



Need for Risk Assessment, Preparedness and Prevention of Pedestrian Crowd Disasters In Religious Pilgrimages of India

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Abstract : Understanding the principles and applications of crowd dynamics in mass gatherings is very important, specifically with respect to crowd risk analysis and crowd safety. Historical trends from India and other countries suggest that the stampedes in mass gatherings, especially in religious events occur frequently, highlighting the importance of studying crowd behaviour more scientifically.

Index Terms- Crowds, religious pilgrimages, preparedness, arrangements, management, Police.

INTRODUCTION

Crowds occur frequently, usually without serious problems. Occasionally venue inadequacies and deficient crowd management result in injuries and fatalities. Extreme crowding results in individual loss of control and both psychological and physiological problems. Crowding is a common experience. The crowd incidents occur in a wide variety of venues and different circumstances, the most common being – sporting events, entertainment events, food distribution, religious events, riot or bomb scare, cases of fire and so on.

Festivals and religious pilgrimages attract thousands of people and the event organizers face numerous challenges in effective crowd management. Mass gathering venues are prone to crowd hazards such as crushing, trampling, suffocation and public health issues (HSE, 2000). The world crowd disaster web has a record of 260 crowd disasters across the world since 1950, which has accounted for 14,989 deaths and 28,242 injuries (Asgary, 2019). Out of the various classes of crowd disasters in the database, 27.69 % occurred at entertainment venues, 23.85% at religious places and 23.08% at sports venues. Crowd disasters of religious origin (62 in number) have caused the death of about 8,000 people, which is 53% of the total fatalities. The global database reveals that 51 % of religious crowd disasters have occurred in India.

Mass gatherings of a religious nature are quite common and frequent in India. The crowd size is generally much higher in religious congregations compared to entertainment and political meetings. Crowd disasters are becoming routine in India and even recur at the same venues. Sixty-seven percent of human stampedes in India are reported from religious mass gatherings venues. Thus, the inadequacy of crowd risk management strategies is a serious concern in India. This demands effective and comprehensive crowd management systems to address all facets of religious events (Gayathri et al., 2017; Illiyas et al., 2013; Ngai et al., 2013).

In most of the non-conventional mass gathering venues such as cinema halls, metro stations and bus depots, organizers weigh the operational capacities at the design stage itself. But in the religious mass gathering destinations in India, the capacities have not been pre-defined for articulated planning. The amount of space available to the participants and the capacity of the venue are important factors for planning, preparedness, monitoring and safe conduct of mass gathering events (HSE, 2000; Fruin, 1993; NDMA, 2014). In India, entries to some religious mass gathering venues are regulated based on the spatial capacity, where prior registration and entry passes are administered for the visitors / pilgrims. The majority of religious mass gathering venues lack such pre-registration processes, and no restrictions exist to regulate the size of the crowd. The massive influx of visitors exceeding the maximum venue holding capacity and high crowd densities are inherent reasons for crowd disasters in India (Gayathri et al., 2017; Holman & Balsari, 2017; Burkle & Hsu, 2011; Ankita & Prashansa, 2015).

NEED OF THE STUDY

Understanding the principles and applications of crowd dynamics in mass gatherings is very important, specifically with respect to crowd risk analysis and crowd safety. Historical trends from India and other countries suggest that the stampedes in mass gatherings, especially in religious events occur frequently, highlighting the importance of studying crowd behaviour more scientifically. This is required to support appropriate and timely crowd management principles, in the planning of crowd control measures and provision of early warning systems at mass gatherings. Common pedestrian behaviours in crowds like group formation, self-organization, leader follower effect, queue formation, bottleneck conditions have substantial influence on crowd dynamics. It is important not to let a single aspect go overlooked with respect to mass gatherings since it can lead to major stampedes. Kumbh Mela, one of the largest mass religious gatherings in the world, features these different crowd scenarios observed often in the same event area and thus provides a unique opportunity to study the crowd behaviour in a holistic way. Understanding these pedestrian behaviours and having a clear understanding of the normal behaviour may provide opportunities to change crowd dynamics and overcome the adverse effects resulting in safer mass religious gatherings in future. This paper provides an exhaustive review of the current understanding of crowd dynamics and explores the modelling techniques that are available to enhance crowd safety. The purpose of this literature review is to improve the understanding of crowd dynamics, and highlight the research gaps in the context of crowd safety in mass religious gatherings like Kumbh Mela

LITERATURE REVIEW:

The purpose of this literature review is to improve the understanding of crowd dynamics and highlight the research gaps in the context of crowd safety in mass religious gatherings. The safety of humans in crowded environments has been recognised as a rapidly growing research area and has been of significant concern to many government agencies (Helbing et al., 2007). Increases in urban populations and mass events have raised interest among researchers and authorities in regard to the problems of pedestrian and crowd dynamics (Haghani and Sarvi, 2018). To date, there has been limited empirical research on pedestrian and crowd behaviors, dynamics and motion (Shahhoseini et al., 2018). Identifying and understanding the mechanisms that may lead to crowd disasters and incidents are critical to ensuring safety in crowded environments (Helbing et al., 2007). In addition to this, place management aims to identify and understand elements such as the political, legal, economic, social and technological aspects of our environment, which ideally lead to ensuring it is “fit for purpose” (Kalandides et al., 2016; Parker, 2008).

Crowd psychology and behavior have been studied for decades. The focus so far is on the ways to control a crowd. The principle of Sigmund Freud’s theory about crowd behavior is that people who are in the crowd act differently towards people than those who think individually. The danger is that according to this theory, a person may follow other’s behaviors and become less aware about the true nature of their actions. Le Bon, who was considered as the founder of crowd psychology, did not agree completely with Freud. Le Bon’s theory indicated that crowds foster

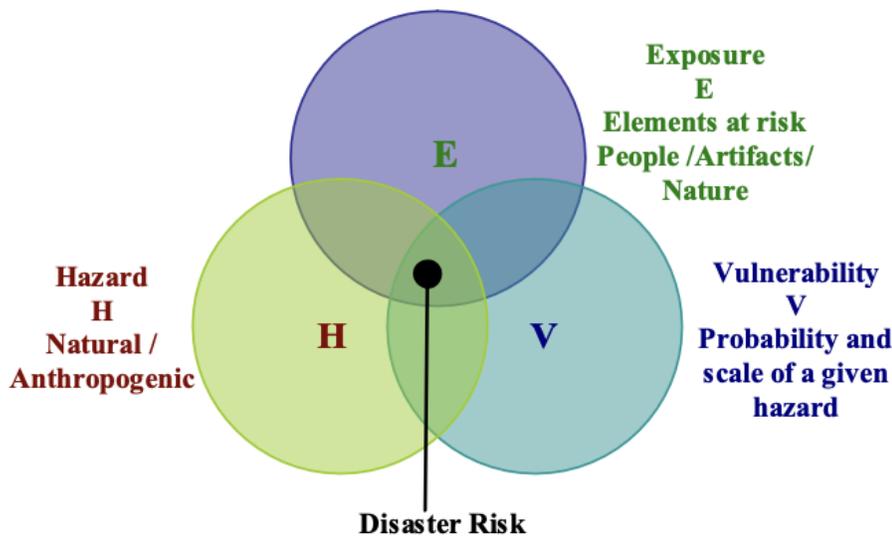
anonymity and sometimes generate emotions. He did not consider crowds as totally irrational. Theodore Adorno criticized the belief in spontaneity of the masses. According to Adorno, the masses were an artificial product of administered modern life Edward Bernays was one of the first to study the manipulation of the public using the psychology of the subconscious.

Many of Freud’s followers criticized Le Bon’s concept of collective soul or collective unconscious, as the crowd has no soul of its own. The convergence theory follows this notion to consider that the crowd behavior is not a product of the crowd itself, but is carried into the crowd by particular individuals. Ralph Turner and Lewis Killian developed the Emergent – Norm Theory of crowd dynamics. They said that people in a crowd make their own rules as they go along. Crowd behavior is never entirely predictable. The emergent – norm theory clearly shows that people in a crowd take on different roles, same as leaders, others as followers and same as inactive bystanders or opponents. According to this theory, everyone plays a significant role in determining the crowd behaviors.

It is difficult to describe the psychological and physiological pressures within crowds at maximum density. When crowd density equals the plan area of the human body, individual control is lost, as one becomes an involuntary part of the mass. At occupancies of about 7 persons per square meter the crowd becomes almost a fluid mass. Intense crowd pressures, exacerbated by anxiety, make it difficult to breathe. The heat and thermal insulation of surrounding bodies cause some to be weakened and faint. Psychologists have likened a crowd to a series of intermeshing behavioral cells. Each cell is composed of a small group of surrounding people, with limited communication between them. Cell members do not have a broad view of what is occurring in the crowd.

RESEARCH METHODOLOGY

For any area Hazard Vulnerability analysis can be done by evaluating the site on the basis of potential event under the categories of Probability, Risk and Preparedness.



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| <p>Disaster Risk (DR) Risk Management RM</p> | $DR = (H \times V \times E) / RM$ |
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The issues considered for **Probability** included:

- a) Known Risk
- b) Historical Data

Issues considered for **Risk** included:

- a) Threat to life/health
- b) Disruption of services.
- c) Damage / Failure possibilities
- d) Loss of Community Trust
- e) Financial impact
- f) Legal issues

Issues considered for **Preparedness** include:

- a) Status of current plans
- b) Training status
- c) Insurance
- d) Availability of backup systems
- e) Community Resources.

With the help of a table ratings for each event in the area of probability, risk and preparedness, values should be multiplied. The total values in descending order, represent the events most in need of organization focus and resources for emergency planning. Assessing the issues of preparedness the crowd management strategies to avoid critical crowd densities needs to be studied in depth.

The crowd incidents so far reported have shown different types of group motivation. In some cases there is an interruption of a simple traffic process; others fall into two general behavioral categories either a flight response or a craze. Analysis of major crowd incidents has enabled us to provide a model for understanding the cause of crowd disasters. The elements of the model form the acronym “FIST”, which is a useful reminder that any crowd situation can become threatening and potentially lethal. The acronym is defined as follows: FORCE (F) of the crowd, or crowd pressure; INFORMATION (I) upon which the crowd acts or reacts, real or perceived, true or false; STANDING AREA (S), physical facilities – stairs, corridor, escalators; TIME (T) duration of incident, event scheduling, facility processing rates.

With stampedes killing hundreds of people every year in the country and incapacitating an equal number of them, there is an imperative need to seriously consider and put in place an effective management, control and monitoring mechanism to prevent avoidable tragedies. All major religious places of India must take the following steps: **a)** Assess the Carrying Capacity of the temple premises, **b)** Do the Hazard Vulnerability analysis (**HVA**) by evaluating the site on the basis of potential events under the categories of Probability, Risk and Preparedness, **c)** Assess the level of preparedness of local police in terms of training, equipment and support with legislation primarily because Police has the role of first responder in case of any disaster management.

There has been a growing interest of physicists in pedestrian dynamics and crowd studies. Major studies date back at least to the year 1995, when a many-particle model was proposed to describe observed self organization phenomena such as the directional segregation (“lane formation”) in pedestrian counter streams and oscillations of the passing direction at bottlenecks. It took five more years until clogging effects and intermittent flows in situations of crowd panic were discovered. Since the year 2000, there has been an avalanche of publications on pedestrians. This includes papers on other force models and cellular automata models of pedestrian dynamics, addressing counterflows, the self-organized dynamics at intersecting flows, capacity drops by interaction effects, and the instability of pedestrian flows. Recent studies focus on the empirical or experimental study of pedestrian flows by means of video analysis. One of the most relevant and at the same time most challenging problems are panic stampedes, which are a serious concern during mass events. Despite huge numbers of security forces and crowd control measures, hundreds of lives are lost in crowd disasters each year. The occurring eruptions of pressure release bear analogies with earthquakes and are de facto uncontrollable.

Definitely, repeated incidents of crowd disasters all over the world clearly reveal insufficient and inadequate planning at high-density public events. Pedestrian crowds are a perfect example of a social system, in which social interactions can lead to unintended consequences. Even though normal pedestrians try to avoid harming others, crowd disasters have occurred again and again. How they happen has long been a mystery, but thanks to a better understanding of social interactions, better underlying mechanisms can be identified, and early warning signs can be recognised. Research has shown that the most common reasons for crowd disasters are one of the following: a) Denial of access at a place b) Perceived breach of rules c) Perceived abridgement of rights d) Lack of organization e) Excessive or inappropriate use of force 7) Unwillingness to obey rules. Crowd density and crowd carrying capacity for maintaining mass gathering safety has received greater acceptance in the recent past (Keith Still, 2014).

Disaster evacuations are stressful events in which citizens and law enforcement frequently interact with each other. Most emergency response plans are based on military strategies that operate independent of the general public, but the police must be cognizant of several social psychological factors that affect citizens’ behavior during evacuations, including risk perception, social networks, and access to resources. Drawing from social psychological, criminal justice, and disaster research, we need to understand how citizens’ priorities and behaviors change as a disaster evolves and how the policing strategies accommodate these changing behaviors and facilitate a successful evacuation. A better understanding of how people behave and what police are taught, can increase citizen compliance with law enforcement during disaster evacuations, remove citizens from harm, save lives, and improve the relationship between communities and the police.

Since behavior is a function of the person and the environment, it is significant that each crowd should be considered unique with its unique manifestations and well defined and measurable steps are taken. Fruin (1984) and Sime (1993) highlighted that there is a need to understand the interaction of efficient crowd management and place systems design for events, as these are the major factors that affect crowd disasters. There is an urgent need to develop a simple method for religious venues whereby administrators or event managers can systematically assess the crowd carrying capacity, and assess the hazard vulnerability of the religious pilgrimage site.

CONCLUSION

Understanding the principles and applications of crowd dynamics in mass gatherings is very important, specifically with respect to crowd risk analysis and crowd safety. This is required to support appropriate and timely crowd management principles, in the planning of crowd control measures and provision of early warning systems at mass gatherings. Common pedestrian behaviours in crowds like group formation, self-organization, leader follower effect, queue formation, bottleneck conditions have substantial influence on crowd dynamics. It is important not to let a single aspect go overlooked with respect to mass gatherings since it can lead to major stampedes. Kumbh Mela, one

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