

Risk Analysis for Major Concert Events  
The Benefit of Hindsight  
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**Abstract**

This paper argues that a risk assessment relating to crowd safety at a contemporary concert event that is based solely on quantitative measurements is fundamentally flawed. A common approach to risk assessment is reviewed and a need to adopt a four dimensional approach to risk identification is argued.

**Introduction**

A logical start point for a discussion on concert crowd safety standards is to consider the level of fatal accidents that have occurred at contemporary concert events in recent years. After all, if there have been very few fatal accidents a discussion on improving crowd safety might seem pointless. Data provided illustrates (a) the level of fatal accidents that have occurred, (b) the circumstances in which accidents have occurred and (c) risk categories identified.

**Research Method**

The year 1974 was chosen as the start point for research into concert accidents. This year was selected on the grounds that it was the year that the Health and Safety at Work Act was introduced in the U.K.. Empirical research was then conducted at international level to gather data on accidents/incidents that had occurred during the period 1974-2003 in order to establish if there were similarities between fatal incidents that occurred at concert events held thousands of miles apart. A review of enquiry reports and published literature on fatal incidents was then undertaken. Fatal incidents involving fire or criminal behaviour were then discounted on the grounds that the root cause of fatality and injury to crowd members had been clearly identified. This allowed attention to be focused on incidents where the root cause had not been scientifically explained and an assumption had been made that irrational crowd behaviour had caused an incident/accident.

After discounting fire and criminal acts my research indicated that there had been at least one hundred and thirty-six fatal incidents at concert events that had not been scientifically explained. This figure is not claimed to be a definitive total, it merely demonstrates that fatal accidents/incidents at concert events are a recurring problem that is

growing in terms of casualties. The data that is provided in appendix A indicates the figures for the respective countries/territories that made up the figure of one hundred and thirty-six.

### **Data Analysis**

The first level of data analysis focused on the circumstances in which the victims met their deaths. It was found that one hundred and thirty-six victims died in twenty-nine separate incidents that occurred in twenty different countries/territories:

32 during ingress into a concert

29 in front of (or diving off) a stage during a performance

13 people fell from balconies at arenas and stadiums

9 during egress from a concert venue

53 during egress from a concert venue directly into a railway station subway

Two interesting points came to light at this stage.

1. Crowd safety problems were not confined to the front of stage during a performance.
2. The death of 53 people during egress from a stadium directly into a railway subway indicated that the parameters of a concert risk assessment might need to be extended.

At the second level of analysis venue type was considered. Here it was found that:

19 people died at temporary sites

64 people died at architecturally designed venues

53 people died at a related site (railway station)

At first glance the results obtained from this level of analysis can be misleading as they suggest that architecturally designed venues are less safe than a temporary site. An obvious explanation for a high accident rate at permanent venues could of course be that permanent venues are used far more frequently therefore the chances of an accident/incident are greatly increased over temporary sites that are used occasionally.

It was found that at events where a risk assessment was undertaken, the organisers took a quantitative approach. Generally speaking a quantitative approach considers systems that can be measured i.e. *space, pedestrian speed and flow, tolerance level* (temporary structures), *venue design, staff training and communications*. Typical problems found with a quantitative (pure risk) approach to risk were however:

**Space:** It was found that the 0.5m<sup>2</sup> measurement of space commonly used to establish capacity often failed to consider how people interpreted use of space i.e. sitting/laying down and migration. The need for medical teams (triage casualties) and security teams (aid with extraction) to get deep into a crowd very quickly were overlooked at some events.

**Pedestrian speed & flow:** Important research was often ignored i.e. little consideration was given to studies of the effect of varying levels of human body eclipse and mobility.

**Tolerance:** While the structure might be sound it was found at some events that little attention had been given to working conditions within structures, particularly at front of stage barrier systems.

**Venue design:** Ignorance of crowd dynamics often resulted in poor exit systems and no specific egress routes for the disabled

**Staff training:** There is no qualification for crowd management therefore standards varied from volunteer staff with no training at all to regular staff that was highly trained by a private security company.

**Communications:** It was found that the use of hired radio systems, lack of operator training and misuse lead to communications breakdown at critical times.

A conclusion was reached at this stage therefore that a solely quantitative approach to crowd risk assessment is questionable as at least four categories of risk might exist. Summarised here as follows:

**Quantitative risks:** measured or pure risks

**Qualitative risks:** the psychology of the crowd

**Commercial risks:** Those risks that might be associated with promoting a product or radio station i.e. encouraging extreme behaviour by throwing out free gifts to the crowd.

**Environmental risks:** ground conditions in terms of the impact of poor drainage following heavy rain.

Within each category there are of course a web of complex issues that need to be considered in order to compile a comprehensive risk assessment. It should also be noted that this is not a definitive list of categories, other issues are likely to spring up as research develops our knowledge.

### **Qualitative or cultural risks**

Having considered pure risks above, let's turn attention to cultural risks. Rock culture originated from the United States of America during the mid fifties and from the outset it was promoted as an anti establishment youth culture that deliberately encouraged a demonstrative response from a

crowd. At contemporary concert events crowd excitement levels can be maintained and even increased by the clever use of lighting, sound, special effects, and the actions of the artiste, to a point where a crowd mass can often appear to act irrationally. Support for this argument is to be found in the actions of a youth culture that now accepts irrationality in the form of; moshing, skanking, surfing and stage diving, (see terminology appendix B) as normal cultural behaviour.

The crowd accepts such activities as normal in spite of the fact that each has the potential to cause a lateral or dynamic surge, a crowd swirl, crowd collapse or localised high density. All of which might possibly subject crowd members to a dangerously high-pressure load.

A key factor here is that we are playing with human emotions, therefore understanding the variables that can influence the psychology of a crowd and, the extremes of behaviour that can result, become equally as important as understanding the laws of dynamics. Brian Toft (1996) pointed this out in his critique of the limits to the mathematical modelling of disasters when he stated that individuals create their own sets of criteria against which risk is interpreted. Toft drew on Douglas and Wildavsky (1982) to illustrate his point, as follows:

*"Risk perceived by a given society or individual are not objective but subjective, consequently the whole notion of an unbiased objective approach to quantitative risk assessment is undermined. For, if the assessment of risks is subjective (i.e. the probability and magnitude of risk only exists in the mind of the beholder), then it is not possible for anyone to take objective measurements of a risk as one would a physical phenomenon".*

Support for Toft`s argument can easily be found by observing the actions of young people that attend rock concerts. Youth attitude was graphically illustrated as far back as 1979 when an American student wrote an article in her school paper about a forthcoming concert by the Who on the 3<sup>rd</sup> December 1979 at the Cincinnati Riverfront Arena. Under the title of `Concerts a real trip`, student Terri Sigmon wrote of the atmosphere that the rock industry had deliberately created:

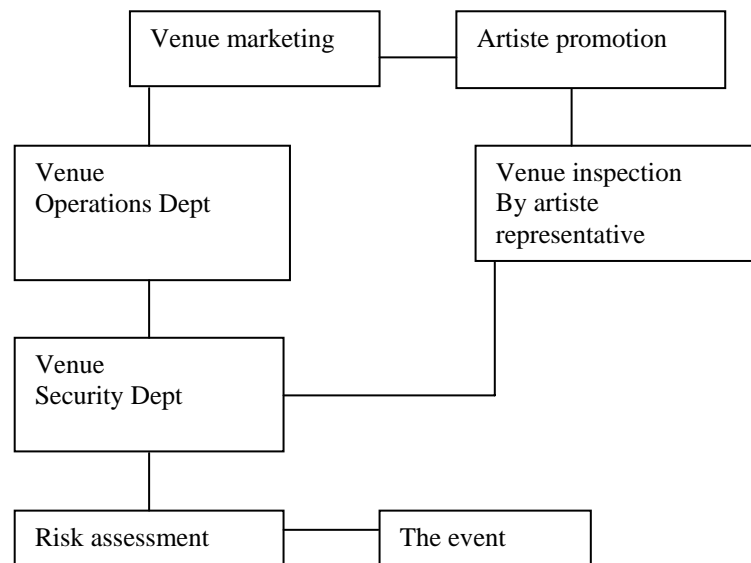
*"... a roar rises from the crowd in excited anticipation of what is about to happen. Suddenly all the bruises, cuts and crushed ribs seem worth it. The rock concert has began". (Sigmon T. 9<sup>th</sup> November 1979)*

At the Who concert that Sigmon was anticipating eleven young people died as the result of a crowd crush during ingress. The disaster occurred at a building that was architecturally designed for crowds. That same design is still used today at many venues.

### Commercial risks

Do not necessarily mean the financial risk taken by the promoter. It can refer to the actions taken prior to and during a performance to enhance sales of a product or radio station. Promotional events are growing in terms of crowd attendance but we often fail to learn from the past On the 16<sup>th</sup> June 1883 one hundred and eighty-three children were killed in a crowd collapse and subsequent crush as a result of trying to claim free gifts offered by the promoter. It is common practice today for presenters and/or performers to throw out tee shirts and/or records into a mass crowd of very young people, such actions invite a crowd surge.

Shopping malls are an increasingly popular venue for promoting an artiste(s) because people can immediately purchase a record that they have just seen an artiste perform. The model below illustrates how the shopping mall promotion system generally operates:



The above model is explained as follows:

- Step1: The record company approaches the venue-marketing department
- Step2: The marketing department accepts and notifies the security department of the date and time of the artiste visit.
- Step3: The artiste's representative visits the venue to meet with the security manager to clarify security and safety issues
- Step4: The security manager makes a risk assessment.
- Step5: The event takes place under the supervision of the venue security team/contractor.

The problem with this type of event is that there can be a lack of understanding of crowd culture by a shopping mall that is keen to attract more people to gain business. A record company can exploit this situation to gain press coverage. It has been known for a record company to invite a TV crew along because there is a good chance of crowd chaos. The rationale applied is *any* publicity is *good* publicity.

Possible flaws in the shopping mall promotion are:

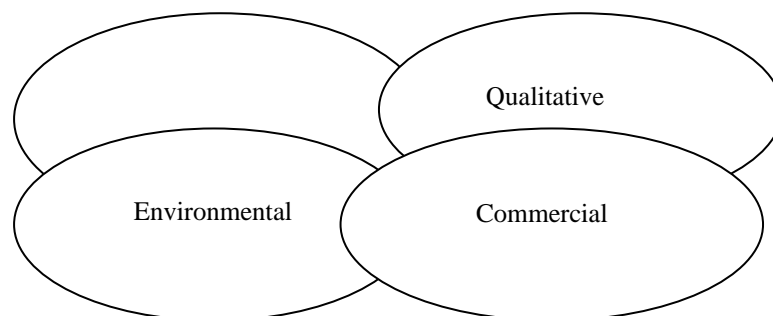
- Risk assessment might be based on emergency evacuation needs for the mall - there is no local area contingency plan
- There is no mandatory requirement for the performer(s) representative to provide prior knowledge of potential crowd actions.
- The venue security manager might not be trained to undertake time consuming research to identify the risks associated with an artiste(s) or event

### **Environmental risk**

The Glastonbury Festival is one that is held in high regard by both ticket buyers and the industry. The event takes place however at a venue that for the rest of the year is a cow pasture that does not drain well. While the public have been known to enjoy frolicking in the mud, who knows what risk to their health might exist. Good natural drainage at a green field site should therefore be a key consideration.

### **Conclusions**

It is argued here that the first step in the risk assessment process is to undertake a comprehensive risk analysis of similar events. The purpose of the risk evaluation analysis is to discover if, when and why, a crowd related accident has occurred at a similar event. The final risk assessment should then demonstrate a four dimensional approach to risk management:



- **Quantitative:** Will the measurements taken from an engineering perspective actually work in practical conditions?
- **Qualitative:** Can we accurately predict the changing psychology of the crowd behaviour during the stages of ingress, attendance and egress.
- **Environmental:** Topography
- **Commercial:** Actions of performers/presenters

Each category is considered separately but each holds equal importance.

End

### **References used in this paper**

Toft B 1996: Limits to the Mathematical Modeling of Disasters: *Implicit assumptions about risk p101*: in Accident and Design ed Hood C. & Jones D.K.C.: UCL Press

Sigmon T 1979: in Are The Kids All Right?: by Fuller G.J. *p 21*: Times Books 1981

## Appendix A

### Fatal Incidents

DATE	PLACE	KILLED	ACTIVITY
1974	White City UK	1	F.O.S. crush
1979	Cincinnati USA	11	Ingress crush
1986	Long Beach USA	3	Fell from balcony
1986	Seattle USA	1	F.O.S. crush
1987	Nashville USA	2	Ingress crush
1989	Donington UK	2	F.O.S. crush
1991	Salt Lake City USA	3	F.O.S. crush
1992	Costa Rica	1	Ingress crush
1992	South Korea	1	F.O.S. crush
1993	Hong Kong	1	F.O.S. crush
1994	New York USA	1	Stage diving
1995	London UK	1	Stage diving
1995	Israel	3	Ingress crush
1996	Columbia	3	Ingress crush
1996	Ireland	2	F.O.S. crush
1996	South Korea	2	F.O.S. crush
1997	Michigan USA	1	Fell from balcony
1997	Dusseldorf GER	1	F.O.S. crush
1997	Brazil	7	Fell from balcony
1999	Belarus	53	Egress crush *
1999	Austria	5	Egress crush
1999	Sweden	1	F.O.S. crush
2000	Denmark	9	F.O.S. crush
2000	Baltimore USA	1	Fell from balcony
2001	Indonesia	4	P.A. egress crush
2001	Belgium	1	Fell from balcony
2001	Australia	1	F.O.S. crush
2002	Venezuela	11	Ingress crush
2003	Brazil	3	Ingress crush

**Fig 1** *F.O.S.= Front of Stage* \* *Indicates that the incident occurred at a railway station close to a venue, it is therefore recorded as egress related. Total = 136 Deaths*



## **Appendix B**

### **Terminology**

*Crowd surfing*: individuals hoist themselves above head height of the crowd and then surf (or roll) around supported by the crowd, normally toward the stage.

*Moshing*: the act of persons slamming into each other (sometimes referred to as slam dancing). Can look like violent behaviour but is not intended to be.

*Skanking*: where crowd members dance around in a circle similar to a tribal dance. Can be the prelude to moshing or crowd surfing.

*Stage diving*: the act of a performer or crowd member diving from the stage into a crowd. The intention is that the crowd will support the diver above their heads and allow them to surf.