network within, adequate, or would emergency responders have to walk significant distances to the principal spectator areas(s)?
  - b. once on site, is there sufficient room (i.e. for staging, manoeuvring) to permit repositioning or redeployment of emergency vehicles as dictated by the incident?
  - c. due to the nature of road access would early arriving vehicles (e.g. ambulances) be prevented from leaving by gridlock produced by subsequently arriving equipment?
4. Is the site served by an access road or street which could be closed to the public and used only for expeditious emergency and service vehicle ingress and egress?
5. a. Is the site layout such that, in the event of a mass casualty situation, space is available for an on-site triage area to permit stabilizing medical treatment prior to removal of critical patients?

- b. Is such an area accessible to ambulances, to eliminate the need to carry patients long distances?
6. If access roads are unpaved, would emergency vehicles become bogged down if heavy rains occurred during, or just prior to, the event?
7. Does the site allow for adequate crowd regulation, e.g. existing regimented seating areas, flow barriers, etc.?
8. Are spectator overflow areas available to prevent crush, should spectator turnout significantly exceed expectations, a common phenomenon in rock concerts?
9. a. Is the surrounding road network able to handle the anticipated spectator vehicular traffic?
- b. If spectator parking areas are filled, will the road network allow continued vehicle flow thus preventing gridlock?
10. Should anticipated spectator parking areas be filled, are there nearby areas for overflow parking? Are shuttle buses desirable, feasible, or necessary?
11. In an urban setting, as is characteristic of a stadium venue, could the adjacent street on all four sides be closed to other than emergency, service, and resident vehicles, to permit a perimeter for access as well as a buffer zone?

## **SPECTATORS**

12. Does the nature of the event predispose it to certain negative spectator issues; eg.
- a. rock concerts can create problems with youth abuse of alcohol and/or drugs, and in some cases, even weapons,
  - b. religious/"healing" events can attract an inordinate number of the ill or infirm, thus increasing the potential for on-site medical/health related emergencies,
  - c. certain sports events can attract over-reactive supporters and hooligan acts,
  - d. events for senior citizens can often increase the number of medical crisis at the event as opposed to a younger, and healthier sector of the population.

## **LEGISLATIVE ISSUES**

13. Is there currently legislation which governs or restricts the event? (A model provincial statute is shown in Appendix II.)
14. Could local legislation (by-law, ordinance, etc.) to permit good order at the event be prepared and passed prior to the event?



15. Have legal counsel for the municipality in which the event is proposed been advised, with a view to determining:

- liability for injuries,
- liability for acts or omissions,
- liability for financial obligations incurred in responding to major emergencies occasioned by the event.

16. Has, or can, the promoters be required to post a bond to cover costs of municipal response to emergencies, subsequent site clean-up, traffic, crowd, and other policing functions?

17. Have any legal permits required been applied for, and obtained, such as parade permits, permits to serve liquor, fire safety permits ?

18. Are acts of municipal council required to close certain adjacent or periphery roads or streets?

#### **PUBLIC HEALTH ISSUES**

19. Have appropriate health authorities been consulted for:

- running water (particularly for hand washing by food service and medical personnel),
- sufficient public toilets (with provision for pump out of portables and servicing as necessary during the event),
- adequate refrigeration for perishable food stuffs,
- recognized, approved suppliers of bulk food stuffs to the site food provisioners,
- sufficient covered containers for the storage of food waste, including removal during the event,
- appropriate storage and removal of liquid waste?

20. Will public health inspectors be available on site during the event to monitor public health compliance?

21. Do public health authorities on site have legislated authority to enforce "cease operation" orders on on-site food providers who are in contravention of standards or are otherwise operating contrary to the public interest?

#### **EMERGENCY HEALTH ISSUES**

22. What level of on-site medical care (if any) is indicated (by the nature of the event) and will be provided?

#### **Facilities**

23. Will a first aid room, tent, or vehicle be on site?

24. Will any such facility be

- clearly identified, and
- reasonably accessible by spectators?

25. How, and by whom, will medical supplies be obtained, including secure on-site storage of drugs?

### **Medical Care**

26. What level of care will be available on site, e.g. physician, nurse, paramedic, first aider?

Who will provide such coverage and how will they be compensated?

### **Ambulances**

27. Will ambulances be positioned on site, or will they have to be called to the site on an asrequired basis?

28. If ambulance(s) are on site for participants (e.g. racers, etc.) are these ambulances dedicated only to participants, or can/will they be available for spectator injuries?

### **Logistics**

29. Will medical staff be confined to a hospital room to which the injured must make their way, or will clearly identified field medical teams patrol dense spectator areas?

30. Will there be vehicles to transport spectators protracted distances on site to the event medical facility?

31. Will medical vehicles be appropriate to the terrain: e.g. regular ambulances for road networks, 4-wheel-drive vehicles for off-road areas, golf carts or similar vehicles for densely packed or widespread spectator areas?

32. How will ambulances be notified of, or summoned to, spectators requiring assistance in widespread spectator areas?

### **POLICE, SECURITY, AND LAW ENFORCEMENT**

33. Will the site/promoter use regular police officers for on-site policing, or will private security officers be engaged?

34. Will police service only public areas outside the event perimeter, or on site as well? If the latter, what is the split in role/function between police and private security?

35. What enforcement policies will be exercised in relation to minor offences on site, so that discretion will be exercised consistently throughout the event?

36. Will there be areas on site which collect and store significant sums of money, and how will security, and off-site transfer/banking be achieved? (At large events, ticket/box office, midway ride cash offices, and on-site liquor sales have traditionally been meccas for large cash holdings.)

37. Will there be a central on-site repository for cash periodically collected from various locations at the event, for consolidated transfer off-site?

38. Are such areas positioned near road access to avoid carriage of large sums of money on foot through spectator areas?

### **CONTINGENCY PLANS .**

39. Have law enforcement agencies additional staff on stand by or recall should the event require immediate increase in police services?

40. Have area hospitals been alerted to the nature of the event, type of spectators, and medical problems which might be anticipated? Have area ambulance services been likewise advised?

41. Have local fire department/rescue services been notified as to the nature of the event, and what services might be required?

42. Have public works and engineering operations been advised?

- Have the necessary types of heavy equipment that could be required in a catastrophe (e.g. grandstand collapse) been identified?
- Have plans been made to activate that equipment at any time (including after hours) during the event?

43. If there is a reasonable possibility of death (e.g. automobile or power boat races, air-shows, etc.) has provision for a coroner/medical examiner to be on site been made? (Such will avoid delays in body removal and the ensuing emotional trauma to other participants and spectators alike.)

44. In order that the exact location of an emergency be identified quickly,

- Will a site plan, incorporating access roads, pathways, major landmarks, spectator, performer and vendor areas be available?
- Will any numbered identifiers for vendors' locations or booths be included on the site plan?

45. Where helicopter flights are contemplated for spectators or media to view the event from the air:

- Will flights be prohibited directly over the event and spectators, and confined to circular paths around the perimeter?
- Will staging areas or heliports be confined to the periphery of the event, to avoid flights over spectators during take offs and landings?
- Does the proposed staging area or heliport comply with federal regulations governing such usage?

## **SITE ACCESS AND PERIMETERS**

### ■ [PATHWAYS AND ROAD NETWORKS](#)

### ■ [VEHICLE ACCESS](#)

In an emergency, responders should not have to compete with spectator traffic in accessing the site. An access or perimeter road network can facilitate egress from the site in a crisis.

In the Woodstock Concert (Bethel, New York, 1969) spectators literally abandoned their cars on the access roads after available parking lots filled, creating a massive traffic jam and preventing the ingress of emergency vehicles. When police attempted to alleviate the problem by closing the off-ramp from the major access freeway, spectators merely proceeded to the next exit and returned from the other direction, the ramp from which had not been closed due to initial minimal traffic from that direction.

In the Bradford (England, 1985) Stadium fire, ambulances and fire-apparatus were prevented from accessing one major stadium entrance due to a narrow street on which vehicles had been permitted to park on both sides. In some cases, fire trucks had to creep along the sidewalks as the only way to by-pass parked cars and other emergency vehicles that arrived earlier.

These incidents are in contrast with the road network access that were in place at three Canadian events.

At two major weekend-long rock concerts at Mosport Park in a rural setting near Bowmanville, Ontario, in 1978 and 1980, police closed one access road (a rural concession road with minimal indigenous traffic) to all but emergency and service vehicles. While there were few roads into the area, this road entered the site from the east, while the bulk of the spectators came from the west, i.e. the heavily populated areas around Toronto. With multi-lane highway access to the road leading to the spectator

access road, few attempted, or probably were aware of, the other, more remote access. Regardless, the forethought of restricting access facilitated the exiting of ambulances and their expeditious return to the site, as well as facilitating exchange of police and medical staff at shift change.

At a major all-day rock concert in Hamilton, Ontario (1975), the stadium involved covered a city block, with a residential street on each of its four sides. Police closed all four streets to all but emergency vehicles (and necessary access by residents), providing an effective operating perimeter, emergency access, and buffer. (Coincidentally, immediately across one of the streets was a school, unoccupied in the summer months. The lower level was used as a field hospital (with smaller, first aid stations on each side of the stadium itself) with the upper level used as a police command post, affording an excellent view into the stadium and surrounding streets).

Site access and perimeters have been demonstrated to be a desirable, if not essential component of the emergency management structure. The latter cases cited demonstrate that although the physical layout, location, and access may differ, a pre-event analysis should permit identification of routes/road networks appropriate to controlled or emergency access.

#### **PATHWAYS AND ROAD NETWORKS**

In outdoor events covering large areas, internal pathways and vehicle clearways are essential for emergency access.

Pedestrian pathways through dense crowd areas, such as festival seating (described elsewhere in this report), are necessary primarily for medical staff to access sick or injured spectators.

Ideally, such pathways will consist of a perimeter path around the periphery of the spectators, with two cross paths at right angles joining the perimeter loop. (In essence, a circular perimeter path with a cross-shaped path effectively segmenting the patrons into four quadrants). This mechanism was shown to be most effective when employed at the Mosport Park, Ontario, rock concerts in 1978 and 1980, with upwards of 80,000 attendees.

In this case, the physical layout by coincidence facilitated this approach, as during previous frequent auto races, pedestrian traffic had worn away the grass to the underlying soil. As a result when the rock concerts were held on the site, persons seated on the ground (the only option) invariably chose to sit on grass rather than dirt thus leaving the pathways clear for access.

While this, as noted, occurred by coincidence, the emergency access it thus provided greatly facilitated medical response to patrons in the densely packed spectator area. (A high board fence, to discourage spectators from approaching the stage, reduced the sight line of any who sat too close, thus effectively completing the perimeter pathway).

While not all physical locations will present in this matter, outdoor sites could have such pathways artificially created with loads of soil placed over the grass. In time, such would be absorbed and thus would not require post-event removal.

In a series of major outdoor religious gatherings in southern Ontario in 1984, spectators were cordoned off into manageable groups, using snow fences, etc. While accepted at the time, such "pens," however, might not be well received by audiences in the future.

Positioning of temporary seating on the floors at indoor events can be done with the same principle of cross aisles for access in mind.

### **VEHICLE ACCESS**

In outdoor events with vast spectator areas, emergency vehicle clearways may be necessary in addition to emergency on-foot access to denser areas noted above.

Such clearways were established during a series of visits in 1984 by a world religious leader, which attracted an estimated three-quarters of a million people. In this way, ambulances responding to emergencies were not in conflict with site pedestrian traffic, which was kept off the clearway by various methods - barrier tape, snow fence, security officers, etc. - depending upon the area.

When field medical personnel on-foot accessed sick or injured spectators, in the denser areas, the patient would be brought to the nearest point on the clearway to rendezvous with an ambulance summoned by radio.

A similar concept was employed at the rock concerts noted above under "Pathways." The racetrack (with encircled the spectator area, including the pedestrian pathways) in effect served as a vehicle clearway.



Photos 1, 2: Ambulance movement (above and below) is impeded by absence of emergency vehicle clearways, at 1984 religious rally.



Photo 3: Ambulance proceeds expeditiously when emergency vehicle clearways are maintained.



Photo 4: Dirt pathways traversing on-grass seating permit access through densely packed spectator areas.

## **SPECTATOR MANAGEMENT AND CROWD CONTROL**

- [CRITICAL CROWD DENSITIES](#)
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- [LIQUOR, DRUGS, AND WEAPONS](#)

The greatest task is the ability to manage the crowd effectively, and prevent an unmanageable mass over which control is lost (or abdicated). "Effective crowd management requires a thorough understanding of crowd behaviour and a coordinated effort to plan safe environments to accommodate all kinds of audiences at all kinds of events" [32].

The objective is "... to prevent the build-up of large accumulations of patrons particularly within short time periods in confined spaces" [5].

### **CRITICAL CROWD DENSITIES**

Fruin identifies "critical crowd densities" as a common characteristic of crowd disasters. Critical crowd densities are approached when the floor space per (standing) person is reduced to about 1.5 square feet [5].

Considering the various movements or positions spectators will occupy, approximate minimal mobility requirements have been empirically identified by Fruin [5].



- pedestrians moving in a stream require average areas of 25 square feet per person to attain normal walking speed, and to by-pass and avoid others;
- at 10 square feet per person, walking becomes significantly restricted, and speeds noticeably reduced;
- at 5 square feet per person, the maximum capacity of a corridor or walkway is attained
- (with movement at a shuffling gait and movement possible only as a group. This would be characteristic of a group exiting a stadium or theatre);
- at less than 5 square feet per person average, individual pedestrian mobility becomes increasingly restricted;
- at approximately 3 square feet per person, involuntary contact and brushing against others occurs. (This is a behavioural threshold generally avoided by the public, except in crowded elevators and buses);
- below 2 square feet per person, potentially dangerous crowd forces and psychological pressures begin to develop.

"The combined pressure of massed pedestrians and shock-wave effects that run through crowds at critical density levels produce forces which are impossible for individuals, even small groups of individuals, to resist" [5].

#### **APPLICATION TO CROWD MANAGEMENT**

Utilizing the guidelines noted above, such, when combined with the dimensions of crowd accesses (corridors, aisles, etc.) may permit (or demand) a "metering" technique (allowing a maximum number of patrons to enter the area at one time), holding subsequent numbers at the entrance until the preceding group has been "absorbed" into the desired location.

#### **PANICS AND CRAZES**

While the word "panic" is associated with a number of human behavioural patterns, in a crowd application possibly the definition by Fruin [5] is most appropriate: "group behaviour involving flight from a real or perceived threat, in which personal escape appears to be the only effective response..." As Fruin emphasizes:

"... initial flight from a real source of danger is a very normal human reaction ...panic behaviour is really a result of frustration of that escape" [5].

While panic is normally a flight or escape reaction, a "craze" is an opposite, but equally threatening, crowd situation. A craze is defined as: "group behaviour in which there is a temporary, short-lived competitive rush by a group toward some attraction or objective" [5]. An alternate, but parallel definition is: "where no apparent danger is perceived (by

numbers of a group) but (where) the group is given direction ... by an induced sense of urgency" [32].

Group restraint is temporarily abandoned as a result of a short-term fixation on the objective.

Panics are usually associated with crowd egress (exiting), whereas crazes are associated with crowd ingress (entering) [5].

Often perceptions, no information, or incorrect information are catalysts to the panic or craze. It must be remembered that in a dense crowd, individual perception is limited to interpretation of the behaviour of surrounding persons in immediate view [5].

## **DEFUSING**

One aspect that can be a precursor for difficulties is the tedium that is created by an extended wait in line (for tickets or admission). Such boredom can create or magnify tempers, particularly, if with little distraction, there is a perception of other doors being opened first, other patrons getting in at the head of the line, etc.

All of the following have been used with success, in different venues:

- the playing of up-tempo music (of a type consistent with the age-group of the crowd) over the public address system;
- humorous, animal-costumed individual (e.g. a mascot) walking up and down the line, giving hand-shakes, pats, and waves;
- large inflated beach ball, which is hit and lobbed back and forth over, and by, the spectators;
- food and beverage sellers moving through the group;
- e. cheerful security staff, passing up and down the line, talking to people.

Some of these same approaches can be utilized inside the event, to calm a potentially agitated crowd.

In addition, up-tempo music with which a costumed mascot may conduct a spectator sing-along, or a ticket or program number draw on the field for the last ball used at a sporting event, can both tend to alleviate tension in a crowd, and have been used successfully.

## **OUTDOOR CONCERTS**

The biggest single factor in outdoor crowd management is the control of the number and distribution of spectators on the field. As a review of one such major event noted "Those

managing the event were not able to rectify the crowd crush condition in front of the stage after they had failed to exercise control over the number of people congregating there" [23].

Pauls in his empirical research on a 1980 Toronto outdoor rock concert, suggests a minimum of 5 square feet per person for "festival seating" (i.e. on ground without seats) [23]. Less than that approaches critical crowd density (for such seating) and the problems it invites, as noted previously.

Pauls further noted "Some means must be found for limiting the number and density of persons immediately in front of the stage." [23]. The observation confirms many similar conclusions at such events before and since.

## **SEATING**

While conclusions from the literature are not totally definitive, most serious crowd-related injuries tend to occur in events involving young people, where general admission without reserved or designated seating occurs. Spectators anxious for the best vantage point, flow into the seating areas once the gates or doors are opened, pushed by the crowd surge behind. Should there be an impediment to that flow, those at the front can be crushed by the pressure of those behind. Such a crush killed eleven teenagers at a concert at Riverfront Coliseum in Cincinnati, Ohio, in December 1979, and resulted in 95 lives being lost at a soccer stadium in Sheffield, England in April 1989.

Ideally, all seating will be reserved, i.e. a seat number will show on all tickets. While this is the desirable goal and possible in a theatre or concert hall setting, it is accepted that is a most difficult task in a ground seating venue.

While it is particularly difficult to regiment ground seating on an outdoor field setting without seats, every effort should be planned and made to regulate the numbers and speed at which spectators can enter the seating area.

Reserved seating should be strongly considered as the only seating allowed for those events that attract excitable and competitive crowds.

## **TICKETING**

Depending upon the physical layout of the event, advance tickets (as opposed to those purchased at the gate) can be printed with specific entrances to be used for specific seating areas. This will automatically segment the crowd initially, reducing the numbers at any one egress point.

In certain, non-performance events (e.g. picture displays, art shows, etc.) times printed on tickets can be staggered to spread patrons arrival over a wider time frame.

Tickets sold for seating with obstructed views should be clearly endorsed as such to prevent angered patrons and attempts to encroach on other seating areas.

Where the demand for tickets is expected to attract an uncontrollable element or ticket buyers in numbers beyond the sales outlets' capacity to accommodate them, a mail order system should be considered [32].

## **BARRIERS**

Channelling or funnelling spectators into specific, otherwise undefined areas (e.g. creating a pedestrian path from parking lots to spectator areas) can be done by two means; physical and psychological barriers. The effectiveness, and hence choice, will be dependent upon the anticipated mood and behaviour of the spectators.

### **Physical barriers**

These can be such as snow fence (a relatively inexpensive and easily installed and removed method), or a series of saw-horse type barricades, either linked to each other, or the intervening gaps between them traversed by strands of cable.

Individual, saw-horse type barricades should be secured to the ground. In one incident at a major Canadian exhibition, a child climbed onto the bottom rung of such a barricade, causing it to overbalance and fall on her, occasioning fatal injuries.

### **Psychological barriers**

Yellow plastic barrier tape (commonly termed "crime scene tape") is economical and easily strung. Such is effective for an orderly crowd, but its effectiveness is predicated on obedience rather than physical control.

Planning will of necessity have to pre-determine the probable attitude of the crowd and the implication for security or safety should the barrier be breached, in determining the appropriate method.

## **CROWD THROUGHPUT CAPACITIES**

Fruin in his writings on crowd disasters [5] presents various guidelines for spectator throughput in entry to a performance. For planning purposes he suggests:

- ticket-takers faced with a constant line can throughput a maximum of one patron per second per portal in a simple pass-through situation;
- two seconds per patron if the ticket must be torn (and stub handed to patron);
- more complicated ticketing procedures (and/or answering the occasional question) will protract time per patron.

### **Doorways**

Free-swinging door, open portal, or gate can accommodate up to one person per second with a constant queue.

Revolving doors and turnstiles would be half this rate of throughput, or less.

## **Corridors, Walkways, Ramps**

Have a maximum pedestrian traffic capacity of approximately 25 persons per minute per foot of clear width, in dense crowds.

## **Stairs**

Have a maximum practical traffic capacity of approximately 16 persons per minute in the upward direction.

Narrow stairs (less than 5 feet in width) will reduce maximum capacity above.

## **Escalators and Moving Walkways**

A standard 48-inch wide escalator or moving walkway, operating at 120 ft. per minute can carry 100 persons per minute under a constant queue.

## **ENTRY**

As crowds for some events with popular performers, particularly with general admission or festival seating, will assemble well in advance of announced show-times, it is essential that crowd management procedures and personnel be in place early, with a contingency plan to call in staff even earlier, should even the most generous estimate of early arrivals be surpassed.

It is essential that a line-up be initiated with the first arrivals - to attempt to organize an even medium size crowd can be exceedingly difficult, as the sequence of arrivals cannot be determined. While the line formation in respect to arrival is of little consequence to organizers, it can create animosity in a crowd which feels latecomers are ahead of them - such animosity is to be avoided, and can be, if (a) line(s) is initiated with the first arrivals.

Historically (Cincinnati and Sheffield), a crowd surge (or craze) occurs when patrons outside perceive (incorrectly in the Cincinnati incident, correctly so in Sheffield) the event has commenced prior to their gaining admission.

To avoid such incitements, prior to any testing of internal sound systems, particularly with test music, external public address systems should announce to those awaiting admission that the sound system is being checked, the performance has not commenced, and there will be ample time for all to enter.

Such problems can be exacerbated if the doors are opened at approximately the same time as the performance sound system is activated.

## **Other Entry Strategies**

Where tickets are purchased in advance, specific entrances may be allocated for certain

seating sections, and possibly printed times may be staggered (by a few minutes) from other tickets (and named entrances). This reduces congestion in the interior area in the search for the correct seat.

Such is valid only with reserved seats, and desirably with entrances out of sight of the others, to avoid other lines fearing they are being deprived of the best seats by nearby "early" admissions.

Controlled entry (see section "Metering") is always essential, as it becomes difficult to predict accurately the catalyst for a crowd surge, or craze.

Internal procedures and staff should be in place to permit earlier-than-announced door openings, to reduce tension on particularly large crowds, as well as permitting a slower and hence better controlled ingress in the time prior to the performance.

An earlier-than-announced/anticipated opening can reduce spectator fears that those towards the rear of the line may not gain entry in time to see the commencement of the event. While this is seldom if ever true, it is the spectator perception that can lead to problems.

As doors are opened for spectators, security - usually three in U.S. experience [28] - position themselves (see "Metering"), and allow one portion of the line (a 10 feet segment) to pass to the entrance, while the following groups are maintained in position until the first group clears the entry portals. As their group clears, these security staff then take a position at a subsequent point. In this method, controlled groups are released into the entry and seating area with minimal likelihood of a craze (or of serious consequences should one occur, due to the minimal numbers entering at any one time.)

## **METERING**

Metering is the term applied to control procedures to prevent critical crowd densities from developing in a specific area.

Typical problem areas (what might be termed "bottlenecks") include entrance corridors (leading to seating areas), escalators (in particular, at the "leaving" end), stairways, and turnstiles and revolving doors.

The square footage shown under "Critical Crowd Densities" can be used as a rough determinant as to what a given area should be permitted to accommodate.

## **Escalators**

Where escalators are in use for crowd ingress or egress, a staff member should be at the top and bottom, regardless of the direction of travel (e.g. up or down). The person should be positioned on the side of the escalator equipped with the emergency stop switch in order not to have to break through the queue for access in an emergency.

Apart from being able to stop the escalator immediately should someone fall, thus alleviating a pile-up, the person can "meter" the flow, by spacing patrons' access to prevent the overcrowding which leads to jostling and falls. Equally important, however, is to prevent access to the escalator temporarily if the escalator is delivering more people into the receiving (i.e. leaving end) than the available space can accommodate.

### **Stairways**

The same metering of the flow of patrons onto stairways can be accomplished to prevent the pressures that lead to falls and pile-ups.

### **Corridors**

Metering can and should also be applied where patrons could fill access corridors to a point approaching critical crowd densities.

### **Waiting Lines**

Where spectators are lined in file on the street along an external wall awaiting ticket sales, admission, etc., critical crowd densities are not usually a problem, as the remainder of the width of the sidewalk, and ultimately the roadway, provide for space expansion.

Where lines are formed between two rows of fences or barriers (to create a specific path), critical crowd density can occur as patrons fill the width of the path. In such cases, "breathing spaces" or buffers maintained approximately every 10 feet, can provide for necessary space expansion and hence density release.

These spaces are created by cords, ropes, or simple light plastic tubes, placed across the line of spectators approximately every ten feet, and with a "buffer" of an additional few feet of clear space before the next 10 foot segment of patrons. As an alternative, the cords or tubes can be placed across the spectator line every 10 feet, without the buffer areas. Although such does not provide an expansion and hence density release area, it still nevertheless tends to segment the crowd into manageable groups of people, and has also found to be effective [28]. Such allows control, and prevents a surge when the doors or gates are opened in a general admission or festival seating venue. Obviously, such separators need monitoring by security to ensure they remain in place, maintaining the intended buffer zones.

## **EXITS AND CORRIDORS**

One of the major causes of fatal incidents at large public performances has been locked fire exit doors, often done to prevent youthful patrons, once inside, from opening the doors to provide free access to friends. Obviously such practice is fraught with disaster, but the practice continues. Alarms that are activated by the opening of exit doors can provide a significantly safer alternative and deterrent, particularly if the doors are so signed.

All exit doors must be operative from the inside (i.e. direction of egress) and should be verified immediately prior to public admittance.

All exit signs must be in place and operational. In addition, low-level, retro-reflective signs that extend the width of the door should be considered.

Doors that appear to lead to exits, but do not, should be so marked, to prevent panic and entrapment in a dead end, in an emergency.

All exit corridors must be kept clear of impediments to crowd movement (e.g. storage containers, bulk waste receptacles, etc.)

Where turnstiles are present at entrances, such should be of a "free-wheeling" design in reverse so as not to inhibit use as an emergency exit, or if portable, moved aside once the bulk of the patrons have entered.

Exit corridors must not be crossed by lighting or electrical cables which can create tripping hazards. Where, of necessity, these must cross aisles or other public areas, they must be highlighted (e.g. coloured tape) and secured to prevent a tripping hazard, as well as insulated to prevent short circuits from spilled beverages, etc.

#### **LIQUOR, DRUGS, AND WEAPONS**

Liquor and drugs can be a catalyst for and/or exacerbate unruly behaviour and hooliganism in a crowd. There are a combination of strategies that have been implemented with varying degrees of success in reducing the problem.

- The sale of alcoholic beverages should be prohibited at events where unruly audiences are expected, or where a significant number of the patrons will be under the legal drinking age. (This recommendation was also made by the Crowd Control Task Force investigating the Cincinnati rock festival deaths.)
- Advance tickets and display advertising should contain the message that liquor, drugs, weapons and fireworks will not be permitted into the event and that purchase of the tickets is deemed as consent to a search of person and property for such prior to admission.
- Signs in event parking areas, and at admission gates should also display the warning in 2 above, to discourage patrons from bringing liquor (or drugs) into the event.

There are, however, possible negative consequences to such signage. Some patrons may attempt to consume quickly a quantity of liquor intended for the entire event, prior to admission, ultimately causing problems for the event medical staff, as identified by Chapman et al [1].



Alternatively, it could also have the effect of having spectators leave the liquor in their car, only to imbibe in the parking lot at the end of the event prior to departing for home.

The most desirable approach, obviously, is to discourage patrons from transporting liquor to the event.

- Searches of personal belongings (jackets, purses, bags, etc.) and confiscation of any liquor or drugs found further reduces the on-site liquor-related problems.
- 

Different approaches to seized liquor have been used. In some cases, seized liquor is opened and dumped into large drums in front of the patron. While effective in itself, it can, and has been proven to, create a hostile audience, one which is now in conflict with security and management before the event even begins.

Other approaches have been to give the patron the option of returning it to his/her car (with a subsequent loss of place in line), or tagging it (with duplicate number, peel and stick stickers) for reclaiming when exiting the event. Such approach can also be applied to any potential weapons found, if confiscation, for whatever reason, is not appropriate

## **STAGES, PLATFORMS, AND OTHER PERFORMANCE VENUES**

- [INDOOR](#)
- [OUTDOOR](#)
- [BREAK-AWAY STAGE SKIRTS](#)

### **INDOOR**

The nature of the audience (as determined by the performers), will determine the stage configuration. While classical music and ballet performances normally attract a mature and reserved audience, in contrast teenage and sub-teen fans have frequently been known to storm the stage in order to touch their idol. These incidents, apart from being disruptive, can and have caused injuries.

It thus becomes necessary for emergency planners to obtain a "feel" for the audience - and conduct - that a particular performance will engender.

There are two major ways in which this intelligence can be gained (other than intuitively):

- a. by a review of press reports from, and contact with officials at, previous performances.
- b. in respect to adolescent entertainment (e.g. rock concerts) by speaking with youth, who historically have been able to provide remarkable insights into what

authorities might expect with respect to specific entertainers and the type of audiences, and conduct, they attract.

- c. posts must be securely anchored to the floor not merely mounted to free-standing bases. In the latter case a crowd surge impacting the fencing will cause its collapse and the entanglement and injury, and possible trampling, of spectators.

Such a fence construction also usually provides a certain amount of "give" upon impact, reducing the potential for crush injuries as occasioned in the 1989 Sheffield (England) stadium tragedy.

## **OUTDOOR**

The same fence can be utilized in an outdoor setting as well, however board fences are often erected instead. This has the added benefit of providing a walk space on the spectator side of the fence as well. As most outdoor concert locales do not have seating, spectators in the front rows seated on the ground have to take a position several feet back from the fence to allow for a sight-line over the top of the fence to the stage. This area permits emergency access to the front rows of spectators.

In any stage protection barrier, it must be capable of a certain amount of flex, to prevent the crushing of spectators in the front by a crowd surge from behind, yet sufficiently solid to prevent collapse and the associated injuries. Fences often are not installed to address this two-fold requirement.

## **BREAK-AWAY STAGE SKIRTS**

On stages erected six feet or higher above the ground (common in outdoor festivals) the front skirt around the base of the stage can be constructed so as to break-away under the pressure of a crowd surge, thus allowing spectators to be pushed under the stage, rather than being crushed against its base [23]. The solution is less than ideal for stages with less than 6 foot underclearance, due to face/head contact potential.

It should be stressed that this is a last resort safety back-up, and although undesirable to have spectators pushed under a stage, it is preferable to having persons crushed against its front base. Such a break-away skirt does not replace an in-front barrier, but functions as a fail-safe device.

In one permanent outdoor concert location in southern Ontario, an ad hoc medical post is set up under the stage to accept injuries occasioned at the front of the spectator area (see photo 10, page 45).

## **TEMPORARY STRUCTURES**

Due to their transitory nature, many events require temporary, easily erectable structures. Such include the stage platform itself, as well as towers to house speakers and floodlights, temporary seating (i.e. bleachers), and artistic or appearance items such as archways, overhead signage, etc. and even midway rides.

Due to the temporary nature of the event, the structures are often hurriedly erected (sometimes access to the site is only permitted a short time before opening), and usually designed for rapid removal at the event's closing. In addition, these temporary structures are frequently neither designed nor erected to withstand other than intended use, with no margin for safety. High winds or spectators climbing for a better vantage point can overstress the structure. Historically, a number of accidents have been occasioned by such constructions.

- On the U.S. Memorial Day week-end in 1960, two people were killed and 60 injured at the
- Indianapolis Motor Speedway when the supporting guy wires came loose from their anchorage causing a temporary seating tower to topple over.
- Also in the 1960s, a high-wire performer at Toronto's Varsity Stadium was severely injured when the guy wires supporting the towers came loose, causing the structure to collapse.
- At a Toronto exhibition a young girl was killed when an overhead decorative archway fell on her. The archway was blown over when a sudden and severe wind came off Lake Ontario.
- Also on the same site that year a skating competitor suffered head injuries and was rendered unconscious when a scenic archway fell and struck her.

It is essential that all such temporary structures be designed and erected, with a margin for safety and a view to potential hazards, under the supervision of an engineer or inspector not in the employ of the contractor or promoter. Such should also be inspected periodically during events of longer duration.

Temporary structures that may be used for other than their intended purpose should be signed and/or secured to prevent inappropriate use or access.

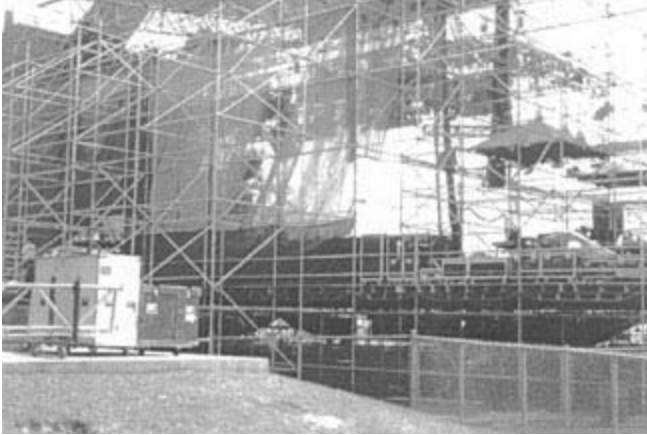


Photo 5: Temporary structures must be erected and stabilized not only sufficient for their intended purpose, but also for such eventualities as strong winds, unauthorized spectator ascent, etc.

## **SECURITY**

- [PEER SECURITY](#)
- [POLICE](#)
- [PRIVATE \(UNIFORMED\) SECURITY](#)

There are essentially three types of security that can be provided at large public events. The nature of the crowd and the type of event may suggest (and have historically suggested) that some facets of the crowd management spectrum are better served by one than the others:

- - a. Peer security.
  - b. Regular police officers in uniform (whether paid by the jurisdiction or the promoter).
  - c. Private security guards in uniform.

In addition, a mix of security types for different aspects of the event may be most appropriate.

### **PEER SECURITY**

Experience has shown that, in general, overall control of youth audiences is better and more simply achieved by what is termed "peer security" - security staff of the approximate age of the spectators, who can relate to and be accepted by the youthful patron. Usually wearing brightly coloured T-shirts plainly marked SECURITY (or at one

event, "SECURITY - Please Feel Secure"), the staff avoids the military or semi-military posture of rigid authority and the force that often accompanies it.

As one concert organizer describes it, "They do not carry weapons and do not attempt to fill a police function. They serve as crowd monitors, people movers, and troubleshooters" [28]. Such personnel are "not there to reform or catch the alcohol or drug user... They concentrate on maintaining orderly crowd flow for the safety of the patrons" [28].

As with any staff, appropriate guidelines for such personnel have to be provided, along with the limits of their authority. Duties for security at the historic Woodstock concert in 1969, which attracted 500,000 spectators, were:

"... keeping the peace, helping people in distress, assisting the staff of doctors and nurses, clearing paths for ambulances, seeing that areas were cleared for helicopter take-offs and landings, and guarding the stage, the performers, and all the land we hadn't rented. They did not include busting people, whether for drug offenses, nudity, obscene gestures, or [sex acts]. People on bad drug trips were to be handled gently until someone with experience could be found [to assist]" [25].

Joe Kimble, Chief of Police from Beverly Hills, California, as an observer at Woodstock, stated: "I have a strong conviction that traditional police methods are not necessarily the best methods" [13].

### **Searches**

(See also "Liquor, Drugs, and Weapons", p. 20)

Two of the major event security providers in the United States utilize women to conduct liquor searches, because "... they have found that women are more readily accepted by both sexes" [28]. Women obviously feel more comfortable having another woman check their personal belongings, while males find it less confrontational than if another male were to examine their possessions.

It is interesting to note that all items confiscated by both groups noted above are checked and can be retrieved by the patron after the concert. Spectator hostility is not fostered by dumping seized liquor in front of them, for example. (It should be noted that the restrictive legislative issues governing search and seizure by police do not apply here, as it is a wilful consent between two private individuals).

### **Attitude**

Bruce Jenny, owner of Event Security comments, "Rock concert security has to be low key, complementing the ambience of the concert" [28]. Jenny comments that the attitude of his security personnel has been a factor in crowd compliance. Security staff are charged with not only directing the attendees, but also with making them feel welcome [28].

As Irving Goldaber comments in his article *Is Spectator Violence Inevitable*: "Every individual... who comes into contact with the spectator is a crowd controller of a sort. This contact person sets, by dress, demeanour, and actions, behavioural expectation levels" [6].

## **POLICE**

Police certainly have a role, but it may not be one that is all-encompassing. In many events, uniformed police handle perimeter issues of traffic control, essential street closures, etc., leaving interior event security and crowd control to peer security.

Certain spectator groups may not, however, be amenable to peer security, and this includes crowds which historically have seen violence as part of the event "culture." European soccer fans are one such group.

While various defusing techniques (see "Defusing", p. 14) should be available and attempted, often nothing less than a contingent of stern uniformed police will dissuade a spectator group which enters with the expectation and intent of violence. This is in marked contrast to rock concert audiences who enter in a peaceful frame of mind, but are induced to rowdiness by liquor, shortcomings in the event, or other provoking catalysts.

## **PRIVATE (UNIFORMED) SECURITY**

Such can sometimes provide the worst of both worlds; the uniform gives an authoritative appearance that is often not supported either by training or authority in law.

As a result, they provide neither the strength (either physically or legislatively) of the law, nor the rapport of peer security.

Their use in crowd events might best be left to non-confrontational roles, such as ticket-takers and security for specific areas, such as art displays, paintings, etc.

While their value in crowds of youthful exuberance, or volatile sports spectators is questionable, they are probably well suited (and less costly than regular police officers) at events which attract more docile spectators - religious rallies, charitable dinners, art shows, etc.

## **PUBLIC HEALTH ISSUES**

- [PRE-EVENT SURVEY](#)
- [FOOD SANITATION](#)
- [WATER](#)
- [TOILETS](#)
- [GARBAGE](#)

- [ANIMALS, RODENTS AND VEGETATION](#)
- [SWIMMING AND WATER AREAS](#)
- [SITE ENVIRONMENT](#)
- [INFECTION/PERSONAL HYGIENE ISSUES](#)
- [TATTOOING](#)
- [CONTINUITY](#)
- [POST EVENT](#)

### **PRE-EVENT SURVEY**

A pre-event public health survey is highly desirable for any outdoor site intended for a mass spectator event. Such survey should identify and quantify:

- Public health hazards:
  - insects, rodents, snakes, noxious weeds, marshes, environmental pollution, etc.
- Safety hazards:
  - quarries - particularly unfenced, pits, scrap piles, swamps, cliffs, deep water, etc.
- Sources/locations of/for:
  - potable water - waste water disposal - toilet facilities - collection, storage, and disposal of garbage, particularly scrap foodstuffs.
- Campsites:
  - safe areas if overnight camping is to be permitted, with particular attention to low-lying areas, areas adjacent to waterways, and areas near power lines, all of which could create problems in a severe storm.
- Vehicular access routes for portable toilet pump-out, garbage removal, water tankers (if used), ambulances, and other essential service vehicles.

### **FOOD SANITATION**

Food sanitation is a vital aspect of public health planning. While important at any event it

gains particular importance during special, one-time events and outdoor events in warm weather. Such locations have historically had less than ideal mechanisms for refrigeration.

Even with adequate on-site refrigeration, however, food spoilage can still occur if supplies are transported some distance, or allowed to remain in vehicles without temperature control prior to unloading.

To ensure adequate standards are met, a public health (food) inspector should initially assess food service set-up, as well as periodically monitoring its provision throughout the event.

For events where, for whatever reason, inspectors will not be available on site, the following guidelines should be considered an absolute minimum:

1. Staff hand washing facilities for food preparers and servers should be immediately available to encourage usage.
2. Persons with diseases, open sores, or with coughs or colds should not be utilized.
3. Hairnets or other headgear should be used.

#### **Storage**

- 1. Food should be stored off the ground, and in covered containers, away from animals and insects.
- 2. Refrigeration for meats and other easily spoiled foods should be available, particularly outdoors in hot weather. Storage of large quantities on ice (i.e. in chests) is not always adequate, as the food that is stacked on top is farther removed from the cooling, as well as being continually exposed to the outside temperatures upon frequent opening.
- 3. Raw meats and poultry should not be allowed to drip onto other foods below. .

#### **Preparation**

1. Raw and cooked meats should not be stored together, nor prepared on the same surface.
2. Vegetables should not be washed in the same container or sink used to thaw meat or poultry without a thorough wash with soap and rinse with household bleach.

#### **Refrigeration**



Bacterial contamination of food can create a number of health-related problems such as salmonella food poisoning. Bacteria grow rapidly in unrefrigerated food, for example:

- - a. at refrigerated temperatures, bacteria will double every six to eight hours - the same bacteria will double at room temperature every 15 minutes;
  - b. one bacterium, growing optimally can become 4 billion in just 8 hours.

## **General**

As a overall guideline in food sanitation, it should be:

- a. kept cold
- b. kept clean
- c. kept covered

## **WATER**

An adequate source of drinking water must be available. (One guideline is three gallons per person per day [19].)

An appropriate means of access for spectators must be considered in a field or outdoor venue.

## **TOILETS**

Where existing toilet facilities are judged inadequate, additional portable units must be available.

Toilet locations should be:

- - a. well-marked,
  - b. well-lit (including surrounding area) if night usage is envisioned,
  - c. serviced (including pump-out of portables) on a 24-hour basis during the event (vehicle access is obviously necessary),
  - d. located away from food storage and food service areas. (Provision for hand-washing for food service staff, and spectators prior to eating, should be located adjacent to food service areas. Thus some hand washing facilities should be available near toilet areas, others near food service areas.)

## **Numbers**

Numbers of toilets required is a matter for conjecture. An equal distribution of toilets male/female, although typical, has been found to be unrealistic. One Canadian guideline

[19] for outdoor festivals suggests: per 1,200 persons, three toilets and three urinals for males and nine toilets for females.

A 1987 Cornell University study of highway rest stop washroom usage for the Washington State Department of Transportation suggested a 60-40 ratio of female-to-male fixtures would be appropriate.

After a 1988 research survey of usage times of public rest rooms indicated females take up to twice as long as males in the facilities, the State of Virginia required newly constructed public places to provide a 2-to-1 female-to-male toilet ratio.

The state of California uses a 3 to 2 ratio.

In an outdoor setting, it becomes a relatively simple matter to provide additional portable toilets. As a hedge against long line-ups, particularly at female toilets, some organizers have provided additional, non-designated toilets to be used by either sex. Those with sensitivities can continue to use the designated toilets, those without such concerns can use either. The effect is to reduce lines at both male and female toilets.

In an indoor setting with fixed facilities, additional toilets are difficult to arrange. One sports arena in Philadelphia reduces the problem by converting some men's washrooms to women's for events where a large female audience is anticipated.

## **GARBAGE**

Garbage should be deposited in covered containers placed strategically around the site. Covers are essential if food waste is anticipated, particularly in outdoor settings in summer heat.

Spectator density may prohibit garbage removal vehicles, and as a result some method of emptying containers to prevent overflow must be considered, with possibly a central, properly prepared holding area, until bulk removal after the event.

Specific containers for recyclables should be considered, if feasible.

## **ANIMALS, RODENTS AND VEGETATION**

In outdoor settings, control of rodents, snakes and insects of significance to health must be addressed.

The possibility of rabies in the animal population in the vicinity of the activity area must be addressed.

Noxious weeds and poison ivy/oak should also be considered.

## **SWIMMING AND WATER AREAS**

Water quality must be addressed not only in designated swimming areas, but also in bodies of water which could be utilized for ad hoc swimming in hot weather.

Some form of supervision, i.e. lifeguards, are indicated, particularly if families with small children are expected, alcohol consumption (with subsequent judgement impairment) is anticipated, and/or the water area is of questionable safety (i.e. depth) as a swimming area.

Experience has shown that where youthful audiences attend an outdoor concert in hot weather, particularly in overnight situations without washing facilities, any nearby water area will be employed as a make-shift swimming/bathing/washing area.

### **SITE ENVIRONMENT**

Accident generating hazards, such as rock outcroppings, cliffs, steep ditches, pits and rock cuts, scrap piles, and dangerous (e.g. barbed wire) fences must be identified, corrected, or if not possible, cordoned or fenced off and/or marked with signs.

### **INFECTION/PERSONAL HYGIENE ISSUES**

As a means to limit the transmission of diseases in certain festival environments, particularly those of overnight duration and/or with the availability of camping (and hence requisite privacy), the provision or availability of condoms and a needle exchange/disposal mechanism should at least be considered. While a sensitive and controversial issue, it is nevertheless an important public health concern in contemporary society and must be addressed.

### **TATTOOING**

With a return in popularity of tattoos, transient operations, in vans, motor homes, and trailers, have begun to appear at certain types of public gatherings, such as carnivals, motorcycle races, auto swap meets and similar events.

Due to the potential of cross-infection, particularly of blood-borne diseases, any such operations should be inspected to ensure, as a minimum, disposable (single-use) items are utilized where possible, proper sterilization equipment and techniques are employed for the remainder, and clinical "sharps" containers are utilized for used needle disposal.

### **CONTINUITY**

To ensure continuity of public health initiatives, an initial public health inspection should be made just prior to opening. (Such is for compliance, as a result of the initial public health survey noted earlier.) Subsequent periodic inspections should be made during the event, depending upon its duration. These are particularly indicated for outdoor events in hot weather with transient food vendors, who may not have sufficient sanitary or refrigeration mechanisms at their disposal.

Such inspectors should have access to resources to mitigate any problem noted (e.g. toilet servicing, unsafe area fencing repairs, water testing, etc.)

**POST EVENT**

A post-event survey should be made to ensure a proper clean up is undertaken, particularly from a public health perspective (e.g. all scrap foodstuffs, discarded needles - if possible drug use, etc. --are removed and properly disposed of). Obviously, from an environmental perspective, a proper return of the site to pre-event conditions, is essential.



Photos 6, 7: Spectators create long lines at water tanker (above), and at toilets (below). Ontario 3 day rock festival, 1980.





Photos 8, 9: At this outdoor public barbecue, meat is uncovered, unrefrigerated, and on the ground in the August heat (above). During serving, bread which fell was merely kicked under the cooking stands, an attraction for rodents (below). Fuel tanks for the barbecues were often left unattended, and in the hot sun all day.



## **MEDICAL CARE PROVISION**

- [NEEDS](#)
- [MEDICAL CARE PROVISIONS](#)

- [FIELD TEAMS](#)

- [AMBULANCES](#)

## **NEEDS**

While spectators who require, or avail themselves of, on-site medical care will vary significantly in numbers and types of problems, some statistics from rock concerts which, generally speaking, are the largest generator of victims (barring unpredictable disasters such as the Bradford Stadium fire or the Ramstein air show crash), are available.

Chapman et al [1] identified an almost identical proportion (0.5% to 1.5%) of concert goers requiring some form of medical assistance, regardless of the "character, locale, physical layout, and size of the concerts."

Interestingly, although alcohol and drug use was common in most festivals, such was the sole or major diagnosis in less than 10% of the patients [1]. Other complaints included lacerations, fractures and sprains, burns, sunburn, heat stroke, seizures, asthma, and exposure, the latter due to a sudden temperature drop combined with rain.

At mass gatherings generally (including, but not limited to, rock concerts), even barring civil disturbances and environmental aspects (e.g. extreme heat), the incidents of illness is greater than that expected to occur naturally in a population of comparable size [4].

## **MEDICAL CARE PROVISIONS**

The provision of medical care to event spectators (and participants) is essential not only for humanitarian reasons, but for legal considerations as well. In addition, the provision of an on-site first aid or medical area will significantly reduce the demand on area hospitals' emergency departments.

Information on the specifics of physical hospital set-up, equipment requirements, etc. is available in the references (see also Appendix III), which may be tailored for the nature of the event by medical staff involved.

Some aspects, however, should be addressed, in addition to those in the "Pre-planning" section of this document, as a result of recurring difficulties from past experiences.

## **FIELD HOSPITAL**

While these site hospitals have normally been able to contend with the casualties presented (the Woodstock Festival 1969, being a notable exception), failure to plan for, or have event promoters follow through on promises of, a number of logistical requirements, have made medical, nursing, and ambulance efforts unnecessarily onerous. Many of these have occurred in outdoor (e.g. medical tent) settings.

- Clean water for hand washing and other medical uses has historically been difficult to obtain. Often a single garden hose has had to suffice.
- Electricity for certain medical appliances has often been as minimal as an electrical extension cord run across the ground from some distant building. Further complicating medical care was the ensuing lack of adequate lighting in tent hospitals at night.
- Washroom facilities for staff and patients were often not in close proximity and/or had to be shared with spectators.
- Meals for medical staff, although provided by promoters, often didn't arrive, in sufficient quantity, or until hours later.
- Tents provided for hospital usage have been without flooring, or a floor which was not attached to the tent walls. As a result, rain and other water runoff flowed under the tent walls and across the floor, creating an intolerable working situation, not to mention a hazard with electrical appliances.
- No telephone service (landline) strung to the medical tent was available to permit ordering of additional staff or supplies, and notifying area hospitals of patient transfers. The advent of cellular telephones has alleviated the problem in recent years, however arrangements for such provision must be made.
- Reserved access roads have not been provided, requiring staff at shift changes and ambulances to compete with lines of spectators' vehicles.

## **FIELD TEAMS**

In tightly packed areas, particularly near the performers' stage, medics on foot may be the only viable approach. Experience has shown that clearly marked medics on foot circulating in dense spectator areas are quite effective, and will be readily summoned by patrons in an emergency, even when the person requiring care is a stranger to them. By contrast, even when a clearly marked field hospital is visible, spectators are often unwilling to make the sometimes long trek to obtain assistance, thus running the risk of losing their seating position, particularly for someone they don't know, or for whom they fail to appreciate the seriousness of the condition.

Identification of field medical teams, where ambulance or clinical uniforms are unsatisfactory for the venue, has been successfully accomplished by T-shirts clearly marked "Medical Staff," "Hospital," or with red crosses, front and back. (Note: As the red cross symbol is a registered mark of the International Red Cross and its National Societies, it should not be used without permission.)

## **AMBULANCES**

While conventional ground ambulances are appropriate for patient transfers to off-site medical facilities over good roads, in an outdoor setting such vehicles may be unsuitable for off-road usage. Ad hoc roadways and cross-country terrain may require four-wheel drive vehicles, particularly if grounds are saturated by recent rainfall. As four-wheel-drive ambulances are not available in most areas, four-wheel-drive suburban-style vehicles, equipped with portable ventilator/suction, trauma kit, and spinal board with necessary immobilization equipment, can serve in the short distances between spectator areas and the field hospital.

A magnetic roof light, portable radio, and side placards can obviate the necessity to alter the vehicle itself.

In denser spectator areas, any vehicle can have access problems, and consideration should be given to utilizing golf carts, either designed or modified to accept a stretcher, in these areas.

The ambulance network, then, may have to consist of a mix of medics on foot, golf-carts, four-wheel-drive vehicles, and conventional ambulances, to best facilitate the patient transport requirement.



Photos 10,11: Emergency first aid station under the performers' stage (above). Field hospital with ambulance and golf cart ambulance (below). Rock festival, Barrie, Ontario, August 1992.





Photos 12, 13: Stretcher-equipped golf cart (above) transports patient from spectator area to field hospital, which is well utilized (below).



**SAFETY ISSUES**

- [SEATING ANCHORAGE](#)
- [GAS CYLINDER ANCHORAGE](#)
- [LIGHTING AND POWER REQUIREMENTS](#)
- [PUBLIC ADDRESS SYSTEM](#)
- [TWO-WAY RADIO COMMUNICATION](#)
- [EMERGENCY TOOLS](#)

### **SEATING ANCHORAGE**

Seating in a community centre, arena, or similar location often combines the standard fixed perimeter seating, with additional seating on the central floor (or in the case of an arena, on subflooring laid over the ice surface).

Often these temporary chairs - folding or stacking - are not secured to the floor, or each other. For a sedate recital or similar performance, usually no difficulty results. However, with a more enthusiastic audience, two problems can occur.

First, persons standing on the seats for a better view (common in rock concerts) are prone to injury if balance is lost or they are jostled. In such instances, other spectators can be likewise upset, caused by a domino effect in the closely spaced chairs, and a potential for significant number of injuries created.

Secondly, should an audience become hostile, as happened in one Toronto concert in August, 1980, the portable chairs can become dangerous missiles. In the Toronto incident, 18 people were injured (including five police officers) when fans, angered at a performer's last minute cancellation, turned aggressive.

Where portable, folding, or stacking chairs are utilized, particularly with youthful or exuberant audiences, they should be secured to the floor. Where this is not possible, attachment of the front and rear legs of a row of chairs, to two long planks, one running under the front legs, and one running under the back, will provide a viable solution.

### **GAS CYLINDER ANCHORAGE**

Often at public events tall portable pressurized gas cylinders are used to inflate children's balloons, provide cooking fuel, carbonate beverages, etc. Frequently such cylinders are not restrained, or are merely fastened to a two-wheeled hand trolley used to move them, which is itself not independently secured.

Should such cylinders fall over and crack the cylinder neck or valve, the uncontrolled release of the stored pressurized gas can create a deadly projectile of the cylinder.

As a result, all vertical gas cylinders must be secured, both top and bottom, by ropes or chains to a structural post, wall, etc.

### **LIGHTING AND POWER REQUIREMENTS**

Even in venues darkened for the performance, lighting should always be adequate to identify exits, and corridors and aisles leading thereto [23, 32].

Auxiliary power or generators should be in place to provide minimum light levels in a power outage, as well as to power the public address system. The latter may permit directions that will alleviate panic to be given to the spectators in a power failure [5, 23].

As many concerts are performed with only stage lighting, access to the main lighting (or house lights) is essential in case of an emergency. The location, and means of activation (if not simple on-off switches) must be known to those on site responsible for emergencies.

### **PUBLIC ADDRESS SYSTEM**

Some means of communicating with the crowd is essential, and this includes those amassed outside the stadium, etc., as well. Ideally the two systems should be separate, to permit messages to be directed at each group (those inside the stadium/building and those on the outside awaiting admission).

While the sound system used by the performers may appear to serve the internal requirement, historically those responsible for it have refused to allow its use, except during the change of performers. As a result, on several occasions, requests to make an announcement for next of kin in a medical emergency have been denied for as long as 40 minutes.

It thus becomes essential that appropriate arrangements, and access in an emergency, are developed in advance. If a separate system is to be utilized, some means of provision to silence or over-ride performers' sound system is required.

Experience noted by Pauls [23] identified the necessity of :

- - a. clarity of announcements (both in volume - relative to spectator noise - as well as instruction), and
  - b. respect for, or credibility of, the announcer, in achieving the required/desired action.

Where outside public address systems cannot be put in place, the public address systems which form part of the electronic siren in most emergency vehicles may suffice.

### **TWO-WAY RADIO COMMUNICATION**

While it goes without saying that the various emergency services (police, medical, etc.) must be able to communicate with their own staff, experience has shown that they must be able to:

- a. communicate with each other,
- b. communicate between their own staff who are outside and those inside (in order to get a proper overview of the total situation), and
- c. be able to communicate with senior event organizers - including security (who may be the first to identify an incipient problem).

A central communications area (room, trailer, etc.) with a representative from each major agency may facilitate the provision of vital information by providing a central monitoring of relevant radio communications.

### **EMERGENCY TOOLS**

Experience at Cincinnati, Sheffield, and other incidents suggest the difficulties could have been reduced, and future similar incidents avoided, if basic forcible entry tools were available. The provision of (a) kit(s) containing:

- a. a fire axe with prong,
- b. a pry or crow bar, and
- c. a pair of heavy duty bolt cutters, strategically placed could be of immediate assistance in an emergency.

### **ANCILLARY CONSIDERATIONS**

- [TOXICITY LABORATORY](#)
- [INFORMATION CENTRE](#)
- [LOGISTICS SUPPORT](#)

A number of ancillary aspects can be considered. Not all will be necessary or appropriate in all event types.

### **TOXICITY LABORATORY**

A major difficulty posed in appropriate field clinical diagnosis of the rock concert drug overdose victim is an unclear idea as to the drug, dosage, or potency taken by the patient. Even when the victim is coherent, the drug believed taken may have in reality been another, or adulterated. As is well known, there is no quality control, or ethics, in street drugs.

To attempt to cope with on-site drug identification, medical staff at the Watkins Glen, New York, rock concert (July 26-29, 1973, estimated attendance 600,000) established a mobile toxicology laboratory on site in a trailer adjacent to the hospital tent. This is believed to be the first time such was included as part of the medical facility at a rock concert [14].

The benefits included triage of drug overdose cases for removal to city hospitals, as well as reducing such numbers which otherwise would have been necessary without toxicological confirmation in the field diagnostic process.

#### **INFORMATION CENTRE**

A well-identified, well-publicized information centre on site, staffed with knowledgeable staff, can reduce pressures on security, medical, and other event staff, by providing a full range of informational services to patrons. Reduction of uncertainty in spectators reduces the tension that can lead to behavioural problems.

#### **LOGISTICS SUPPORT**

The immediate availability, preferably on-site, of maintenance staff, an electrician, and a plumber can reduce the possibility of a problem escalating to a level which may effect public health or safety.

### **CONTINGENCY PLANS FOR SPECIFIC HIGH-RISK EVENTS**

- [POWER BOAT RACES AND SIMILAR ON-WATER EVENTS](#)
- [AUTOMOBILE AND SIMILAR RACES](#)
- [AIR SHOWS](#)
- [FIREWORKS/PYROTECHNICS](#)
- [EVENTS INVOLVING PRE-TEEN AND EARLY TEEN AUDIENCES](#)

#### **POWER BOAT RACES AND SIMILAR ON-WATER EVENTS**

##### **Medical Support**

●

A medical response boat should be available, in water with appropriate spinal stabilization and resuscitation equipment on board. Such boat should be linked by two-way radio to the rescue boat (no. 2, below) and land ambulance.

- A rescue boat should be in attendance with experienced divers equipped with scuba gear, and trained to effect inverted, below-surface releases as well as under-water extrications.
- Landing locations appropriate for the transfer of stretcher patients from boats to land ambulances must be identified.

### **Spectator Areas**

1. Appropriate buffer walls should be in place to retard out-of-control vessels which run aground at high speed from entering spectator and pit areas.
2. Where spectators are permitted to line piers and breakwalls, (i.e. along areas of deep water)
  - a. a line should be marked to warn spectators from the edges fronting on deep water.
  - b. a dedicated boat should be in attendance to constantly patrol the area, be equipped with a loud hailer to direct spectators (who venture too close to the edge) and equipped to provide a water removal and resuscitation. This vessel should be separate from, and in addition to, any vessel committed to the event participants.
3. All boats intended for rescue or medical attention should be clearly marked.
4. Any vessels used for participant or spectator control should be staffed with personnel with appropriate lifesaving and emergency medical training, including CPR.
5. Any vessel intended for medical assistance and/or water rescue should contain sufficient clear space to resuscitate the prone human form, and be equipped as a minimum with:
  - a. spinal board for full body immobilization, including necessary cervical collars and restraint strips.
  - b. ventilation equipment, which should desirably be a positive pressure oxygen ventilator, and as a minimum, a bag-valve-mask unit, preferably with an oxygen assist. Oropharyngeal airways and suction should also be included.
  - c. a supply of large pressure dressings.

- d. personnel trained and experienced in the use of the equipment identified above.
- e. personnel trained and attired to enter the water to effect a rescue and removal.

### **AUTOMOBILE AND SIMILAR RACES**

Note: Organized auto races conducted by professional racing bodies at permanent facilities normally meet these guidelines. The following are intended for occasional or one-time events with less official sanction.

#### **Medical Support**

1.
  1. An ambulance and trained staff should be immediately available. The vehicle should be designed and intended as an ambulance, not merely a van with basic equipment provided as an ad hoc measure.
  2. The ambulance should be positioned for rapid access to the track, and an appropriate communications mechanism should be in place to immediately activate its response to a track emergency.
  3. Guidelines should establish in advance:
    - whether or not the race will continue if the ambulance leaves (i.e. to transport a patient), and/or whether a back-up ambulance will be available to take its place during the former's absence.
    - whether the ambulance will be dedicated strictly to the participants, and if so, what means are available to assist with medical emergencies among the spectators.
  4. Means to obtain fire department /rescue vehicle extrication services expeditiously if such are not available on site.
  5. Consideration as to the provision of a field hospital should be given, in relation to the size of anticipated spectator attendance, distance to hospital, etc.
  6. A policy should be established that clearly stops all racing if the ambulance is called onto the track. Some races continue to run, under caution or other signals, while the ambulance, on the track shoulder, accesses an accident not obstructing the race. A fatal accident at an Ontario track some years ago, when a competitor's vehicle impacted a track ambulance, suggests total stoppage in such situations should be strongly considered.

#### **Spectator Areas**

1. Walls or barriers should be in place to isolate spectators from out-of-control vehicles.

It is not sufficient to provide a barrier of sufficient height to retard penetration by a single impacting vehicle, but the possibility of one vehicle mounting another or somersaulting end over end must also be considered, in barrier strength and particularly height determination.

In addition, parts of automobiles involved in collisions can become projectiles, and wheels can come loose and bounce into spectator areas. As a result, a strong wire mesh may be necessarily affixed to the top of the retaining wall as an additional protective mechanism, permitting spectator visibility while serving as a trap for projectiles.

2. Spectator access to the track and pit areas at race conclusion should be carefully monitored, if permitted at all. Participants often test vehicles after the event, with neither drivers nor spectators anticipating each other on the track.

#### **Pit Areas**

1.
  1. As in-race refuelling of cars in pit areas can create potential for fire if fuel inadvertently contacts hot parts or is subject to an inadvertent spark, appropriate and sufficient-sized fire extinguishers must be available and manned by trained personnel at the refuelling site(s).
  2. Depending upon track access and sight line to the pit area (particularly for longer duration races where vehicles will be rapidly serviced for return to competition), a marshall with access to a signalling device (e.g. an air horn) should be positioned to warn pit crews and others of an entering vehicle.
  3. If spectators are to be permitted in the pit area, consideration must be given as to protection from such aspects as hot engine parts, sharp metal used in emergency repairs, etc., as well as safety in crossing the race course to the infield.

#### **AIR SHOWS**

Although most air shows are properly staged by competent participants, certain factors to reduce the implication of a serious incident should be considered by emergency planners.

#### **Acrobatic Areas**

1. The acrobatic and fly-past areas should not take place over the spectator areas.
2. Where aircraft exit a manoeuvre laterally (i.e. parallel to the ground), the direction of exit should be away from, or parallel to, the spectators, not towards or over them.
3. Acrobatic manoeuvres should not take place over built-up areas, but over fields, water, airstrips, or other uninhabited locale.



## **Safety**

Stand by fire equipment should be capable of delivering foam onto a crashed aircraft. Most municipal fire departments carry and utilize only water. Should the air show not take place at an airport with foam trucks, alternate arrangements should be considered, as water delivering fire apparatus will be unsatisfactory.

In the event of a mishap, organizers should have a clear idea as to the requirements of the coroner/medical examiner and air crash investigators.

Contingency plans should consider how spectators will be dealt with, (i.e. show cancelled, closest spectators held as witnesses, home video cameras (which might have recorded the incident) requested, etc.)

## **Parachute Jumps**

1. Parachute jumps should have landing zones safely away from spectators, or hazards to the jumpers. In one southern Ontario incident a number of years ago, the two jumpers were blown off course, one narrowly missing landing on a busy highway, the other landing on the roof of an exhibition grandstand.

Spectators can also be injured in the scramble to avoid a jumper descending into their midst.

## **FIREWORKS/PYROTECHNICS**

Most incidents involving fireworks can be avoided with special attention given to the launch site.

### **Placement/Launch Site**

1. Where possible the launch site should be on water (i.e. on a barge). Should the supply ignite, the barge can be abandoned to burn itself out.
2. There must be a buffer between the crowd, and the launch site, in the event of a tip over after ignition resulting in a lateral, rather than vertical, projection.
3. Fireworks must not be projected over the heads of spectators, as debris, often hot, from overhead fireworks can fall into spectators eyes, onto their heads, etc.
4. Fireworks should not be projected over flammables, trees, bush areas, buildings, or boats (if over water).

5. Unused fireworks should be stored in covered metal containers to prevent inadvertent ignition, either by staff, or by descending hot particles from previously deployed overhead fireworks.
6. Firefighting equipment, commensurate with location, should be on immediate standby including fire extinguishers (and preferably trained fire-fighter(s)) at the launch site.
7. Protective gear including face shields, helmets and heavy gloves - in case of explosion, premature, or delayed ignition - should be worn by those deploying and igniting the fireworks.
8. The launch site and surrounding area should be carefully inspected after the event to ensure no incipient or rekindled fires are possible. All used fireworks should be soaked and removed from the site, along with any securing spikes, wires or other potentially hazardous objects which could provide a subsequent hazard.

#### **EVENTS INVOLVING PRE-TEEN AND EARLY TEEN AUDIENCES**

Concerts that attract younger audiences (e.g. pre-and early teens) can create a number of difficulties for staff, including lost individuals, those who get separated from friends, miss scheduled return transportation, have insufficient funds for alternate transportation, etc.

Often parents will drive young spectators to the event, but have difficulty in finding them at the conclusion, or traffic jams prevent close access upon return.

A concept to alleviate these difficulties for all involved was implemented for such events some years ago by Toronto's CNE Stadium.

A "Parents' Oasis" was set up on site adjacent to the stadium to provide parents with a waiting area during the concert. Coffee, soft drinks, and cookies were provided by area suppliers as well as newspapers to pass the time.

Parents were thus able to identify a specific meeting place at the conclusion of the concert with their children prior to their entering the stadium.

Information booths were set up outside the stadium, as well as clearly marked event staff, to assist lost children, with public address access to the Parents' Oasis. This provided instant paging of parents if necessary.

At another concert in the same stadium, the Oasis was set up under the stands, in a players' dressing room. Parents could have access to their child's actual seating location, if desired.

The concept of a Parents' Oasis is one that recommends itself to concert-type events aimed at younger audiences which are such that parents would not want - or be wanted by

their children - to be in attendance at the actual performance. The efforts in providing such a facility are more than offset by the reduction in effort needed to deal with the youthful audiences at the conclusion of the event.

## **MILITARY ASSISTANCE**

### ■ [AID OF THE CIVIL POWER](#)

### ■ [HUMANITARIAN ASSISTANCE](#)

Note: This section has applicability to Canada only. Different laws and practices may apply to military assistance to civil governments in other countries.

While most events will not involve military assistance, exceptions do exist (Woodstock Festival, New York State, 1969) and emergency planners should at least be aware of the protocols involved.

Two distinct types of military assistance are available, and it should be clear as to which (and the differing activation protocol) is appropriate, or desired, in the given situation.

### **AID OF THE CIVIL POWER**

The doctrine, or term, of Aid of the Civil Power is a precise legal term embodied in the National Defence Act. Its application is in situations of real or perceived insurrection against civil authority, with which the usual civilian police authorities are unable to cope.

Canadian Forces personnel so mobilized are weapon-equipped and have all the legal powers of constables, although they are under the control of their usual military commanders. Activation of aid of the civil power may only be done in writing in a manner prescribed under the National Defence Act (sec. 274-285, R.S.C. 1985) by the appropriate provincial Attorney General.

Costs incurred in such operations are, by law, assumed by the federal government (sec. 285, N-5, R.S.C.)

### **HUMANITARIAN ASSISTANCE**

The Canadian Forces frequently assist government agencies in emergencies, utilizing their human and materiel resources, as well as their unique logistics, communications, and other expertise.

Agencies so requesting however, must appreciate that such assistance falls outside the Aid of the Civil Power statute, and as a result, a charge-back of all costs incurred may be made to the requesting party or agency.

As a result, municipal and regional government agencies should contact the appropriate provincial or territorial officials for support, as such may be more appropriately available.

In addition, not only may it avoid an unexpected charge-back, but avoids utilizing unnecessarily military resources outside their primary defence mandate.

## **REFERENCES AND BIBLIOGRAPHY**

■ [APPENDIX I](#)

■ [APPENDIX II](#)

■ [APPENDIX III](#)

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