Application of Geospatial Technology in Stampede Disaster Management during Fairs and Festivals in India

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Abstract

There are many places of religious importance in India where lakhs of people gather at a particular time of the year for a fair (mela). Some of these places witness large number of visitors all the year round. There is always a risk of stampede and chaos in such a large gathering, if it is not managed properly. Large crowd participate in such festivals as participants to observe the rituals and also as spectators. They are commemorated with mass gatherings which last from hours to days and have become the hotspots of different kinds of hazards in the country and a few of them had turned into disasters. Gathering of large and diverse crowd at a limited geographical area always challenge the safety measures unless it is systematically planned, executed and monitored. The present paper deals with how the application of geospatial technology can be used in the management of stampede disasters and how can these disasters can be avoided or minimized.

Keywords: Stampede, Mass Gatherings, Hotspots, Geospatial Technology.

Introduction

India is the land of many religious beliefs and faiths which involve seasonal change or has some cultural significance. Festivals often serve to fulfill specific communal purposes, especially in regard to commemoration or thanksgiving. The celebrations offer a sense of belonging for religious, social, or geographical groups, contributing to group cohesiveness. Also certain institutions celebrate their own festivals to mark some significant occasion in their history. These occasions could be the day these institutions were founded or any other event which they decide to commemorate annually. Seasonal festivals are determined by the solar and the lunar calendars and by the cycle of the seasons. Every celebration centres on the ritual of prayers, seeking blessings, exchanging good will, decorating houses, wearing new clothes, music, dance and feasting creates a huge crowd.

Society and festivals celebrations are part of our cultural and religious diversity. India being the second most populated country in the world with diverse religious heritage has vast number of festivals that are celebrated on grand scale. Many of them are celebrated at national level, regional or state level. Mass gatherings of religious nature attract large crowds of dissimilar physical and behavioral characteristics sometimes cause massive crowd stampedes. For mitigation and control over these incidents and smooth organization of festival/event geospatial technology is necessarily be employed.

Geospatial technology is an organized system that makes possible the acquisition and storage of geographic and related attribute, data, for the purpose of retrieval, analysis, and display to promote, understanding and assist decision making. The utility of GIS is to solve real world geographical problems and to provide long term planning opportunities. Improved decision making remains one of the key drivers of GIS; as customers can create a complete operational picture enabling informed and real-time decisions. Also, with the increased ease of data capture in the field using mobile devices like smart phones and tablets, users are putting GIS mapping in the hands of the field workforce.

Now this technology influences almost all the sectors wherever the geographical area has deep impact on the performance and development. GIS scans the area under supervision from satellites or aerial sources and extracts the information on the basis of an algorithm, which is used according to the application. As in this era of digitization every

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technique works on digital data, GIS too in not different from them. The following are the applications of GIS in management of resources:

Human Resources

Plans for man transit recreation areas, police unit allocation and pupil assignment, analyze migration pattern, population growth, crime patterns and welfare needs. It also manages public and government services.

Natural Resources

Facilitates timber management, preservation of agricultural land, conservation of energy resources, wild life management, market analysis, resource allocation, resource extraction, resource policy, recycling and resource use.Other use of GIS is in watershed management area, agriculture, land administration, sustainable development, education, communication, transportation.

Natural Environment

Identify and manage area of environment, analyze land carrying capacity and assist in developing environmental impact assessments.

Objectives of the Study

The following are the objectives of the present research:

1. To prevent any risk of crowd disasters; and
2. To suggest plan for rescue and relief management of the people affected by crowd disasters.

Hypothesis

The research hypotheses of the present work are as follows:

1. The crowd stampedes are mainly caused by improper and insufficient management planning.
2. There is a direct relationship with geographical information system in human life.

Methodology

The present paper is organized around implication of GIS application in disaster management. It also comprises descriptive research methods and interpretation by means of using different source of material. The study has used a mix method and descriptive design. The researcher has collected all the available data from secondary sources. It is a critical appraisal of various articles, books, newspaper, old researches, online data, journals, statutes, reports of government and private agencies and other material related to GIS and disaster management.

Review of Literature

GIS is a computer assisted system for the acquisition, storage, analysis and display of geographic data (Idrisi 32 Guide to GIS and Image Processing, Volume 1). According to ESRI, GIS is a computer based tool for mapping and analyzing things that exist and events that happen on earth. This technology integrates common database operations such as query and statistical analysis with the unique visualization and geographic analysis benefits offered by maps. It is an integrated system of computer hardware, software, and trained personnel linking topographic, demographic, utility, facility, image and other resource data that is geographically referenced - NASA.

Though often caused by nature, disasters can have human origins. According to the International Federation of Red Cross and Red Crescent Societies (IFRC): A disaster is an abrupt disastrous event that badly disrupts the functioning of a community or society and causes human, material, economic and environmental losses that go beyond the community's or society's ability to cope using its own resources.

With recent innovations in the arena of remote sensing and geographic information systems, the use of geo-informatics in applied geomorphology is receiving more attention than ever. It is examined how modern concepts, technologies, and methods in geo-informatics can be used to solve a wide variety of applied geomorphologic problems, such as characterization of arid, coastal, fluvial, aeolian, glacial, karst, and tectonic landforms; natural hazard zoning and mitigations; petroleum exploration; and groundwater exploration and management (Siddan Anbazhagan, S.K. Subramanian, 2011).

It is explained that remote sensing is not only helpful for ground water targeting but also useful in urban land use mapping and development of infrastructure / amenities. An earnest attempt is inevitable to explore the capability of remote sensing in new areas like tourism sector, which are not yet amenable to it, but could be within our reach. This will boost the tourism industry across all the sectors in generating revenue in the form of foreign exchange. The effective use of remote sensing will develop tourism on sustainable basis and makes Andhra Pradesh a sought-after tourism destination in the country (V. Raghu and M. Venkata Swamy, 2009).

The GIS technology is used to identify geographical areas and sub-populations at increased risk for Pneumocystis carinii pneumonia (PCP), the most common and highly treatable opportunistic infection, at the time of diagnosis of acquired immunodeficiency syndrome (AIDS). For this study a population-based PCP index was defined as the number of PCP related hospitalizations divided by the number of persons living with AIDS (Arno *et al.*). These data were obtained from New York State Department of Health hospital, discharge records and AIDS surveillance data. Using the International Classification of Diseases, Nineth Revision (ICD-9) codes, the sample consisted of 39,740 and 2262 persons hospitalized with AIDS (042.0-044.9) and PCP (136.3), respectively, in 1997. Human subject protection was achieved by removing all personal identifiers. PCP indexes were calculated, geocoded, and mapped by zip code using Maptitude GIS (Arno PS, Gourevitch MN, Drucker E, Fang J, Goldberg C, Memmott M, Bonuck K, Deb N, Schoenbaum E).

The socio-spatial indicators associated with leptospirosis cases (by census tract) that were found to be significant at varying distances were flood risk area (50-1000 m), solid waste collection (150-600 m), population density (150-600 m), sewerage coverage (200-1000 m), water supply coverage (200-600 m), proportion of houses (400-600 m), and population per household (500-1500 m). This study demonstrated the effectiveness of using GIS technology to describe

and analyze social and environmental vulnerabilities around a single "sentinel event." The GIS was able to identify risk factors of disease and help health planners target resources to priority populations (Barcellos C, Sabroza PC).

Society and festivals celebrations in India are part of our cultural and religious diversity. India being the second most populated country in the world with diverse religious heritage has vast number of festivals that are celebrated on grand scale. Many of them are celebrated at national level, regional or state level. Mass gatherings of religious nature attract large crowds of dissimilar physical and behavioural characteristics (Illiyas *et al*, 2013). Festivals enliven social life and unite the people by bringing them together in joyful celebration of significant events and in shared remembrance of joyful past (MIB, 1992). All the great religions in India have religious mass gatherings. Maha Kumbha Mela, Dussehra, Ganesh Chaturthi, Rath Festivals, Chhath Pooja etc. are few national level festivals celebrated through mass gatherings at various regions.

There is risk of a crush when crowd density exceeds about four people per square metre. For a person in a crowd a signal of danger and a warning to get out of the crowd if possible, is the sensation of being touched on all four sides. A later, more serious, warning is when one feels shock waves travelling through the crowd, due to people at the back pushing forward against people at the front with nowhere to go. Keith Still of the Fire Safety Engineering Group, University of Greenwich, said as 'Be aware of your surroundings. Look ahead. Listen to the crowd noise. If you start finding yourself in a crowd surge, wait for the surge to come, go with it, and move sideways. Keep moving with it and sideways.'

After the 1883 crush known as the Victoria Hall disaster which killed 183 children, a law was passed in England which required all public entertainment venues to be equipped with doors that open outwards, for example using crash bar latches that open when pushed. Crash bars are required by various building codes.

Major Festivals of India

A festival is an event ordinarily celebrated by a community and centering on some characteristic aspect of that community and its religion or traditions, often marked as a local or national holiday, Mela or Eid. Next to religion and folklore, a significant origin is agriculture. Food is such a vital resource that many festivals are associated with harvest time. Religious commemoration and thanksgiving for good harvests are blended in events that take place in autumn, such as Halloween in the northern hemisphere and Easter in the southern. According to the religions and rituals, festivals have been categorized into following categories:

Hindu Festivals

There are lots of cultural and traditional festivals celebrated by the people of Hindu religion all over the world. Hinduism is considered as the oldest organized religion of the world as well as counted as the third largest religion of the world. Each Hindu festival celebration has a special ritual to be celebrated in that way by the act of worship, offerings to deities, offering *Ganga Jal*, fasting, bathing in *Ganga Jal* in early morning, feasting, *Dan, Dakshina, Puja, Katha, Hoom, aarti* and so many. All the people of Hindu religion celebrate their festivals by uniting together in community without any distinction of age, caste and gender.

Table 1: Major Hindu Festivals in India

Month	Festival
January	Pongal, Makar Sankranti, Thaipusam, Pongal
February	Vasant Panchami
March	Maha Shivaratri, Holika Dahan, Holi (Dhulandi)
April	Chaitra Navratri, Ugadi/Telugu, Hindu Nav Varsha, Gangaur, Mewar Festival, Ram Navami, Mahavir Jayanti, Hanuman Jayanti
July	Rath Yatra, Guru Purnima
August	Raksha Bandhan, Janmashtami,
September	Onam, Kumbh Mela, Ganesh Chaturthi, Brahmotsavam, Pitra Paksha
October	Ramlila, Rambarat, Navratra, Dussehra, Maharishi Valmiki Jayanti, Karva Chauth, Dhanteras, Diwali, Govardhan Puja
November	Dev Uthani Ekadashi, Bhai Dooj

Source: Tourism Development Corporation of India, New Delhi.

The dates of the Hindu festivals are fixed according to the dates of the Hindu lunar calendar, which depends on the sun and moon movements throughout the year. Some of the festivals of Hindu are celebrated as the historical mythology, some for seasonal changes and some for cleaning and keeping the environment safe. Some of the festivals celebrations are limited to the specific sects or Indian subcontinent regions.

There are many believes in the Hinduism because of various historical sculptures, ancient and sacred religious text, Hindu deities etc. The birth and death anniversaries of the god and goddess are also celebrated in the Hinduism with lots of fun and frolic activities such as music, dance etc.

Muslim Festivals

All the people of Muslim religion enthusiastically celebrate their all the Islamic festivals all over the world. There are many religious festivals which they celebrate with great passion and dedication by following the date of their Islamic calendar. Some of the very important Muslim festivals are Ramzan, Id-e-Milad, and Muharram, Bakr-Id etc. which they celebrate in special ways by offering prayers in the mosques, feasting, fasting and wishing to each other.

They decorate their homes with colored lights and other things in the evening and celebrate throughout the night by getting together. Some of the Islamic festivals have been declared as the public holiday in the educational institutions, government offices and other working place. The Islam has five most significant Pillars such as 'Shahadah (Faith),

Salah (Prayer), Zakah (Donate), Sawm (Fasting) and Hajj (Pilgrimage).'

Table 2: Major Muslim Festivals in India

Month	Festival
January	Giaravahin Sharif
April	Hazarat Ali's Birthday
May	Shab E Miraj, Shab-e-Barat
July	Jamat-Ul-Vida,Id-ul-Fitr(Ramzan Eid)
September	Id-ul-Zuha (Bakrid or Eid Ul-Adha)
October	Muharram
December	Barawafat, Milad-Un-Nabi

Source: Tourism Development Corporation of India, New Delhi.

Sikh Festivals

As India is considered as the country of numerous religions, cultures and traditions that's why it is known as having unity in diversity. People of Sikh religion have lots of unique and ritual festivals which they celebrate with full courage and enjoyment. They commemorate the lives of their 10 Sikh gurus including their teachings. Some Hindu festivals are also celebrated by the people of Sikh religion having different reasons of celebration.

All the worship at the festival in Sikhism is directed towards the holy book called "the Guru Granth Sahib" which was first compiled by the Sikh guru, Guru Nanak and later edited by the Sikh Guru, Arjan. The Guru Granth of the Sikh religion has the place of deity among people and taken out on a palanquin in the public processions while celebrating any Sikh festival. They involve lots of music and religious songs, readings from the holy book, holy songs, singing of Gurbani while celebrating their festivals in order to attach with God.

Table 3: Major Sikh Festivals in India

Month	Festival
January	Lohri, Guru Gobind Singh Jayanti
March	Holla Mohalla
September	Sodal mela
October	Guru Ramdassji Janmadin
November	Guru Nanak Jayanti
December	Guru Purab (Installation of Guru Granth Sahibji)

Source: Tourism Development Corporation of India, New Delhi.

Jain Festivals

People from Jain religion have lots of rituals and religious ceremonies to be celebrated as the festival. Their rituals belong to the idol worships in various ways and festivals belong to the life events of Tirthankara which involves the purification of the soul. Their rituals are divided in two parts named Karya and Kriya. According to the Jain Svetambara there are six obligatory duties called Six Avashyakas which are "Chaturvishnati-stava: praising Tirthankaras, Kayotsarga: meditation, Pratikramana: expiation of past sins, Pratyakhyana: renunciation of anything, Samyika: practising serenity and meditation and Vandan: respecting teachers and ascetics".

According to the Jain Digambara there are six duties which are "Dana: charity, Devapuja: worship of Tirthankaras, Guru-upashti: respecting teachers and ascetics, Sanyam: controlling self by following

different rules, Swadhyaya: studying spiritual texts and Tapa: austerities" which has been involved as a fundamental ritual activities of the Jains.

Table 4: Major Jain Festivals in India

Festival	Month
Mahavir Jayanti	April
Paryushan	August
Deep Diwali	October
Mahamastak Abhishek	After every 12 years in 2018

Source: Tourism Development Corporation of India, New Delhi.

Christian Festivals

As India is a land of variety of cultures and ethnicity because of celebrating lots of colourful festivals by the people of different religions. People of the Christian religion celebrate their festivals like Christmas, Easter, and Good Friday etc. with big enthusiasm and fun filled activities. People from other religions also involve in the Christmas celebrations which prove the unity in diversity of India.

There are various famous places in India where the Christian festivals are celebrated such as Goa as most of the oldest and beautiful churches are there. They do feast,prayers and processions while celebrating their festivals.

Table 5: Major Christian Festivals in India

Festival	Month
Good Friday	March
Easter	March
Christmas	December

Source: Tourism Development Corporation of India, New Delhi.

Buddhist Festivals

People from Buddhist religion celebrate their festivals well connected to Lord Buddha and the Bodhisattvas. It is considered that the Buddhist festivals were first started by the lord Buddha and He advised his followers to be in touch with each other to strengthen their bond. Buddhist has their own beliefs and rituals of celebrating historical festivals. They do worship of the historical objects while celebrating their festivals and they become more religious, spiritual and intellectual which are not restricted to any service of the community.

Table 6: Major Buddhist Festivals in India

Month	Festival
February	Losar
May	Budh Purnima
June	Hemis Gompa
August	Ullambana

Source: Tourism Development Corporation of India, New Delhi.

Stampede Disasters

The most common hazards prevailing in mass gathering events are characterized by the surge of individuals in a crowd, in response to a perceived danger or loss of physical space. It often disrupts the orderly movement of crowds resulting in irrational and dangerous movement for self-protection leading to injuries and fatalities. The availability of limited open space, uneven topography and high density of pilgrims together make the festival venues a

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stampede hotspot. Human stampede at festival gatherings happen due to the following reasons:

Rush and Surge of People

People may try to enter into a special place for better view/participation in the functions which results in jostling, suffocation, failure of confining walls, barriers and gates.

Accidents

Collapse of temporary or permanent structures, accidents on bridges, vehicle accidents.

Natural or Human Induced Hazards

Slope failure, heavy rain, slippery surfaces, fire, intentional acts etc.

Rumors

Spread of rumor about an accident, man-animal conflict, terror attack, and stampede near to the venue.

Long Queue Discomfort

People standing in tightly packed queues for long hours create discomfort among individuals and they may try to escape from the queues.

Disaster Management

Disasters can be categorized into natural and man-made. It is impossible to predict precisely when the events will happen but it is possible to predict whereby they will be most destructive when they do strike. Earthquake, volcanic eruption, flood, drought, forest fire, land slide, tsunami, cyclone etc. are the disasters. These cannot be avoided but by management, losses occurring to these can be minimized by using GIS application. Planning is an integral part of disaster management. It is deciding in advance what is to be done, when, where, how and by whom it is to be done. It includes the selection of objectives, policies, procedure and programmes from available resources. It is to be done in four stages:

Mitigation

It is the part of planning which actually eliminates or reduces the probability of a disaster. For example identifying and minimizing the risk posed by the building, its equipment and filling and the natural hazards of areas.

Preparedness

When the preventive/ mitigation measures are not adequate to prevent disaster then phase starts as to which different mock drills regarding different disasters are to be done, monitoring, training exercise, install early warning system and prepare emergency response teams.

Response

These are the activities which are to be done when disaster strikes. Provide all possible facilities to the victims of the disasters as soon as possible. Stabilize the environment to prevent growth of mold which reduces the probability of any other emergency situation arising due to disaster.

Recovery

Final stage of planning which helps in bringing all the systems to normal levels that can be further categorized in short term and long term recovery methods.

Geospatial Technology and Stampede Disaster Management

Use in Mapping Basic Utilities

Mapping is a central function of Geographic Information System, which provides a visual interpretation of data. GIS stores data in database and then represent it visually in a mapped format. People from different professions use map to communicate. It is not necessary tobe a skilled cartographer to create maps. Google map, Bing map, Yahoo map are the best examples for web based GIS mapping solution. The route chart along with sites of amenities can be drawn/shown in various maps/ display or sign boards for the appropriate management of the event.

Application in Traffic and Communication Services

GIS can be used in managing transportation and logistical problems in the festival/event area. The routes for entry and exit, parking, stay, food and water, medical services etc.can be demarketed and facilitated well in advance for proper management of the mass gatherings. It can also be used as a key tool to minimize accident hazard on roads, the existing road network has to be optimized and also the road safety measures have to be improved. This can be achieved by proper traffic management. By identifying the accident locations, remedial measures can be planned to minimize the accidents by the stakeholders.

It is a great planning and decision making tool for telecom industries. It enables wireless telecommunication organizations to incorporate geographic data into the complex network design, planning, optimization, maintenance and activities. This technology allows telecom to enhance a variety of application like engineering, customer relationship management and location based services.

Festival Information System

GIS provides a valuable toolbox of techniques and technologies of wide applicability to the achievement of sustainable tourism development. This provides an ideal platform required to generate a better understanding, and can serve the needs of tourists. The visitors will get all the information on click, measure distance, find hotels, restaurant and even navigate to their respective links. Information plays a vital role to tourists in planning their travel from one place to another, and success of tourism industry. This can bring many advantages for both tourist and tourism department.

Preventions of Crowd Disasters

It is a public security practice where large crowds are managed to prevent the outbreak of crowd crushes, affray, and fights involving drunken people or riots. Crowd crushes can cause in many hundreds of fatalities. Crowd control can involve privately hired security guards as well as police officers. As crowd disasters are local events, disaster management is primarily the responsibility of the organizers and local/district administration with support and guidelines from State and National authorities.

The crowd disasters can be prevented by simple crowd management strategies. The primary

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crowd management objectives are the avoidance of critical crowd densities and the triggering of rapid group movement. It involves the assessment of the people handling capabilities of a space prior to use. It includes evaluation of projected levels of occupancy, adequacy of means of ingress and egress, processing procedures such as ticket collection, and expected types of activities and group behaviour. It may be part of a crowd management plan, or occur as an unplanned reaction to a group problem. It can include extreme measures to enforce order, such as the use of force, arrest, or threat of personal injury. The crowd control should be managed through controlling the crowd inflow, regulating the crowd at the venue and controlling the outflow by baricating the festival area.

Planning for Crowd Management

The following steps should be taken for planning the crowd management:

Capacity Planning (Long-term and Short-term)

In India, religious places have high probability of crowd disasters. Their locations play a major role in this. Development of shrine locality could be difficult in many places; but it is necessary to develop infrastructure for crowd management. There is need for long-term perspectives for infrastructure development which should depend upon popularity, periodicity of event, weather, terrain, local population etc. The staging points should be planned for physical or virtual locations through which each visitor must pass. Each staging point must have sufficient facilities for rest, food, water, hygiene etc. Multiple routes should be encouraged. This will help in movement of vulnerable groups i.e. children and old people.

Understanding Crowd Behaviour

Individual behaviour in a crowd is sometimes influenced by the behaviour of others. The unlawful actions of some people may result in larger number following them. Therefore, it is essential to identify and separate such group of people at the earliest and should be removed. The action should be taken with tact and firmness without inviting undue attention of general public.

Stakeholders Approach

Organizers must rethink crowd control and encourage community stakeholders i.e. NGOs, neighbourhood societies, mohalla association etc.) to take ownership in events for unity of purpose, faster decision, response, etc.

Preparation of Action Plan

The following action plan should be adopted for the smooth management of fairs and festivals:

Disaster Management Training

It would be provided to the persons actively engaged in rescue and relief works, so that they can proactively involve themselves in performing their Disaster Management duties.

Inter- Agency Group

The State Government should promote the activities of Inter Agency Group for Disaster Management related training, awareness generation, capacity building, information dissemination etc. This group comprises UN Agencies, NGOs, Academic Institutions and Networking Organizations etc.

Incident Response Team

It will be constituted in every district to take up response activities at times of disaster and specialized training will also be provided to them.

Technical, Scientific and Managerial Skills

The persons engaged in disaster management, should be updated time to time, through appropriate training. A team of persons, having specialized disaster specific knowledge, should be formed by every department, which would be trained from time to time in rescue and relief operations in the relevant disasters. It should be obligatory for all departments to send these officers/employees for training and for undertaking the relief operations. The Centre for Disaster Management would impart training to all departmental officials from time to time. Disaster management issues should be incorporated in the departmental training programmes.

Deployment of Personnel

Civil Defence, Home Guards, NCC, NYK, Scouts, NSS etc. should be strengthened through appropriate disaster management training.

Safeguarding of Basic Infrastructures

It is very important that important infrastructures like dams, bridges, roads, railway lines, power houses, water storage tanks, irrigation canals, rivers, airports and other civic utility services have and observe world class safety standards and upgrade it periodically as required. A Technical Safety Cell needs to be constituted by concerned departments to ensure that such key infrastructure observe the best maintenance and safety protocols. .

Mock Drills

The effectiveness of plans and standard operating procedures is to be tested and refined through training and mock drills. Different nodal departments in the State need to take up disaster specific mock drills regularly. The state and district authorities will be encouraged to inculcate a culture of preparedness and quick response.

Community Based Disaster Management

During any disaster, communities are both the first affected and first responders. Community participation ensures local ownership, addresses local problems and promotes volunteerism and mutual help to prevent and minimize losses. Mutual Partnership Scheme need to be implemented to ensure public participation in the community based disaster management. Women and youth need to be encouraged to participate in disaster management related decision making through Committees and action groups. Different groups in the community need to be organised and trained for disaster preparedness. Awareness among people needs to be generated regarding different types of disasters.

Effective Administrative Structure

Swift deployment of trained personnel at the site of disaster, timely flow of information and quick and effective decision making at different levels contribute a lot during disasters. For this, it is essential to develop a systematic administrative structure like Incident Response System, as per the guidelines of NDMA. There need to be one

Responsible Officer, at every level, who will have full command on disaster management systems. The officers of all departments need to work under his directions for ensuring a coordinated and effective response to such disasters. In times of disasters of greater magnitude,it is the State Executive Committee (SEC) and/or the State Disaster Management Authority (SDMA) which needs to be activated to ensure a timely, efficient and effective response to such disasters through a coordinated and planned action plan. At district level, the District Collector will be the Responsible Officer (RO) for management of disasters. All officers of State/Central Government departments, working at district level like officer in-charges of Police, Home Guards, Security Forces, Para Military Forces and Railway, Telecom and other important institutions, need to work under the directions of District Collector.

Emergency Operation Centres (EOCs)

District Emergency Operation Centres (DEOCs), should be established at district level, which are equipped by telephone, fax, wireless, email facility and other modern means of communication would be immediately activated in the event of any disaster. The officer-in-charge of this DEOC will be the senior district level officer of the disaster related nodal department and this centre will be the focal point for all activities related to disaster at district level. Information related to disaster will be collected at this centre and necessary action related to disaster management would be issued by the District Collector. Necessary information as may be necessitated would ordinarily be transmitted for public consumption through GIS technology that may be made available too, on demand as per the situation on ground. During disaster situation, control rooms may also be set up near the site of disaster, if required, to carry out rescue and relief operations through closer co-ordination. Control rooms will also be set up at district level departmental offices connected with relief works for effectively managing disasters.

Crisis Management Plan (CMP)

It enables the organizers and stakeholder departments to avoid confusion on command, control and response during emergencies. It should present as a written outline of common protocol to activate emergency and coordinate the crisis response activities. Though the emergency departments are primarily responsible for emergency response, cooperation from associate departments and other stakeholders are important for the feasible implementation of crisis management plan. The crisis management plan can be invoked on noticing the likelihood of human stampedes, fire, natural calamity or any other human induced incidents. Crisis communication plan, evacuation plan, onsite medical response plan and standard operational guideline for stakeholder forms the core structure of Festival CMP. The event organizer should prepare the crisis management plan in consultation with emergency service departments and it should be reviewed annually for seasonal festival.

Standard Operating Procedure (SOP) enlists the roles and responsibilities of organizers for festival safety preparedness or crisis management. The roles given in the SOP are limited to the festival crisis management process only. If the event turns to a major disaster, wherein the assistance is required from the government authority, the command and control coordination may be carried out under the Emergency Support Functions plan.

Conclusion

It is a public security practice where large crowds are managed to prevent the outbreak of crowd crushes, affray, fights involving drunken people or riots. Crowd crushes can cause in many hundreds of fatalities. Crowd control can involve privately hired security guards as well as police officers. As crowd disasters are local events, disaster management is primarily the responsibility of the organizers and local/district administration with support and guidelines from state and national authorities.

The crowd disasters can be prevented by simple crowd management strategies. The primary crowd management objectives are the avoidance of critical crowd densities and the triggering of rapid group movement. The festival controller should approach the emergency services to avail their services for the safe conduct of religious festival.

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