

Crowd Disaster Management through Geospatial Technology: A Geographical Study

Abstract

Each year, crowd disasters happen in different areas of the world. How and why do such disasters happen? Are the fatalities caused by relentless behavior of people or a psychological state of panic that makes the crowd 'go mad'? Or are they a tragic consequence of a breakdown of coordination? These and other questions are addressed, based on a qualitative analysis of data and information, which document the organization and planning of the fairs and festivals. The analysis reveals a number of misunderstandings that have widely spread. Disaster management plan decides in advance what is to be done, when, where, how and by whom it is to be done. It includes the objectives, procedure and programmes from available resources. The present paper is intended to understand the significance of geographical information system in human life and affected communities and the role of disaster management with challenges faced by the authorities.

Keywords: Crowd Disasters, Tragic Consequence, Disaster Management Plan, Geospatial Technique.

Jai Bharat Singh

Associate Professor,
Deptt.of Geography,
Govt. Dungar College,
Bikaner, Rajasthan

Introduction

Disaster means a catastrophe, calamity or grave occurrence in any area, arising from natural or manmade causes, which is of such nature or magnitude as to be beyond the coping capacity of the community and local resources. It 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.

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. Religious pilgrimage is highly prone to human stampedes as it is comprised of huge crowd including women, elderly people and children (Illiyas *et al*, 2014). The availability of limited open space, uneven topography and high density of pilgrims together make the festival venues a 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.

Akshita Jhala

Research Scholar,
Deptt.of Geography,
Singhania University,
Pacheri, Haryana

Objectives of the Study

The following are the objectives of the present research:

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

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.

Study Area

Haryana is a small state located northern India. It was carved out of the former state of East Punjab on 1st November 1966 on a linguistic basis. It is bordered by Punjab and Himachal Pradesh in the north, by Uttar Pradesh and Delhi in the east and by Rajasthan in the south and south-west. It is located between 27^o39' to 30^o35' north latitudes and between 74^o28' and 77^o36' east longitudes. The total geographical area of the State is 44,212 sq km, which is 1.4 per cent geographical area of the country. The altitude ranges between 200-1200 m above mean sea level. The State has four main geographical features - (i) Yamuna-Ghaggar Plain, (ii) Shivalik Hills, (iii) Semi-desert Sandy Plain, and (iv) Aravali Ranges. Haryana is extremely hot in summer at around 45^oC and mild in winter. The hottest months are May-June and the coldest December-January. The climate is arid to semi-arid with average rainfall of 35.4 cm. Around 79 per cent of rainfall is received during July to September, and the remaining rainfall is received during winters.

It has a population of 25.35 million. Chandigarh is its capital city while Faridabad is the most populous city of the state. Haryana is one of the most economically developed regions in South Asia, and its agricultural and manufacturing industries have experienced sustained growth since the 1970s. Since 2000, the state has emerged as the largest recipient of per capita investment in the country.

The state is administratively divided into four divisions-Ambala, Rohtak, Gurugram and Hissar.

Within these there are 21 districts, 62 sub-divisions, 83 tehsils, 47 sub-tehsils and 126 blocks. It has a total of 154 cities and towns and 6,841 villages.

Methodology

The present study is organized around implication of GIS application in disaster management. This study also comprises descriptive research methods and interpretation by means of using different source of material. The study has used a mix method, descriptive design. The researcher has collected all the available data from secondary sources. It is 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

Human stampedes have been identified as a major hazard that could happen during mass gathering events in India, as well as anywhere in the world where people crowd together. Illiyas *et al* compiled and analyzed stampede data from religious, entertainment and political gatherings over the last five decades in India to derive an effective risk reduction framework for mass gatherings. Religious gatherings and pilgrimages have been venues for 79 per cent of the stampedes in India. Noticeable occurrences and casualties have been reported from 15 Indian states and there have been instances of recurrent stampedes at certain locations. Risk management strategies to tackle stampedes during religious festivals are quite inadequate and have failed consistently in India because of the large crowds and the constantly widening spread of the venue (Illiyas *et al* 2013). Developing countries like India has witnessed more crowd disasters at religious places (NDMA, 2014).

There are many crowd disaster events happened in India in the recent past. Human stampede in 1999 occurred at Hilltop near Pamba at Sabarimala in Kerala caused the death of 52 pilgrims. The second incident also happened during the Sabarimala Pilgrimage on the Makarajyothi day in 2011 at Pullumedu. The stampede at the makarajyothi view point took the lives of 102 innocent pilgrims from Tamil Nadu, Karnataka and Andhra Pradesh. In Rajasthan, Jodhpur stampede during Navaratra was also very hazardous.

Human Stampede Human stampedes, the most common hazard 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. Religious pilgrimage is highly prone to human stampedes as it is comprised of huge crowd including women, elderly people and children (Illiyas *et al*, 2014). The availability of limited open space, uneven topography and high density of pilgrims together make the festival venues a stampede hotspot.

Standard operating procedure enlists the roles and responsibilities of organizers/departments 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 district/state authority, the command and control coordination may be carried out under the Emergency Support Functions plan of the State (SEOC, 2014). Hence, Government Departments/Agencies are advised to be familiar with the ESF plan of the state for dealing major disasters. Standard Operating Procedure for Government Departments given below is applicable to the festivals which are notified under the Travancore Cochin Public Health Act 1955 and the district or State Government facilitates the smooth organization of the event. For other events where festival organizers

who require services from Government agencies may directly approach each agencies with the provision of festival safety budgeting.

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 behavioral characteristics (Illiya *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.

Major Festivals of Haryana

In Haryana, there is dominance of Hindu population. Such fairs are centered on some local deity or regional deity. People attend them and there is thus mutual exchange of ideas. They obtain their annual supplies of such articles. The fair is a source afforded on occasion for outing and enjoyment. All Hindu festivals have a deep spiritual importance or high religious significance and have religious, social and hygienic elements in them.

Suraj Kund International Fair

This fair has been gaining popularity ever since it was organized for the first time in the year 1981. It is celebrated with a splash of colors, as well as the rhythm of drum beats that gives huge joy when participated in the Suraj Kund of Faridabad. This Mela comprises the unique diversity of the Indian culture and traditions, which are created to display the rural attribute of India. This International fair displays the Crafts Mela that showcases some of the most beautiful handlooms as well as the handicrafts of India. Also, one can observe the handmade fabrics that are dipped in grand colors; even some kinds of interesting wooden and clay dolls are found at this Mela. It has multi-cuisine food courts, where popular cuisines from all over the globe are displayed. There are also attractive folk performances that mesmerizes the evening for the sake of entertainment quotient. There are even delegated places for amusement; adventure rides etc. which makes Haryana a must-visit place during this fairs.

Mango Mela

It is organized during the months of June and July at 'Yadavindra Gardens' of Pinjore. This place is about 20 km from Chandigarh. The main idea behind the festival is to enhance and highlight the tremendous popularity of the mangoes. This Mela seems to be a great treat for the mango lovers. Several types of mangoes arrive to Haryana from the states of Bihar, Punjab, Himachal Pradesh and Uttar Pradesh including Haryana itself. This is the reason why Mango Festival attracts people with wide-spread of different shaped mangoes (both quality and hybrid) in varied price range.

The main aim of the two-day Mango Mela, is to provoke farmers to accept the latest technology to raise their mango production with ease so that they can grow quality mangoes, and get good ROI on the mangoes grown. The Mango Mela even offers a forum to help the farmers to sell their mangoes. It also gives a common platform for the Self Help Groups to sell their products. There is also a competition held between mango growers from all over the country who enter their prized fruits at the competition during this festival. The visitors at the festival get the chance to taste all the different and traditional varieties of these summer fruits during this festival in Haryana. Along with the mangoes, there are also the latest hybrid fruits from the different agricultural universities. Various companies from the agro and food industries that process mangoes come and display their products at the festival. These products include different kinds of jam, pickles and canned fruits.

Baisakhi Mela

Baisakhi is one of the most popular festivals of north-west India that is celebrated on a large scale particularly in the states of Punjab and Haryana. As such, Baisakhi at Pinjore is a grand event that is celebrated with much pomp and gaiety among the locals as well as visitors from across the country. This festival is celebrated to mark the start of the wheat harvest season. The festival falls on 13th April every year and is also observed as the first day of the New Year as per the traditional Vikrami calendar in India.

Another reason for the celebration of Baisakhi is that the day also marks the anniversary of the founding of "Khalsa Panth" among the Sikh community and therefore, the festival is grandly celebrated in the state of Punjab. However, Baisakhi at Pinjore is an equally frolicsome occasion when people adorn themselves with the best of apparels and jewelry, visit temples and gurudwaras to offer prayers and feast with loved ones. Another popular feature of the festival of Baisakhi in Pinjore is the performance of folk dances by men and women that is a must-watch.

Pinjore Heritage Festival

It is conducted every year at 'Pinjore Gardens' during the month of December, and this festival is conducted to promote the rich culture of Haryana, as well as its historical tradition. This seems to be a great annual event that focuses on the old Pinjore town with its amazing gardens and the entire Haryana tourism. These Gardens at Pinjore are one of the oldest Mughal gardens, where the fair is organized beautifully, with a good theme of the past years.

It is decorated with varied platforms, gates, as well as the beautiful illuminations. There are also facilities such as the food plaza and shops around the fair. Also, there are parking areas that add charm to the Festival. While, there are also certain celebrations, which include the cultural functions such as the live performances by the prominent singers, and the Indian classical dancers, as well as the poets.

Guga Navmi

It is said to be a very holy festival, celebrated in Haryana. While, Guga represents a divine snake

(no evil or harm caused by it) similar to 'Nag Panchmi'. People of Haryana worship the snake God during the months of August and September. Here, many spiritual legends are connected with the Gugga Pir, which is also well-known as Zahir Pir or Baggar Wala. Guga was actually a Rajput king born at Garhdera near Sirsa, after 12 years of his mother's (Bachal) pregnancy, Guga was born.

While celebrating the festival, people used to first decorate a long bamboo tree. For decoration, many decorative pieces like the peacock plumes, hand fans, and the colorful threads are tied along with the blue flag, and a coconut as a remark to this festival and it's called as Charri or fly flap. On the 9th day of the Sawan month, the village priest starts beating drums and takes this all around the village, and people offer their homage with 'churmas'. There are also 5 followers who dance as per the tunes of various musical instruments like the chimta, dholaks, cymbals and so on.

Sohna Car Rally

Sohna Car Rally alias Vintage Car Rally is the festival of the old cars, which is conducted every year in the month of February at Sohna. It was started in the year 1964 and from that time onwards it has achieved a nation-wide significance. This traditional car rally starts at Delhi and then passes through Gurgaon and finally reaches Sohna. And even though there is a lot of thrill and excitement in seeing which vintage car finally emerges as the winner, the most lucrative aspect of the Rally is that you get to see all those cars about which one has so longed read in books but seldom have had the scope of beholding in front of eyes. Old cars like Rolls Royce to the rougher and tougher Fords and Austins, which once gale in the roads is now contesting with each other in the rally in order to achieve popularity. It is a tough competition in every field right from re-installation to maintenance and performance.

It is one of the major events of Gurgaon, attracting thousands of car lovers from all over the country. Sufficient accommodation facilities are available at Sohna during this time. Haryana Tourism celebrates this day with a mela event.

Kartik Cultural Festival

It is conducted during the month of November at Nahar Singh Mahal in Ballabgarh. The main aim of the Kartik festival is to promote martial arts both Indian classical music and dance and a rich variety of folk theatre. The festival had given new existence to the disappearing folk arts, martial arts and worked to bring traditional folk dances and music to the national stage. The visitors to the festival venue will get knowledge about the prosperity of India in the field of performing classical arts. The singers and dancers also get a national platform to perform their talents and they fully utilize this opportunity to enthrall the audience with their riveting performances.

During the Kartik festival, one could get a chance to visit the magnificent Nahar Singh Mahal which is the venue of the festival. It was built by the forefathers of Raja Nahar Singh around 1739 A.D with excellent architectural style, decorated with intricate cupola and minars. This splendid old palace comes

alive during the cheerful celebrations of the festivals due to the sound of music and the movement of dance.

Seasonality is adjusted to the working calendar of rural people and the size of fairs depends upon the success of crops or agricultural production and the behaviour of monsoon. Also the fair is a reflection of socio-economic and cultural heritage of a particular society. The functions of fairs are included religious programmes like Puja, Palkhi, Rath, Naivadhya, Chhabina and so on.

Haryana Festival

One of the many festivals that keep the state in a festive spirit almost all the time is the Haryana Festival. This festival is celebrated to commemorate the day when the state of Haryana was carved out of Punjab in 1966. In the year 2016, the 50th Haryana Day is celebrated all over the State on 1st November.

During this festival, there are cycle rallies as well as a rally cum race that is held from Chandigarh to Panchkula town. All people and cycle riders participate enthusiastically and there is cheer and rejoicing on the streets all over the state.

The festival also marks the Pakwan Pratiyogita, the food festival that is held at that time, at the tourist complexes. There are also blood donation camps and other Run-for-Fun events at this festival. To add more enjoyment, there are musical performances in the evenings that are held almost in all complexes in the state.

Kurukshetra/ Mahabharata Festival

It is one such festival that is celebrated by both religious and non-religious people during the months of November-December. Kurukshetra, named after the renowned Sage King Kuru was the site of the Epic battle of the Mahabharata. It was the place where memorable conversation that took place between Sri Krishna and Arjuna, which was later written down in the holy book of the Hindus, Bhagwad Gita. The festival takes place to mark the Gita Jayanati, or the day the Bhagwad Gita was born. It is during this time that people visit the holy site of Kurukshetra to gain a spiritual experience.

During this festival, the pilgrims take a holy dip in the Brahma Sarovar and the Sannehit Sarovar, the waters of which are considered sacred. There are religious men telling stories from the Bhagwad Gita, recital of religious shlokas as well as other celebrations such as dance and drama performances and the 'Deep Daan' at the Brahma Sarovar which are all a part of this religious festivities. There are striking classical and folk dances as well as troupes who come from all over the country and give brilliant performances based on the theme of the epic Mahabharata. The free medical camps, exhibition of books and classical Bhajan and recital programs are organized.

Causes of Crowd Disasters

The following are the major causes of crowd disasters:

Structural Causes

1. Structural collapse of barricades or temporary structure,
2. Barriers on the way,

3. Poor guard railings,
4. Poorly lit stairway,
5. Absence of emergency exits, and
6. Electricity supply failures

Over Crowd

1. More than anticipated crowd at the festival site,
2. Under estimation of audience, staffing, services,
3. Lack of access control,
4. Closed/Locked exits,
5. Reliance on one major exit route,
6. Uncontrolled parking and movement of vehicles,
7. Callous indifference in regulating traffic,
8. Lack of adequate and strong railings to marshal the queue,
9. Lack of sectoral partition to segregate assembled crowd, and
10. Lack of proper public address system to control crowd

Crowd Behaviour

1. A wild rush towards the entrance or exits,
2. A collision between large inward flow and outward flow,
3. Sudden mass evacuation,
4. Last minute change in platforms of trains Security,
5. Under deployment of security personnel to regulate crowd control,
6. Lack of CCTV surveillance of the crowd,
7. Absence of walky-talkies with the security staff,
8. Lack of door frame metal detectors, and

Lack of Coordination between Administration and Stakeholders/Organizers

1. Coordination gap between concerned agencies
2. Poor infrastructure (plans on paper but no implementation)
3. Communication delays

Geospatial Technology and Disaster Management

It is an organized system in an organized collection of computer hardware and software, people, money and organizational infrastructure that makes possible the acquisition and storage of geographic and related data for the purpose of analysis and decision making.

Disaster management planning is deciding in advance what, when, how and by whom it is to be done, it includes the selection of objectives and programmes from available resources. The basic elements of disaster are: (i) Prevention of risk or threat of any disaster; (ii) Mitigation or reduction of risk; (iii) Capacity building; (iv) Preparedness; (v) Assessing the severity or magnitude of its effects; and (vi) Rescue, relief and rehabilitation.

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 to be a skilled cartographer to create maps. Google map, Bing map, Yahoo map are the best example for web based GIS mapping solution. The route chart along with amenities can be drawn/shown in various maps/display or sign boards for the appropriate

management of the event.

Application in Transport/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 can 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.

Event/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**Crowd Control**

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.

Planning for Movement of Gathering

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. 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. Barriers

should be employed that can alter the space available for occupancy and patterns of group movement.

Planning for Crowd Management

It is deciding in advance what, when, how and by whom it is to be done, it includes the selection of objectives and programmes from available resources. The basic elements of disaster are: (i) Prevention of risk or threat of any disaster; (ii) Mitigation or reduction of risk; (iii) Capacity building; (iv) Preparedness; (v) Assessing the severity or magnitude of its effects; and (vi) Rescue, relief and rehabilitation. 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.

Crowd Control

The guiding principle for crowd control should be managing demand-supply gap through:

1. Controlling the crowd inflow,
2. Regulating the crowd at the venue,
3. Controlling the outflow.

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.

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.

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. .

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.

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.

Conclusion

Religious festivals and mass gatherings have become the hotspots of different kinds of hazards in the country and a few of them had turned into disasters. Gathering of large crowd at a limited geographical area for short time period and the diversity of crowd always challenge the safety measures unless it is systematically planned, executed and monitored.

References

1. Illiyas FT, Mani SK, Pradeep Kumar AP, Mohan K. *Human Stampedes during Religious Festivals: A Comparative Review of Mass Gathering Emergencies in India. International Journal of*

2. NDMA, *Managing Crowds: A Guide for Administrators and Organizers of Events and Venues. India: National Disaster Management Authority, 2014.*
3. NDMA, *National Disaster Management Guidelines-Preparation of State Disaster Management Plans. National Disaster Management Authority, Government of India, 2007.*
4. PRD Kerala, *Fairs and Festivals. Public Relations Department, Government of Kerala, 2014.*
5. SEOC, *Handbook on Disaster Management-Volume 2, Emergency Operation Centres and Emergency Support Functions Plan. State Emergency Operation Centre, Kerala State Management Authority, 2014.*
6. Circular No.35346/Dev.2/08 dated 32.06.2008 from Revenue (Devaswom) Department, Government of Kerala, 2008.
7. *Haryana at a Glance: Statistical Overview & Development Indicators, Jagran Research Centre, 2007, p. 157.*
8. MIB, *Festivals of India. Publication Division, Ministry of Information and Broadcasting, Government of India, 1992.*
9. Mittal, Satish Chandra (1986): *Haryana- A Historical Perspective, Atlantic Publishers & Distributors, New Delhi, p. 183.*
10. NIDM, *National Disaster Risk Reduction Portal - Haryana (PDF), National Institute of Disaster Management (MHA, GOI).*
11. <https://www.indianholiday.com/fairs-and-festivals/haryana/mahabharata-festival.html>
12. www.indianetzone.com › Art & Culture › Indian Festivals › Indian Regional Festivals
13. www.indiatourismecatalog.com/india_events_festivals/festivals_haryana.html