



NATIONAL DISASTER MANAGEMENT GUIDELINES

HOSPITAL SAFETY



February 2016



NATIONAL DISASTER MANAGEMENT AUTHORITY
GOVERNMENT OF INDIA

National Disaster Management Guidelines

Hospital Safety

National Disaster Management Guidelines—Hospital Safety

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The National Disaster Management Guidelines on Hospital Safety are formulated by NDMA, in consultation with various stakeholders, academic experts, subject specialists from across the country and officials from concerned Ministries and Departments of Government of India.

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Hospital Safety



National Disaster Management Authority
Government of India



सत्यमेव जयते

प्रधान मंत्री
Prime Minister

MESSAGE

I am happy to learn that the National Disaster Management Authority (NDMA) has brought out a compendium of comprehensive guidelines to enable a safe hospital environment even in the aftermath of major disasters.

I am sure that the different stakeholders both in the public as well as private sector will implement these guidelines to make our hospitals reliable and disaster resilient.

On this occasion, I extend my best wishes to NDMA.

(Narendra Modi)

New Delhi
22 January, 2016

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Executive Summary

The guidelines on Hospital Safety have been developed with the vision that all hospitals in India will be structurally and functionally safer from disasters, such that the risks to human life and infrastructure are minimized.

The overall aim of the guidelines is to mainstream disaster prevention, mitigation, preparedness and response activities into the health sector in our country, with specific focus on hospitals; such that hospitals are not just better prepared but fully functional immediately after disasters and are able to respond without any delay to the medical requirements of the affected community.

The first chapter introduces the need and importance of hospital safety and risk resilience in today's times.

The second chapter focuses upon the key objectives of the said guidelines as mentioned below:

- (1) To address hospital safety through a multi-hazard and inter-disciplinary approach;
- (2) To ensure structural safety of hospitals (especially of critical facilities);
- (3) To ensure that all professionals involved in the day to day operation of hospitals are prepared to respond to disasters; and,
- (4) To ensure that every hospital in the country has a fully functional and regularly tested Hospital Disaster Management Plan

The third chapter deals with awareness generation activities for hospital safety with an aim to sensitize the key stakeholders and community on the need for disaster management in health facilities and to achieve the overall aim of protecting the lives of patients and health workers by ensuring the structural resilience of health facilities as well as improving the risk reduction capacity of health workers and institutions.

The fourth chapter on hospital preparedness and response focuses upon provisions required to be put in place to ensure functional safety of hospitals/health facilities in disaster situations. The provisions laid down are the minimum required standards that shall be adhered to by all healthcare facilities; and address both internal and external disasters that are likely to affect hospitals. The chapter lays stress upon the key objective of disaster preparedness and response for hospitals/healthcare institutions which is to ensure that they can remain functional and continue providing the necessary health care services during and immediately after an emergency.

The fifth and sixth chapter focus upon the structural and design safety elements as well as fire safety pertaining to hospital. The seventh chapter throws light on the elements pertaining to regular maintenance and inspection for hospitals. The eight chapter provides an overview of the standard Licensing and Accreditation requirements that shall be followed by hospitals to ensure disaster preparedness. Conscious efforts need to be made to achieve the goal of 'safer and functional hospitals' in the country at the earliest; and towards this end, the ninth chapter lays down the 'National Action Framework for Hospital Safety', as a focused strategy which should be followed to achieve this goal.

This guideline has been formulated to ensure that when implemented at all levels, the risks to human life and infrastructure are minimised; and hospitals are not only better prepared but are optimally functional immediately after disastrous events, such that they are able to respond immediately to the medical requirements of the affected community.

It is strongly recommended that the interventions suggested in this guideline are approached and implemented in a systematic and time bound manner, since disastrous events can happen anytime, anywhere and at any scale.

1.1 Hospitals and Disasters

Disasters have an uncanny ability to bring to the forefront vulnerabilities of systems, structures, processes and people which in turn cause large scale damages; and hospitals are no exception to this rule.

In India, experiences from the Gujarat earthquake of 2001, the Indian Ocean Tsunami of 2004 and the Kashmir Earthquake of 2005 have shown that disasters affect not only the population but also health facilities. Particularly when the Children's Hospital in Jammu collapsed; in the city of Bhuj, where thousands of people died and the civil hospital was reduced to a heap of debris when it was needed the most. The fire in AMRI Hospital in Kolkata, where more than 90 people died, reminded us that it is not simply the structural resilience but also operational resilience of hospitals that needs to be addressed, if we wish to reduce the impact of disasters on hospitals.

Both these instances of the civil hospital collapsing in Bhuj and the fire in AMRI Hospital in Kolkata, provided evidence based lessons of the underlying vulnerabilities that cause hospitals to get affected by disasters, which may be broadly grouped as follows:

- Inadequate or non-compliance of structural elements of hospitals to building codes and other safety norms which result in the failure of hospital structures and their component non-structural elements;
- Absence of an operational Hospital Disaster Management Plan;
- Lack of planning and preparedness to respond to disasters;
- Inadequate or complete lack of internal and external communication; and
- Lack of networking amongst hospitals.

As a result, when hospitals are affected by disasters, the repercussions are three dimensional – health, social and economic.

The health impact of hospitals being affected by disasters include, other than the very obvious lapses in medical care being provided to victims of a disaster, lapses in preventive medicine and public health response. This is because hospitals host laboratories and can contribute to the diagnoses and issuance of warnings of imminent communicable diseases that may spread post a disaster.

The social impact of hospitals being affected by disasters includes a loss of confidence/morale in the affected community which can affect the long-term recovery and sense of well-being of the community. The economic impact of hospitals being affected by disasters is a little more obvious, given the enormous investments required to be made to construct hospitals and the expensive equipment that is lost when disasters strike hospitals. Even the use of temporary field hospitals as a contingency measure is economically unviable. It is an attested fact that the costs involved to mitigate and prepare hospitals for disasters are far less than those required for re-building hospitals after they have been damaged by disasters.

Link 1: Excerpts from the National Policy on Disaster Management 2009 on Medical Preparedness and Mass Casualty Management (page 20 – Chapter 5 – Disaster Prevention, Mitigation and Preparedness)

5.2.8 Medical preparedness is a crucial component of any DM Plan. The NDMA, in close coordination with the Ministry of Health and Family Welfare, States and premier medical research institutes will formulate policy guidelines to enhance capacity in emergency medical response and mass casualty management. **DM plans for hospitals** will include developing and training of medical teams and paramedics, capacity building, trauma and psychosocial care, mass casualty management and triage. The surge and casualty handling capacity of all hospitals at the time of disasters, will be worked out and recorded through a consultative process, by all the States/UTs in the pre- disaster phase.....

Link 2: Hospital Disaster Preparedness: (Excerpts from National Disaster Management Guidelines on Medical Preparedness and Mass Casualty Management)

Hospitals are an important unit for the management of mass casualties. Hospital preparedness in the pre- disaster phase enhances the effectiveness of their coordinated response during disaster situations. In India, there are different hospitals under different administrative setups. The availability and quality of medical facilities differ drastically from urban to rural and from private to governmental hospitals. Thus, preparedness calls for hospital disaster management planning at the hospital level, its development and up-gradation, planning at district /state level and overall regional plans for effective management.

1.2 Expected Disaster Scenarios for Hospitals

Hospitals may face both internal and external disasters. The impact of internal disasters such as fire, exposure to hazardous material, utility failures, etc., is typically limited to the hospital/healthcare facility while external disasters include scenarios such as earthquakes, mass casualty events or epidemics where the hospital itself may or may not be affected but is a critical part of the larger response. As such three scenarios can be expected when disasters strike. They are as follows:

- (1) **Community Affected – Hospital Unaffected:** During such scenarios, hospitals play a vital role in the larger disaster response being undertaken. For hospitals such scenarios would imply a sudden increase in demand because of the surge in the number of patients seeking medical attention. There is a possibility of the hospital facility getting overwhelmed if adequate preparedness and response mechanisms are not swung into action as soon as the disaster occurs.
- (2) **Community Unaffected – Hospital Affected:** Such scenarios arise from the internal crises/emergencies of hospitals. As such, partial or complete evacuation and transfer of critical patients to networked hospitals is the key to successful response. Such scenarios also demand a high degree of preparedness on the side of the hospital administration and staff, as well as a speedy response from the surrounding community and hospitals.
- (3) **Community Affected – Hospital Affected:** Such situations exacerbate the challenges posed to hospitals, as they not only need to cater to the existing demand on their facilities but also need to address the sudden increase in demand on their facilities because of the surrounding community being affected by disasters. In such situations the hospitals may even find themselves facing the added challenges of loss of essential services, like water supply, electricity, medical gases, etc. and a reduction in man-hours per patient.

Hence, the only rational manner in which hospitals can be prepared for disasters is by increasing their resilience and reducing their vulnerability; by strengthening both structural and operational aspects of the hospital, such that they achieve a reasonable degree of safety.

1.3 Safe Hospitals

The Pan American Health Organization (PAHO) and the World Health Organisation (WHO) have defined: “a **Safe Hospital** as one that:

- *will not collapse in disasters, killing patients and staff;*
- *can continue to function and provide its services as a critical community facility when it is most needed; and,*

- *is organised, with contingency plans in place and health workforce trained to keep the network operational.”*

The concept of safe hospitals does not merely refer to the physical and functional integrity of health facilities but also the preparation to function at full capacity and cater to the needs of the affected community immediately after disaster strikes.

Thus, making hospitals safe involves understanding and mitigating factors that contribute to their vulnerability during an emergency or disaster such as the building’s location, design specifications and materials used, damage due to non-structural elements, untrained professionals and lack of basic understanding of disaster management. Critical services such as electricity, water and sanitation, waste treatment and disposal of medical wastes are important to ensure continuity of operations during an emergency situation. The importance of hospitals and all types of health facilities extend beyond the direct life-saving role they play. Therefore, special attention must be given to ensure that hospitals are structurally safe and health professionals are sensitized, oriented and trained to handle emergency conditions.

2

About the Guidelines

2.1 Vision

The guidelines on Hospital Safety have been developed with the vision that **all hospitals in India will be *structurally and functionally safer from disasters***, such that the risks to human life and infrastructure are minimized.

The overall aim of the guidelines is to mainstream disaster prevention, mitigation, preparedness and response activities into the health sector in our country, with specific focus on hospitals; such that hospitals are not just better prepared but ***fully functional*** immediately after disasters and are able to respond without any delay to the medical requirements of the affected community.

2.2 Objective of the Guidelines

The key objectives of the guidelines are:

- (1) To address hospital safety through a multi-hazard and inter-disciplinary approach;
- (2) To ensure structural safety of hospitals (especially of critical facilities);
- (3) To ensure that all professionals involved in the day to day operation of hospitals are prepared to respond to disasters; and,
- (4) To ensure that every hospital in the country has a fully functional and regularly tested Hospital Disaster Management Plan.

2.3 Scope of the Guidelines

Health Care in India is categorized into three categories – primary, secondary and tertiary, whereby Sub-Centres and Primary Health Centres (PHCs) fall under the primary level, Community Health Centres (CHCs), Sub-District/ Sub-Divisional Hospitals and District Hospitals

fall under the secondary level and Multi-Super Specialty Care Hospitals fall under the Tertiary level. The provisions laid down in this guideline shall be applicable to all healthcare facilities in the government sector and their equivalent counterparts in the private sector. Smaller facilities may choose to adapt relevant sections of the guidelines to address disaster management concerns as per their context and local conditions.

2.4 Institutional Mechanisms

Both Health and Disaster Management being state subjects, it implies that the respective state health departments and state disaster management authorities, along with the state public works department, will play a crucial role in implementing these guidelines on the ground.

However, the Ministry of Health and Family Welfare, the Central Public Works Department and other licensing agencies at the Central or State levels will also undertake the necessary actions to implement these guidelines for effective compliance.

Wherever necessary, the National Disaster Management Authority, the Bureau of Indian Standards, technical institutions like IITs and other relevant agencies shall extend their support to further the agenda of Hospital Safety in our country.

2.5 Implementation of the Guidelines

Some of the provisions for hospital safety that have been detailed in these guidelines can be undertaken with immediate effect, while some others may require a considerable amount of time for policy decisions, preparation and implementation. Hence to address the implementation of Hospital Safety activities in the country, a detailed National Action Framework has been developed as a part of these guidelines which outlines *short term* (1 to 5 years), *medium term* (5 to 10 years) and *long term* (more than 10 but within 20 years) goals for implementation.

3

Awareness Generation for Hospital Safety

3.1 Scope

The first step towards making hospitals safe is to create awareness among various stakeholders about the need to have safe hospitals, what it entails and actions that can be undertaken.

All awareness generation activities for hospital safety shall aim at sensitizing the key stakeholders and community on the need for disaster management in health facilities and to achieve the overall aim of protecting the lives of patients and health workers by ensuring the structural resilience of health facilities as well as improving the risk reduction capacity of health workers and institutions.

The key objectives of awareness generation activities for Hospital Safety shall be:

- (1) Spreading awareness on protecting critical health facilities from disasters by including risk reduction in the design and construction of all new health facilities, and by reducing vulnerability in existing health facilities through structural and non-structural measures.
- (2) Sensitizing the health workforce in hospitals as they are central to identifying potential health risks from natural hazards.

This Chapter shall focus on the approach that needs to be taken for awareness generation activities to create an environment in which all relevant stakeholders are well aware of and readily support the various actions that need to be taken to make hospitals safe.

3.2 Communication Goals

The key goals of all awareness generation activities shall be:

- (1) To create an enabling environment and momentum to generate strong interest in hospital safety
- (2) Inform the health institutions and its workforce about emergency management, dos and don'ts and linkages between disaster management and hospital safety

- (3) Raise awareness that health facilities should be prepared to deal with emergencies that arise due to disasters both natural and human induced.

3.3 Stakeholders/Target Group

The primary, secondary and tertiary target groups identified for awareness generation on hospital safety are as mentioned below:

3.3.1 Primary Target Group

- (1) **Hospital Staff/Administration**
- (2) **Doctors/Nurses/Paramedical staff** as they provide support towards critical services in hospitals
- (3) **Policy makers**, as they are responsible for taking key decisions and can bring about necessary interventions required for hospital safety

3.3.2 Secondary Target Group

- (1) **Students**, studying in medical/public health colleges as they can be effective change agents. If they are aware, they can implement those learning's to make health facilities safer
- (2) **Architects, engineers and masons** to ensure safe structures (hazard resistant construction with respect to health facilities)
- (3) **Media professionals**, media plays a critical role in influencing community as well as policy makers.
- (4) **Financial institutions** such as banks and other lending agencies that can finance the construction, reconstruction or retrofitting of health facilities

3.3.3 Tertiary Target Group

- (1) **Community members** are the beneficiaries. It is the community that gets first affected during disasters and they need a safe place where they can be treated and provided with other health facilities. Also, community members play a crucial role of first responders during any disaster.

3.4 Key Elements of Awareness Generation for Hospital Safety

An awareness programme on Hospital Safety shall aim at providing the basic information and creating the enabling environment so that the level of acceptance for hospital safety is increased among the target group and an interest to know more is generated. The awareness strategy

for hospital safety shall follow a top down approach, as the major decisions such as ensuring structural safety through retrofitting of hospitals, non-structural safety, taking steps to sensitize employees in various aspects of hospital safety are taken by the top management of hospitals. The strategy shall be developed using multiple modes of communication and adopting a multi-hazard approach. Involvement of all modes of communication such as electronic, print, IEC materials, audio-visuals on disasters, dos and don'ts, standard operating procedures (SOPs) shall be required to reach all segments of the target audience.

While developing messages for an awareness campaign on Hospital Safety, the following elements shall be covered:

- **There are many factors that put hospitals and health facilities at risk.** These include – buildings, their location and design specifications, patients – who are highly vulnerable and during emergencies, the number of patients as well as their vulnerability increases. Other than these, damage to hospital equipments and lack of basic lifeline services adds to the risk.
- **Components of a hospital or health facility are typically divided into two categories.** These are structural (design of buildings, resilience of material used etc.) and non-structural (mechanical equipments, storage, shelves etc.) that determine the overall safety of the health facilities.
- **Functional collapse, not structural damage, is the usual reason for hospitals being put out of service during emergencies.** Elements that allow a hospital to operate on a day-to-day basis are unable to perform during emergency. These include labs, operating theatres, medical records, medical services, administrative process etc.
- **Making new hospitals and health facilities safer from disasters is not costly.** Incorporating mitigation measures into the design and construction of new hospitals accounts for less than 4 percent of the total investment.
- **Makeshift/Temporary/Field hospitals are not necessarily the best solution to compensate for the loss of a hospital or health facility,** as these are not cost effective
- **Seeking the right technical expertise** to ensure that norms and building standards are in place.
- **Creating safe hospitals is as much about having vision and commitment as it is about actual resources** The responsibility of creating safe hospitals must be shared among many sectors: planning, finance, public works, urban and land-use planning, together with the health sector.

3.5 Awareness Generation Exercises

For hospitals to be safe, awareness on disasters and its prevention is must. Information for preparedness, mitigation and response shall be disseminated through various communication modes packaged for different stakeholder groups. It shall be designed to address the specific vulnerabilities of the area. Basic awareness and sensitization of the hospital staff consisting of managerial and administrative staff besides doctors, nurses, para-medical staff is the primary need for hospital safety.

Awareness generation on first aid, search & rescue, trauma counselling, emergency exit routes, fire safety, relevance of disaster management plans, handling emergencies, sanitation, and safe construction are important for building a culture of safety in hospitals and it can be directly taken up by the hospital administration. Sensitization events, consultation/conferences, mass media campaigns, public advertisements/messages shall be used to reach out to the target audience. Special messages on radio, television and print media including journals for doctors, health magazines may also be effective. Case studies documenting the examples of other countries/states should be prepared and disseminated for creating greater public awareness among professionals and related stakeholders. Awareness material such as signage, hoardings, boards displayed in the health institutions such as hospitals (govt. and private), local dispensaries, primary health centres, advertisements on ambulances etc. shall play an important role in sensitisation and public awareness on the important issue of hospital safety and risk management.

Education and Sensitization of medical professionals is the basic premise for risk reduction in hospitals and other health facilities. This includes understanding disasters, its causes and impacts, various phases of disasters and what actions are required to be taken and the critical role that doctors play in the aftermath of disasters. Disaster Management especially with focus on hospital safety and its various aspects need to be mainstreamed in the course curriculum of medical and paramedical students.

Annexure 1 (Table 3.1 – Page 93) lists the Key communication approaches and specific activities that can be used to reach out to key stakeholders.

4

Hospital Disaster Preparedness and Response

4.1 Scope

This chapter focuses upon provisions required to be put in place to ensure functional safety of hospitals/health facilities in disaster situations. The provisions stated herein are the minimum required standards that shall be adhered to by all healthcare facilities; and address both internal and external disasters that are likely to affect hospitals.

The prime objective of disaster preparedness and response for hospitals/healthcare institutions is to ensure that they can remain functional and continue providing the necessary health care services during and immediately after an emergency. To fulfill this objective, initiatives need to be taken with regard to:

- (1) Coordination & Management
- (2) Planning, Training and Drills
- (3) Information and Communication
- (4) Safety and Security
- (5) Human Resources
- (6) Logistics, Supply and Finance Management
- (7) Continuity of Essential Services
- (8) Triage
- (9) Surge Capacity for Medical Response
- (10) Post-disaster Recovery
- (11) Patient Handling
- (12) Volunteer Involvement and Management
- (13) Area Level Networking of Hospitals
- (14) Coordination and Collaboration with Wider Disaster Preparedness Initiatives

Each hospital shall have its own **Hospital Disaster Management Committee (HDMC)** responsible for developing a **Hospital Disaster Management Plan (HDMP)**. Members of this committee shall be trained to institute and implement the Hospital Incident Response System (HIRS) – for both internal and external disasters.

4.2 Coordination & Management

To enable effective preparedness and response during disasters, an efficiently functioning HIRS (Hospital Incident Response System) shall be established in each hospital. The HIRS shall be ingrained into practice, updated/revised and tested through repeated tabletop exercises & drills. The overall objective of the HIRS structure shall be to enable the development of strategies, management of resources, planning and implementation of operations in emergency situations.

All hospitals shall have a HIRS manual detailing but not limited to the:

- (1) **Command Structure: The HIRS Tree stating the positions and hierarchy** with Job action sheets
- (2) **Modular Organization:** The emergency response structure shall be flexible so that it can be expanded, and contracted depending on the type and size of the incident.
- (3) **Consolidated Action Plans:** of all the participating departments involved in developing the overall incident objectives, selection of strategies, planning and performance of tactical activities.
- (4) **Manageable Span of Control:** The responsibility of each individual supervisor shall be limited. The span of control will be from three to five persons, depending on the type of incident, the nature of the response, the skill of the employee and the distance involved.
- (5) **Comprehensive Resource Management:** Stating clearly the expected resources needed in a disaster & their location in the unit/department.

To ensure effective Coordination and Management every hospital shall:

- i. Establish an HIRS system to oversee operations, planning, logistics and finance/administration required for disaster preparedness and response
- ii. Define the functions of the HIRS System
- iii. Define the roles and responsibilities of each member of the HIRS and other critical hospital staff

- iv. Develop job action sheets that briefly list the essential qualifications, duties and resources required for HIRS members, hospital managers and staff for disaster-response activities
- v. Train all hospital staff and community members (including HIRS members) on the structure and functions of the HIRS system so that each one is aware of their role within the HIRS
- vi. Designate a hospital management and coordination center
- vii. Develop SOPs/strategies to implement the HIRS system
- viii. Implement the HIRS action plan

4.3 Planning, Training and Drills

(a) Planning

The planning process shall broadly involve:

1. Formation of a sub-team (within the HDMC) who shall draft the plan.
2. Development of the plan and sub-plans; guidelines, standard operating procedures etc.
3. Allocation of resources to execute the plans; and
4. Defining and allocating roles/responsibilities to be performed by hospital staff in the event of activation of the plan.

The main objective of the Hospital Disaster Management Plan shall be to optimally prepare the staff, institutional resources and structures of the hospital for effective performance in different disaster situations. The HDMP shall be a written document and copies of the same shall be made available to all staff in the hospital. It shall have comprehensive actionable plans for disaster Preparedness, Response and Recovery corresponding to the Pre Disaster Phase, Disaster Phase and Post Disaster Phase respectively. All hospitals shall have an HDMP detailing but not limited to:

- (1) Hazard Vulnerability Analysis (HVA) for the hospital/health facility
- (2) Hospital Incident Response System
- (3) Individual Roles and Responsibilities
- (4) Hospital Capacity and Capability Analysis
- (5) Hospital-Community Coordination, and
- (6) Hospital Command Centre

Adequate resource allocations shall be ensured for smooth implementation of the HDMP.

(Note: Most of the assessment, drafting, discussion and approval of the HDMP shall be done in the pre disaster phase.)

(b) Training

All hospital staff shall be regularly oriented to the Hospital Disaster Management Plan (especially each time the plan is updated or modified). Hospital staff who will implement the HDMP shall be trained every alternate month.

All HIRS position holders (including their 2nd and 3rd line back-ups) shall learn the SOPs and Job Action Sheets (JASs). They shall be trained as Master Trainers with a clear understanding of the training outcomes in terms of examinations. Practice evaluations shall be documented for inspection.

Specialized need-based trainings to perform specific functions during the disaster shall be planned and executed for different categories of staff of the hospital. The training will follow the matrix of skills appended in Annexure 2, 3 and 4.

Regular Training and capacity building provision shall be made to enhance the staff capacity and competency in providing critical clinical services during emergencies.

(c) Drills

Every hospital/healthcare facility shall conduct periodic drills and rehearsals to test the response capabilities to emergencies in real time which will serve as opportunities for practical learning for the hospital staff. There are several types of hospital drills which include computer simulations, tabletop exercises and operationalized drills involving specific emergency scenarios.

(1) Table Top Exercises

A Table Top Exercise is a paper drill intended to demonstrate the working and communication relationships of functions found within the disaster management organizational plan and HIRS. The exercise is intended primarily for the administrators, managers and personnel who could conceivably be placed into an officer's position upon activation of the disaster management plan. All hospitals shall carry out a table top exercise every quarter, with the full HIRS team. Proceedings of the exercise shall be documented for inspection.

(2) Partial evacuation/Non-evacuation Drills & Mass Casualty Incident (MCI) Response Drills

Hospital evacuation may become a necessity if the hospital itself is damaged in a disaster. Such situations need to be foreseen and proper planning has to go into how to evacuate and which

areas of the hospitals need to be evacuated first in case of an internal disaster. All hospitals shall do an ICU evacuation drill & ward evacuation drill once a year.

The function of MCI drill is to check the resilience of the system in terms of capacity & capability when faced with an extraordinary surge of patients in the Emergency Room after an external disaster. All hospitals shall carry out a MCI drill once a year.

All drills shall be evaluated by third party evaluators using a validated drill evaluation tool & documented. The learning from the hot wash after the drill shall be documented for inspection and the HDMP shall be revised accordingly within 7 working days of completion of the drill.

To ensure proper planning, training and drills, every hospital shall:

- i. Ensure that a Hazard- Vulnerability Assessment (HVA) of the hospital and a hospital capability analysis precede the development of the Hospital Disaster Management Plan
- ii. Meticulously plan for each of the critical functions of hospital disaster preparedness and response
- iii. Develop standards/protocols/guidelines for all aspects of hospital disaster preparedness and response
- iv. Allocate adequate resources for the smooth execution of the Hospital Disaster Management Plan
- v. Regularly conduct trainings for the hospital staff involved in hospital disaster preparedness and response
- vi. Test the Hospital Disaster Management Plan by undertaking simulation exercises
- vii. Conduct periodic Disaster Drills/exercises to improve the disaster preparedness and the response capability of the hospital
- viii. Regularly update and revise the Hospital Disaster Management Plan to meet the changing and emerging scenarios.

4.4 Information, Communication and Documentation

(a) Information and Communication

The HDMP shall ensure clear, accurate and timely communication and information management (both internal and external) to ensure informed decision-making, effective collaboration and cooperation, and public awareness through the use of common terminologies, integrated communication and an efficient system of alert. These are clearly delineated in the HIRS

guidelines and shall be followed. A Public Information Services/Media Cell shall also be established.

The HIRS center shall communicate with the District Incident Response System & other key stakeholders like Police, Fire Services, DDMA/SDMA as well as other healthcare facilities managing patients in the same catchment area by establishing a regular channel of communication with them to manage the disaster more efficiently.

In case of a biological / epidemic emergency, the same shall be reported to the highest health authorities at the earliest. Hospitals shall also report to appropriate agencies such as their respective police departments, fire departments, DDMA, SDMA and NDMA.

(b) Documentation

All Medico-Legal Cases shall be recorded properly. However, the treatment of patients will get priority over paperwork. To meet the surge of cases, additional medical records assistant/ technician shall be posted from the Medical records section. Computerised documentation (or manual) will be beneficial for the staff, police, next of kin and the press. Details of the casualties received and being admitted, their clinical condition, along with colour coordinated classification status by Triage shall be documented, for a credible database, for efficient retrieval of information to cater to any post-incident treatment/medico-legal/financial issues arising at a later date.

To ensure effective information dissemination and a robust communication system every hospital/healthcare facility shall:

- i. Appoint/ designate a public information spokesperson to coordinate hospital communication with the public, the media and the health authorities
- ii. Establish an Information desk to provide the requisite information at regular intervals and to serve as a hub for volunteer mobilization and management. The list of casualties along with their status shall be displayed at a prominent place outside the casualty / emergency ward, in both English and the local language, which shall be periodically updated.
- iii. Develop a robust communication protocol, including streamlined mechanisms for information exchange between hospital administration, department heads and facility staff
- iv. Brief hospital staff about their roles and responsibilities during crisis situations
- v. Establish mechanisms for timely information management and reporting to

- supervisory and other relevant stakeholders (neighboring hospitals, private practitioners and pre-hospital networks etc.)
- vi. Ensure availability of reliable and suitable primary and back-up communication system(installation of suitable equipments depending upon the size, location and critical units in the hospital which will get activated in times of emergency; select staff to be trained on the usage of such equipments)
 - vii. Draft key messages for communicating effectively to the stakeholders (patient, staff, public etc.) in preparation for the most likely disaster scenarios
 - viii. Maintain a database containing the contact information of all the hospital staff and other relevant stakeholders & update it periodically

Planning for communications (within and outside the hospital):

Communications is one of the main problems in major emergencies and disasters.

Information transfer has to be reduced to most important facts only. Multiple means of communications should be planned to communicate with hospital staffs and administrator.

The currently available communication networks which should be looked into for availability in the hospital are;

- *internal telephone exchange (for the hospital)*
- *landline phones*
- *private mobile/cellular phones*
- *mobile/cellular phones in closed user group (CUG) for hospital staffs only provided by the hospital*
- *Loudspeakers/ public address system*
- *Wireless sets for security and ambulance personnel*
- *The communications room*

An area should be identified as communication room within the hospital and all internal and external communications must be made from here. This communication room should be in continuous contact with the command centre/control room.

All important numbers of hospital personnel, police, district functionaries of administration other nearby hospitals etc. should be clearly mentioned in the HDMP and a copy of this Plan should also be present in the communication room/ telephone exchange. Excerpts from Guidelines on Hospital Preparedness and Planning – GOI – UNDP - 2008

4.5 Safety and Security

Each hospital shall have Safety and Security Management protocols to describe the processes designed to eliminate or reduce, to the extent possible, hazards in the physical environment and to manage staff activities, to reduce the risk of injuries to individuals and loss of properties. Safety and Security management protocols shall be applicable to all personnel, physicians, departments and properties. The Safety and Security Management activities shall be coordinated by the Hospital Disaster Management Committee (HDMC) in association with all concerned stakeholders, internal and external.

To ensure adequate security and safety, every hospital/healthcare facility shall:

- i. Appoint a hospital security team responsible for all hospital safety and security activities
- ii. Prioritize security needs of the hospital and identify areas where increased vulnerability is anticipated
- iii. Ensure early control of facility access points, triage, and other areas of patient flow
- iv. Establish reliable modes of identifying authorized hospital personnel, patients, patients' attendants and visitors
- v. Establish mechanisms to escort medical personnel related to disaster relief to the patient care areas when needed
- vi. Define security measures required for safe and efficient hospital evacuation
- vii. Define the rules for engagement in crowd control
- viii. Solicit inputs from the hospital security team to identify potential safety and security challenges and constraints, including gaps in the management of hazardous materials
- ix. Solicit inputs from the hospital infection control committee regarding challenges and constraints in prevention and control of hospital infection
- x. Implement procedures to ensure the secure collection, storage and reporting of confidential information
- xi. Define the threshold and procedures for involving local law enforcement
- xii. Establish an area for radioactive, biological and chemical decontamination and isolation

4.6 Human Resources

All hospital personnel shall be adequately prepared for emergencies and disasters. All hospitals shall develop and implement a human resource management policy for the hospital for disaster situations to ensure adequate staff capacity and the continuity of operations during any incident that increases the demand for human resources.

All Hospital employees shall be classified as Essential or Non-essential as defined below:

- (1) **Essential (E):** Employees whose job function is essential to clinical services or operations during times of a natural or man-made disaster.
- (2) **Non-Essential (N):** Employees whose presence is not essential during a declared disaster event, but cannot leave until released by their supervisor and must return to work as usual under routine operations after the disaster has been declared over.

To effectively manage human resources every hospital/healthcare facility shall:

1. Establish and implement a human resource management policy for disaster situations
2. Identify minimum needs in terms of health-care workers and other hospital staff to ensure the operational sufficiency of the hospital/department in emergencies
3. Establish a contingency plan for provision of food, water and living space for hospital personnel during disasters
4. Prioritize staffing requirements and resultant deployment
5. Recruit and train additional staff according to the anticipated need
6. Establish a clear policy to address the needs of ill or injured family members or dependants of staff
7. Ensure adequate staff capacity and competency in providing high demand clinical response services during emergencies by providing training and exercises
8. Ensure adequate shifts and rotation and self care of clinical staff as well as domestic support measures to support staff to work for long hours
9. Ensure adequate capacity of the local community to facilitate hospital services during emergencies
10. Ensure adequate measures to deal with psychosocial and mental health issues of hospital staff and their families

11. Establish an administrative mechanism for issuing authorization and rapid induction to medical personnel who are not on the regular rolls to work in the hospital for enabling capacity surges
12. Ensure that the personnel dealing with contagious diseases are provided with appropriate Personal Protective Equipment (PPE) and interventions (eg. Vaccination) in accordance with the policy and guidelines of the national health authority

4.7 Logistics, Supply and Finance Management

To ensure the continuity of the hospital supply and delivery chain, the following three main functional areas shall be ensured:

- (1) **Operations:** Responsible for the coordinated tactical response for the event/incident
- (2) **Logistics:** Entails provision of facilities, services, and materials, including transportation and fuel, shelter, personal hygiene, food, potable water, water for fire suppression, medical attention and supplies, relief personnel etc.
- (3) **Finance/Administration:** Includes tracking all event/incident related costs and evaluating the financial considerations of the event/incident.

For efficient logistics, supply and financial management every hospital/healthcare facility shall:

- i. Develop and maintain an updated inventory of all equipment, supplies and pharmaceuticals and establishment of a shortage-alert mechanism
- ii. Estimate consumption of essential supplies and pharmaceuticals using most likely disaster scenarios
- iii. Consult with relevant authorities to ensure the continuous provision of essential medicines and supplies
- iv. Assess the quality of the contingency items prior to purchase
- v. Establish contingency agreements with vendors to ensure the procurement & prompt delivery of equipment and supplies in a disaster situation
- vi. Develop mechanisms for storage and stockpiling of additional supplies including pharmaceuticals and ensure an uninterrupted cold chain
- vii. Establish mechanisms for quick assessment of the functional status of different equipment and prompt maintenance and repair of those equipment required for essential services

- viii. Define the hospital pharmacy's role in providing pharmaceuticals to patients being treated at home or at alternate treatment sites
- ix. Establish coordination for a contingency transport strategy for patient transfer
- x. Establish a simple disaster budget protocol for quick mobilization of funds for disaster response
- xi. Ensure availability of petty cash/dedicated contingency fund which could be used for disaster response
- xii. Introduce special accounting policies and procedures for efficient financial management during emergencies

- ◆ Safe disposal of Bio-medical waste as per The Bio-Medical Waste (Management & Handling Rules, 1998 which were notified under the Environment Protection Act, 1986 (29 of 1986) by the Ministry of Environment and Forest, Govt. of India on 20th July, 1998. The guidelines have been prepared to enable each hospital to implement the said Rules, by developing comprehensive plan for hospital waste management, in term of segregation, collection, treatment, transportation and disposal of the hospital waste

4.8 Continuity of Essential Support Services

Every hospital shall ensure the continuity of essential services in all the circumstances by ensuring adequate resources and hospital supplies, developing and ensuring back up arrangement of utility services, having a deployable evacuation plan, coordinating and networking with neighboring hospitals/health care institutions that can facilitate in continuing the essential services of the hospitals during the emergencies.

The Utility Systems Management plan and protocols shall be overseen by a Utilities Subcommittee of the Hospital Disaster Management Committee and report related concerns to that committee.

Every hospital shall also have a business continuity plan (BCP) that can be activated in emergencies to facilitate in continuing essential/critical services of the hospital. The main elements of a hospital BCP shall be as follows:

- (1) plans and procedures for all readiness levels;
- (2) essential business functions;
- (3) succession of key leadership positions and delegations of authority for their associated duties; safekeeping of vital records and resources;

- (4) identification of continuity facilities;
- (5) a plan for interoperable and redundant communications;
- (6) human resource planning;
- (7) validation of the plan through testing, training and exercising activities;
- (8) specify a plan for devolution of essential business functions; and
- (9) provide a plan for reconstitution after the disaster.

A key aspect of continuity of essential support services is the structural design and safety of the essential support service systems. The Utilities Sub-Committee shall refer to the section 3.5 of this guideline and implement the necessary provisions to ensure the continuity of essential services.

To ensure the continuity of essential services every hospital/healthcare facility shall:

- i. List and identify all hospital services and rank them in order of priority.
- ii. Develop a utility management plan and protocols for the hospital, with *clear actionable mechanisms to ensure proper maintenance, 24x7 availability of the routine/normal and emergency domestic and treated water systems, power systems, medical gas and vacuum systems, natural gas systems, heating, ventilation and air conditioning systems, elevators/lifts, fire/life safety systems.*
- iii. Identify the resources needed to ensure the continuity of essential hospital services, in particular those for critically ill and other vulnerable groups (e.g. pediatric, elderly and disabled patients)
- iv. Ensure the existence of a systematic and deployable evacuation plan that seeks to safeguard the continuity of critical care
- v. Coordinate with local health authorities, neighboring hospitals and private medical practitioners to ensure continuous provision of essential medical services to the community
- vi. Ensure the availability of appropriate back-up arrangements for essential life lines including water, power, food supplies, medical gases etc.
- vii. Ensure the availability of adequate hospital supplies
- viii. Ensure contingency mechanisms for hospital waste management

4.9 Triage

Triage is the process of sorting injured people into groups based on the severity of their conditions, so that the most serious cases can be treated first. Every hospital shall **prioritize** patient treatment efficiently when resources are insufficient, by undertaking triage based on the philosophy that **'the sickest is seen first'**. Patients shall be evaluated quickly for their vital signs, chief complaint and other key indicators to be categorized as:

- (1) **Category I (obvious life-threatening emergency):** The physician shall examine the patient with zero delay. Case examples include cardiac arrest, continuous seizures, acute severe chest pain, haematemesis, sudden loss of consciousness, major trauma with hypotension, etc.
- (2) **Category II (Potential for life-threatening emergency):** The possibility of an occult or pending emergency condition. Although some of these patients initially may appear to have not-so-serious chief complaints, about 25% of these patients have high-risk conditions. The patient shall be fully evaluated and treated by a physician within 10 minutes of arrival, since there could be potential instability to the vital signs. Case examples include dyspnoea, high fever, acute abdominal pain, acute confusion, severe pain, serious extremity injuries, large lacerations, etc.
- (3) **Category III (non-life-threatening emergency):** These patients' presentation need emergency care but provide no reason to consider the possibility of threat to life or limb. These patients shall be seen by an Emergency Management physician on a first-come first served basis in the Consultation Room. Case examples include chronic, minor, or self-limiting disorders, medication refill, skin disorders, mild adult upper respiratory tract symptoms, mild sore throat, blood pressure check, etc.

To undertake effective triage every hospital/healthcare facility shall:

- i. Designate an experienced triage officer to oversee all triage operations
- ii. Ensure that areas for receiving patients, as well as waiting areas, are effectively covered, secure from potential environmental hazards and provided with adequate work space, has adequate lighting and access to back up power
- iii. Ensure that the triage area is in close proximity to essential personnel, medical supplies and key care services and that entrances and exit routes to and from the triage area are clearly identified
- iv. Identify a contingency site for receipt and triage of mass-casualty victims and an alternate waiting area for wounded patients who are able to walk

- v. Establishment of a mass-casualty triage protocol based on severity of illness/injury, survivability and hospital capacity
- vi. Establish a clear method of identification of triaged patients
- vii. Ensure adequate supply of triage tags
- viii. Ensure operationalization of protocols on hospital admission, discharge, referral and access to operation theatres when the disaster plan is activated to facilitate patient flow

4.10 Surge Capacity for Medical Response

Surge capacity is the ability of a health service to expand beyond normal capacity to meet increased demand for clinical care. Every hospital shall calculate their surge capacity early in the planning process such that the disaster response structure can be established, expanded, and contracted depending on the type and size of the incident. The objective of planning for surge capacity shall be to undertake the following activities during a disaster event:

- (1) Conduct a situation assessment
- (2) Collect, evaluate disseminate, and use information of the event/incident
- (3) Develop information with regard to the hospital's current status with respect to the event/incident, to assist in the development of contingency plans (including status of response efforts and resources)

The Hospital Capacity Analysis tool shall be used to calculate a hospital's surge capacity by determining:

- (a) Hospital Treatment Capacity (HTC):** defined as the number of casualties that can be treated in the hospital in an hour and is usually calculated as 3% of the total number of beds.
- (b) Hospital Surgical Capacity (HSC):** the number of seriously injured patients that can be operated upon within a 12-hour period. It is usually calculated as.

$$\text{HSC} = \frac{\text{Number of operation rooms} \times 7 \times 0.25}{12 \text{ hrs}}$$

(Note: The above standards are for a 1000 bedded tertiary hospital. Modifications shall be made based on the bed strength and staff strength for individual hospitals. Hospitals shall devise and calculate their own treatment capacity based on their previous experiences.)

To ensure that the estimated surge capacity is applicable in real-time scenarios, every hospital/healthcare facility shall:

- i. Estimate the expected increase in demand for hospital services and calculate the maximum capacity required for the same
- ii. Identify methods of expanding hospital inpatient/outpatient capacity
- iii. Outsource care or shift non-critical patients to appropriate alternative sites to increase the hospital's capacity
- iv. Designate care areas for patient overflow
- v. Verify availability of vehicles and resources for patient transportation
- vi. Establish mechanisms for inter-facility patient transfer
- vii. Identify potential gaps in the provision of critical medical care and address the same while coordinating with neighboring and network hospitals
- viii. Identify sites that may be converted into additional patient care units
- ix. Prioritize/cancel non-essential services when necessary
- x. Adapt hospital admission and discharge criteria and prioritization of clinical interventions according to the available treatment capacity and demand
- xi. Designate a specific area that may be used as a temporary morgue and formulate a contingency plan for ensuring required post mortem procedures
- xii. Establish protocols for maintenance of a special disaster store/stock pile
- xiii. Designate an official for information and communication with attending family members

Additionally, the following resources shall be assessed and maintained to ensure effective surge capacity management:

- 1) Manpower
- 2) Stores and equipment
- 3) Mortuary
- 4) Procedure for discharge/transfer of patients
- 5) Emergency blood bank
- 6) Dietary services
- 7) Mutual aid agreements for transfers and accommodation with network hospitals

4.11 Post-Disaster Recovery

Post-disaster recovery planning shall be part of the Hospital Disaster Management Planning process and it shall be performed at the onset of response activities.

To ensure speedy and effective post-disaster recovery every hospital/healthcare facility shall:

- i. Designate an official/member of the staff to oversee the hospital recovery operations
- ii. Determine the essential criteria and processes to deactivate the disaster response and recovery activities from the hospital's normal operations
- iii. Undertake a Post Disaster Damage Assessment if there is structural damage to the hospital
- iv. Estimate the time and resources that shall be required to undertake complete repair/replacement/retrofitting before a facility that is severely damaged (and requires complete evacuation) can be re-opened
- v. Undertake a post-response hospital inventory assessment and consider repair or replacement of equipment as required (equipment vendors could be involved in assessing the functional status of the sophisticated equipment)
- vi. Prepare and submit a post-response report to the chief of the hospital and other pertinent stakeholders
- vii. Debrief staff meticulously immediately after the disaster response phase to enable them to cope and recover from any post traumatic stress disorder.
- viii. Appropriately recognize the services provided by staff, volunteers, external personnel and donors during disaster response and recovery
- ix. Monitor post disaster health situation in the local community
- x. Systematically and comprehensively document lessons learnt and structural modification/adaptation of the hospital contingency plan as required
- xi. Ensure that the transportation of casualties is undertaken as per the provisions laid down in the HDMP or as per the appropriately modified provisions
- xii. Provide definitive treatment

4.12 Patient Handling

Patients in a hospital can be categorised as:

- (1) ambulatory (outpatients), and
- (2) admitted patients (inpatients).

The mobility of inpatients depends on the severity of their illness, such that:

- i) Seriously ill patients depending completely on life support systems, cannot move by themselves and need support of the health care workers/hospital staff to move
- ii) Not seriously ill patients but those restricted by IV lines, nebulizers etc. need support from their attendants to move, and
- iii) Not seriously ill patients, require no support and can move by themselves.

To avoid panic, chaos, hap-hazard evacuation (should it be required), avoidable injuries and loss of lives, hospitals shall sensitize patients and their attendants on the relevant aspects of the HDMP and their role at the time of a disaster event, during their stay in the hospital.

Patients, their attendants and visitors shall be made aware of:

- (1) **Hazards and Risks:** In and around the hospital through prominently displayed posters, wall hangings and hoardings. The posters, wall hangings and hoardings shall be permanent and displayed at all times in the hospital premises and shall be updated as necessary.
- (2) **Emergency Exit Routes and Evacuation Plans:** To be followed during disasters through the prominent display of exit and evacuation route maps at strategic locations throughout the hospital premises.

Hospitals shall also ensure that their alarms, emergency communication and Hospital Safety and Security Procedures, adequately take into consideration the needs of patients, their attendants and visitors; and ensure that no panic and chaos is initiated.

4.13 Volunteer Involvement and Management

Local volunteers in close proximity to hospitals/health care facilities shall be involved by the hospital authorities for hospital disaster preparedness and response.

Volunteers shall be identified in the pre-disaster phase itself and an updated roster with key information (like contact details, address, etc.) shall be maintained by the appropriate authority in the hospital. Volunteers shall be trained in:

- (1) Basic emergency preparedness and response
- (2) Search and Rescue
- (3) First Aid

- (4) Basic Life Support
- (5) Community Triage
- (6) Health Communication / Psychosocial Care
- (7) Inter-personal Communication and Leadership

Volunteers shall be involved in all preparedness activities from the pre-disaster phase itself and shall participate each time the hospital undertakes a drill, preparedness exercise, training, etc. on Disaster Preparedness and Response.

4.14 Area Level Networking of Hospitals

To respond to a scenario when the hospital's surge capacity has been exceeded by the number of patients requiring medical attention, every hospital shall network with other hospitals in the area so that patients may be transferred to the nearest equipped hospital for treatment without any delay. Hospitals shall define the arrangements/memorandum of understandings between them and the networked hospitals during the pre-disaster phase itself, for such eventualities. A list of all networked hospitals (along with their capacity, speciality) shall be maintained and updated regularly by the appropriate authority in the hospital.

Patients shall be transferred to a networked hospital only after immediate/life-threatening injuries are addressed. The mode of transport to be used shall be determined according to the patient's needs and the available resources. A volunteer or hospital staff shall accompany the patient to the referral hospital to ensure proper handing over to the competent authority.

4.15 Coordination and Collaboration with Wider Disaster Preparedness Initiatives

Hospitals & the facilities they provide are critical to a community's coping capacity during emergencies/disasters. Therefore, hospitals shall coordinate and collaborate with various health sector and general disaster management preparedness and response initiatives to enhance their own disaster preparedness and response readiness. Hospitals shall make efforts to integrate into the district disaster management plan and disaster response activities; as well as incorporate into their own HDMP relevant elements of the district disaster management plan and the district's planned response activities to be in rhythm with larger disaster management goals of the district/state/country. Further, hospitals shall comply with various Acts, Standards, Regulations and development programmes pertinent to hospitals in the country.

4.16 Hospital Disaster Management Plan with respect to CBRN Emergencies:

The National Disaster Management Guidelines on Medical Preparedness and Response mention that the State Disaster Management Plan will identify and earmark certain hospitals for development of specialized facilities for the management of CBRN casualties. Dedicated staff of all these hospitals will be trained to use PPE and other universal safety precautions laid down in the plan. CBRN management will begin with the decontamination and decorporation followed by immediate and long term medical treatment of casualties. The identified hospitals will create specialized facilities for detection, decontamination, decorporation, treatment (Refer : Point 6.7(page66-68) of the NDM Guidelines on Medical Preparedness and Mass Casualty Management).

Further the guidelines also mention that specified hospitals for CBRN Treatment will stock all the drugs, decorporation agents and other specialized items for treatment of CBRN casualties (Refer Section on CBRN Stores –Page 68-69 of the NDM Guidelines on Medical Preparedness and mass casualty management)

5

Design and Safety of Hospital Buildings

5.1 Scope

Specifications laid down in this Chapter shall be applicable for:

- (a) *Planning, design and construction of New Hospitals; and*
- (b) Re-planning, assessment and retrofitting of Existing Hospitals.

When provisions given in this Chapter conflict with those given in relevant national standards and guidelines (meant for safety of hospitals in India), specifications given in this Chapter shall govern.

Specifications given in this Chapter are intended for

- (a) *Structural Elements (SEs)*

These are components of buildings, which resist loads imposed by external load effects, and support all *Non-Structural Elements (NSEs)* and imposed loads on floors and roof slabs; and

- (b) *Non-Structural Elements (NSEs)*

These are components of buildings, which DO NOT resist loads imposed by external load effects, but are supported by *SEs* of buildings; they fulfil the necessary architectural and functional requirements.

These specifications address all load effects likely to act on Hospital Buildings (including *Blasts, Cyclones and Earthquakes*).

Four aspects shall be addressed to ensure safety of *SEs* and *NSEs* of Hospital Buildings:

- (1) *In New Buildings*
 - (i) *Structural Design and Construction.*
- (2) *In Existing Buildings*
 - (i) Pre-Disaster Safety Assessment,
 - (ii) Retrofitting, and

(iii) Post-Disaster Damage Assessment.

To undertake the above activities, documents are required to assist architects and designers, based on sound scientific principles and best practices worldwide. Tables 3.1 and 3.2 indicate the status of availability of documents. Documents presently not available shall be developed through a nationally coordinated effort.

Table 5.1: Applicable Standards for ensuring Safety of Structural Systems and Structural Elements (SEs) of Hospital Buildings

S.No.	Standard or Guideline	Comment
1	<i>Structural Design of New Hospitals</i>	This Guideline addresses additional requirements for DESIGN of SEs (over and above those prescribed by relevant national standards), but does NOT provide specifications for DETAILING of SEs and connections between SEs. Detailed clauses and commentaries need to be developed specifically for structural design.
2	<i>Pre-Disaster Structural Safety Assessment of Existing Hospitals</i>	Basic IS code is available for masonry and RC structures. Detailed documents need to be developed, which shall comply with the requirements laid down in this Chapter also.
3	<i>Structural Design of Retrofit of Existing Hospitals</i>	Currently, no standard is available. Detailed documents need to be developed, which shall comply with the requirements laid down in this Chapter also.
4	<i>Post-Disaster Structural Damage Assessment of Existing Hospitals</i>	Currently, no standard is available. Detailed documents need to be developed, which shall comply with the requirements laid down in this Chapter also.

Table 5.2: Applicable Standards for ensuring Safety of Non-Structural Elements (NSEs) of buildings

S.No.	Standard or Guideline	Comment
1	<i>Design of NSEs of New Hospitals</i>	This Guideline addresses additional DESIGN requirements (over and above those prescribed by relevant national standards), but does NOT provide specifications for DETAILING of connections between structural and non-structural members. Detailed clauses and commentaries need to be developed on design and detailing of connection between SEs and NSEs.
2	<i>Pre-Disaster Safety Assessment of NSEs</i>	Currently, no formal standard is available. Detailed documents need to be developed, which shall comply with the requirements laid down in this Chapter also.
3	<i>Design of Retrofit of Non-Structural Systems and Elements in Hospitals</i>	This Guideline addresses the additional requirements. Detailed documents need to be developed, which shall comply with the requirements laid down in this Chapter also.
4	<i>Post-Disaster Damage Assessment of NSEs</i>	Currently, no standard is available. Detailed documents need to be developed, which shall comply with the requirements laid down in this Chapter also.
Note: Basic guidance on these four aspects is available in some national and international documents [e.g., 'Reducing Earthquake Risk in Hospitals from Equipment, Contents, Architectural Elements and Building Utility Systems.' Geo-Hazards International. 2009].		

5.2 Expected Performance Of Hospitals

Building Units of a Hospital Campus shall be classified under two groups, namely,

- a. *Critical Units of Hospital Buildings* – Buildings and Structures (and therefore SEs and NSEs) that provide medical services essential in the immediate aftermath of disasters ; and

- b. *Other Units of Hospital Buildings* – Buildings and Structures (and therefore SEs and NSEs) that provide all the other services that may not be required in the immediate aftermath of disasters.

The expected performance is different for each of these two groups of hospital buildings. The *Critical Units* shall comply also with *specifications laid down in this Chapter* in addition to *specifications laid down in the prevalent relevant national standards*; the *Other Units* shall comply with the *specifications laid down in the prevalent relevant national standards*.

5.2.1 Performance Criteria

Under loads actions other than earthquakes for all units of the Hospital Building, no damage is permitted in SEs. But, under the action of earthquake effects, two cases arise for SEs:

- (1) *Critical Units* – structural damage commensurate with *Immediate Occupancy* (IO) performance level is permitted; &
- (2) *Other Units* – structural damage commensurate with *Life Safety* (LS) performance level is permitted.

The definitions of IO and LS performance levels are:

- a. *Immediate Occupancy: Structural Systems and Structural Elements (SEs)* sustain fine cracks and undergo marginal nonlinear actions that pose no threat to the *people* conducting within the hospital and the *activities* to be undertaken in the hospital thereby allowing the structure to be occupiable immediately after the expected load effects are removed; and
- b. *Life Safety*- SEs sustain reasonable structural damage, but do not lead to structural collapse.

Similarly, under loads actions other than earthquakes for all units of the Hospital Building, no damage is permitted in NSEs. But, under the action of earthquake effects, two cases arise for NSEs:

- (1) *Critical Units* – damage commensurate with *Immediate Use* (IU) performance level is permitted; &
- (2) *Other Units* – damage commensurate with *Dysfunctional State* (DS) performance level is permitted.

The definitions of IU and DS performance levels are:

- a. *Immediate Use: Non-Structural Elements (NSEs)* sustain no damage and undergo elastic actions that pose no threat to the use of the NSEs and the *service* to be provided by it

thereby allowing the NSEs to be usable immediately after the expected load effects are removed; and

- b. *Dysfunctional State* – NSEs sustain reasonable damage that renders it temporarily out of use, but that is repairable but do not lead to structural collapse.

5.2.2 Load Levels

Critical Units of hospital buildings and structures shall be designed to resist all expected loads given by

- a. Prevalent relevant national standards, and
- b. Additional specifications laid down in this Chapter.

Extreme load actions are caused by *blasts, cyclones and earthquakes*. Site-specific studies shall be undertaken to estimate the hazard level for these extreme actions for all hospitals with high risk; the level of risk will be determined by the competent authority considering level of hazard, occupancy, importance and criticality of services to be rendered by the health facility.

5.3 Design Standards

Structural Elements (SEs) of all *Critical Units* of the *new Health Facilities* shall comply with requirements of this Chapter in addition to all relevant existing national standards and guidelines laid down by various statutory bodies, non-statutory bodies as well as client owner of health facility. The other Units of the new health facilities shall comply with requirements of all relevant existing national standards and guidelines laid down by various statutory bodies, non-statutory bodies as well as client owner of health facility. The latest versions of national documents currently in use are:

- a. *New Hospitals*: NBC, IS:875, IS:1893(1), IS:1893(4)(for pipelines), IS:456, IS:800, IS:13920, *GSDMA Guidelines*, and IPHS, and
- b. *Existing Hospitals*: NBC 2007, IS:875, IS:1893(1), IS:456, IS:800, IS:1905, IS:13920, IS:13935, IS:15988, and *GSDMA Guidelines*.

5.4 Structural Elements

Higher levels of engineering shall be adopted in the planning, design, construction and maintenance of *Critical Units* of Hospital Buildings; this will require engineers to be examined for their competency before being empowered to work in projects related to health facilities. Hence, the extreme load effects for which *Critical Units* of Hospital Buildings shall be designed

are higher specifications than those for which the *Other Units* of Hospital Buildings are required to be designed. These higher specifications are given in this section beyond those specified in the relevant national standards.

5.4.1 New Health Facilities

A new health facility means

- (1) A new construction, and
- (2) A reconstruction of an existing facility at the same site or new site.

(a) Site Selection

The following sites shall be prohibited for locating a hospital:

- i. Liquefiable ground;
- ii. Hill slopes (unstable), or land adjoining hill slopes known to have rolling debris; (whether sloped or flat)
- iii. Flood or tsunami prone areas;
- iv. Adjoining unsafe buildings and structures; and
- v. Poor accessibility in post-disaster situations.

Local municipal bodies shall undertake to assess these vulnerable areas and inform the stakeholders of the same.

When existing hospitals are located in any of these vulnerable locations, no future expansions shall be permitted in the hospital campuses. Also, critical assessment shall be undertaken to study the risks involved and appropriate actions shall be taken either to mitigate the effects or relocate the hospital. When new towns or layouts are being planned, the master plan of the same shall take cognisance of the prevalent vulnerabilities before determining the location of new hospitals.

(b) Structural Systems

(i) Material

The basic material for the construction of the structural system (and Structural Elements) of new hospital buildings shall NOT be unreinforced masonry. Structural Elements of all new hospital structures shall be made of Reinforced Concrete and/or Structural Steel, except for structures in seismic zone II, where Reinforced Masonry may be used. Design codes need to be developed for design and construction of Reinforced Masonry, and associated capacity development needs to be undertaken alongside of architects, engineers, contractors and masons.

(ii) *Use of Structural Walls*

The structural system of new hospital buildings shall NOT be Moment Resisting Frames alone along any of the two mutually perpendicular plan directions of the building; structural system of all new hospital buildings shall have Structural Walls in each of the two mutually perpendicular plan directions of the building in addition to Moment Resisting Frames.

1. The structural system of Moment Resisting Frames with Structural Walls shall be designed as a DUAL SYSTEM (as defined in IS:1893 (Part 1)).
2. The Structural Walls shall be made of Reinforced Concrete (RC) and provided in select bays running through the full height of the building, irrespective of choice of material of the basic structural system adopted for the hospital, namely RC or Structural Steel.
3. Structural walls made of steel plates or timber may be allowed in the construction of Hospitals only in Seismic Zone II. Even then, safety of such hospital buildings with steel plate or timber Structural Walls shall be established by:
 - a. Analytical Methods, through *nonlinear pushover analyses* and *nonlinear time history analyses* under a suite of appropriate ground motions, and
 - b. Full-scale experimental testing of such structural walls and sub-assemblages including them being subjected to deformations imposed on them during expected ground motions.
4. The total cross-sectional area of all RC Structural Walls shall be at least 4% of the plinth area of the building (if that based on design is smaller than 4%), along each of the two mutually perpendicular principal plan directions.
5. RC Structural Walls shall be designed in accordance with IS:13920 or specialist literature more stringent than IS:13920.
6. When RC Structural Walls are rested on individual strip footings, the large lateral overturning moments and lateral shear force induced under the action of extreme load effects shall be resisted by positive strategies. The bottom raft of the strip footings shall be anchored to rocky strata when underlying ground strata has hard rock, and to pile foundations when underlying ground strata is soft soil. This may not be a concern when RC walls are rested on Mat foundations.
7. At each joint of Moment Resisting Frames, the design moment capacity of column section shall be at least 2 times design moment capacity of beam section.

(iii) Base Isolation Systems

Base Isolation System is an expensive technology option though effective to counter ill effects of strong earthquake shaking in new hospital buildings. Hence, Base Isolation System may be adopted in important hospitals in seismic zones IV and V. But, this system can help in minimising effects of earthquake shaking on NSEs. When the client owner insists on using such a system, it shall be adopted only when safety of such hospital buildings is established by

1. Analytical Methods, through *nonlinear pushover analyses and nonlinear time history analyses* under a suite of appropriate earthquake ground motions, and
2. Full-scale experimental testing of base isolation devices demonstrating that they are capable of resisting expected strong earthquake shaking.

(iv) Prohibited Structural Systems

The following structural systems shall be prohibited for use in new hospitals:

1. Flat Slab buildings, with or without structural walls ;
2. Pre-stressed floor systems;
3. Precast constructions (with natural or man-made materials), in part or whole of the structure, and
4. Pre-engineered structures in part of the whole of the structure
5. Large cantilever structures and long span structures
6. Unreinforced masonry buildings

(c) Structural Configuration

(i) Regular Structural Configurations

All new hospital buildings shall have regular structural configuration only. Buildings shall be deemed to be regular when they meet requirements laid out in Clause 7.1 of the Indian Seismic Code IS:1893 (Part 1). Floating and setback columns shall not be allowed in buildings.

(ii) Structural Configurations Prohibited

Structural configurations with open ground storeys or flexible or weak storeys at any other level shall be prohibited in hospital buildings.

(d) Structural Analysis

Soil-Foundation System

The 3D modeling and analyses of *Critical Units* of Hospital Buildings shall include:

- (i) Flexibility of soil strata underneath the building, based on results of geotechnical studies at the sites; and
- (ii) Possible uplift actions at individual footings under the action of extreme load effects.

Effect of URM Infills

Multiple 3D models shall be considered in the analyses of *Critical Units* of Hospital Buildings to account for detrimental effects of stiffness and strength contributions of *unreliable* URM infills. In the design of SEs and NSEs, these models shall estimate the effects on strength and deformation demands of these *Critical Units* of Hospital Buildings.

(e) Structural Design

SEs of *Critical Units* of Hospital Buildings shall be designed to resist *elastically* the expected load actions on them, including those due to earthquake effects. Hence, the *design lateral earthquake forces* prescribed in this guideline are much larger than those currently employed in design of buildings (including hospitals), to meet the requirement of *immediate use* of the hospital building structure and *fully functional performance* of the NSEs within the hospital building. Here, “designed to resist elastically” shall imply that the stress-resultant demands (namely P , V , M and T) on each structural element is less than its associated nominal capacities (as defined by IS:456 and IS:800 for structural elements made of RC and Structural Steel, respectively).

The design horizontal acceleration coefficient A_h given in Clause 6.4.2 of IS:1893(1)-2002 for design of SEs shall be replaced by:

$$A_h = \frac{ZI}{R} \left(\frac{S_a}{g} \right)$$

where, Z is the Seismic Zone Factor, I the Importance Factor, the Design Acceleration Spectrum for three different soil conditions, and the Response Reduction Factor, all as defined in IS:1893(1)-2002.

Effects of vertical earthquake ground shaking also shall be considered in the design of SEs.

5.4.2 Existing Health Facilities

An existing health facility means

- (1) All existing health facilities that do not meet the standards mentioned in this guideline,
- (2) A reconstruction of an existing facility at the same site or new site, and

- (3) An existing commercial, office or residential buildings designed and built for other functional use, but now intended to be used as a hospital facility.

The number of existing hospital buildings is large, which require seismic retrofitting to meet specifications for earthquake safety laid down in this Chapter. Upgrading this large number of existing hospital buildings is a daunting task.

(a) Building Configuration

The *building structure* of retrofitted hospitals shall meet the criterion specified in this section.

(i) Originally REGULAR Buildings

Buildings shall be deemed to be REGULAR when they meet requirements laid out in the current Indian Seismic Code IS:1893 (Part 1)-2002). The *building structure* of the retrofitted REGULAR buildings shall meet the following criterion under the shaking specified in Section 5.4.2(b) of this document:

- (1) *Linear structural analysis* shall be performed for seismic safety assessment of retrofitted *Regular Buildings*, to assess (i) the stress resultant demands (of *axial load, shear forces and bending moments*) on different structural elements in the existing building, and (ii) the lateral drift demand on the different storeys of the building.
- (2) These stress resultants demands imposed by the level of shaking considered shall not exceed the design capacity of any structural element of the existing building with the considered retrofit scheme.
- (3) The storey lateral drift demand in the existing building shall not exceed 0.4% of the height of the storey using un-cracked section properties. This overall deflection shall be arrived at by *linear analysis* of the structure considering all competent masonry and reinforced concrete elements. For this analysis, material properties shall be taken as per the relevant Indian Standard Codes, namely IS:456 and IS:13920 for reinforced concrete frame buildings and IS:1905 for masonry buildings. If all attempts fail to collect relevant field data for the buildings, lower boundary values for the existing materials may be used. Further, all strength/stress requirements shall be met with as laid out for structural components of the buildings in the said and other relevant Indian Standard Codes.

(ii) Originally IRREGULAR Buildings

Buildings shall be deemed to be IRREGULAR when they conform to the clauses laid out in the current Indian Seismic Code IS:1893 (Part 1)-2002. The *building structure* of the retrofitted IRREGULAR buildings shall meet the following criterion under the shaking specified in Section 5.4.2(b) of this document:

- (1) *Structural analysis* shall be performed as given in IS:13935 or IS:15988 for seismic safety assessment of retrofitted *Regular Buildings*, to assess (i) the stress resultant demands (of *axial load, shear forces and bending moments*) on different structural elements in the existing building, and (ii) the lateral drift demand on the different storeys of the building.
- (2) These stress resultants demands imposed by the level of shaking considered shall not exceed the design capacity of any structural element of the existing building with the considered retrofit scheme.
- (3) The storey lateral drift demand in the existing building shall not exceed 0.35% of the height of the building using un-cracked section properties. This overall deflection shall be arrived at by *linear analysis* of the structure considering all competent masonry and reinforced concrete elements. For this analysis, material properties shall be taken as per the relevant Indian Standard Codes, namely IS:456 and IS:13920 for reinforced concrete frame buildings and IS:1905 for masonry buildings. If all attempts fail to collect relevant field data for the buildings, lower boundary values for the existing materials may be used. Further, all strength/stress requirements shall be met with as laid out for structural components of the buildings in the said and other relevant Indian Standard Codes.

Level of Earthquake Shaking to be considered

Making existing *Critical Units* of Hospital Buildings meet requirements laid down for new hospitals in this Guideline can be difficult – it can be too stringent to meet the specifications corresponding to new buildings, or even too expensive to do so. When existing deficient *Critical Units* of Hospital Buildings are to be retrofitted, they shall be designed to resist the effects of earthquake shaking given by the *design horizontal acceleration coefficient* A_h given in Clause 6.4.2 of IS:1893(1)-2002 for design of SEs given by:

$$A_h = \frac{ZI}{2R} \left(\frac{S_a}{g} \right)$$

where, Z is the Seismic Zone Factor, I the Importance Factor, S_g/g the Design Acceleration Spectrum for three different soil conditions, and R the Response Reduction Factor, all as defined in IS:1893(1)-2002.

(c) Structural Design

Critical Units of existing hospital buildings shall be improved so that their Structural Elements resist the expected load actions on them without significant damage under the action of load actions other than earthquakes, and structural damage such that it does not lead to collapse under the action of earthquake effects.

The *Critical Units* of existing masonry or RC Hospital Buildings shall be assessed by analytical methods specified in IS:13935 or IS:15988, respectively.

5.5 Non-Structural Elements

The *Non-Structural Elements (NSEs)* of all *New Hospitals* and NSEs of all Existing Hospitals shall comply with all relevant existing national standards and guidelines as laid down by the various statutory and non-statutory bodies as well as the client owner of the hospital. In addition, specifications laid down in this Chapter shall be applicable for

- a. Planning, design and construction of *NSEs of New Hospitals*, and
- b. Re-planning, assessment and retrofitting of *NSEs of Existing Hospitals*.

The specifications laid down in this Chapter shall govern over similar clauses given in the prevalent relevant national standards.

5.5.1 Design Strategy

NSEs shall be classified into three types depending on their earthquake behaviour, namely:

- a. *Acceleration-sensitive NSEs*: The *lateral inertia forces* generated in these NSEs during earthquake shaking cause their sliding or toppling to the level of their base or lower.
- b. *Deformation-sensitive NSEs*: The *relative lateral deformation* in these NSE spanning between *two SEs* (e.g., a pipeline passing between two parts of a building with a separation joint in between) or between *an SE and a point outside building* (e.g., an electric cable between the building and ground/pole outside the building), causes them move or swing by large amounts in *translation and rotation under inelastic deformations of SEs* imposed on them during earthquake shaking; and
- c. *Acceleration-and-Deformation-sensitive NSEs*: Both of the conditions described in (a) and (b) above are valid.

Table 3.3 provides a list of NSEs and identifies if the NSE is acceleration-sensitive or deformation sensitive. Some NSEs fall under both categories, with one of the effects being the more dominant (called *primary effect*) and the other less dominant (called *secondary effect*). For such NSEs, Table 3.3 identifies both the primary and secondary effects for design of the connection between the NSE and the SE. All NSEs in new hospitals shall be protected against the effects mentioned above. Positive systems are required to either anchor or release the restraint at the ends (depending whether the NSE is *acceleration-sensitive* or *displacement-sensitive*, respectively) to ensure there is no damage to NSEs.

Table 5.3: Categorisation of commonly used NSEs based on earthquake behaviour

Category	Sub-category	Non-Structural Element	Sensitivity		
			Acceleration	Deformation	Both
Consumer Goods inside buildings	Furniture and minor items	1. Storage shelves 2. Multi-level material stacks	✓		
	Appliances	1. Refrigerators 2. Washing machines 3. Gas cylinders 4. TVs 5. Diesel generators 6. Water pumps (small) 7. Window ACs 8. Wall mounted ACs	✓		
Architectural finishes inside buildings	Openings	1. Doors and windows 2. Large-panel glass panes with frames (as windows or infill walling material) 3. Other partitions	Secondary	Primary	✓
	False ceilings	Directly stuck to or hung from roof	✓		
		Suspended integrated ceiling system	Secondary	Primary	✓
	Stairs		Secondary	Primary	✓

Category	Sub-category	Non-Structural Element	Sensitivity		
			Acceleration	Deformation	Both
Architectural finishes inside buildings	Exterior or Interior Façade	Tiles (ceramic, stone, glass or other) (i) pasted on surface (ii) bolted to surface (iii) hung from hooks bolted to surface	Not Permitted		
	Partitions not held snugly between lateral load resisting members		Primary	Secondary	✓
Appendages to buildings	Vertical projections	1. Chimneys and Stacks 2. Parapets 3. Water Tanks (small) 4. Hoardings anchored on roof tops 5. Antennas communication towers on rooftops 6. Solar Panels on walls or rooftops	✓		
	Horizontal projections	1. Sunshades 2. Canopies and Marquees	✓		
		Hoardings anchored to vertical face	Secondary	Primary	✓
	Exterior Structural Glazing Systems		Secondary	Primary	✓

Category	Sub-category	Non-Structural Element	Sensitivity		
			Acceleration	Deformation	Both
Services and Utilities	From within and from outside to inside the building	<ol style="list-style-type: none"> 1. Water supply pipelines 2. Electricity cables & wires 3. Gas pipelines 4. Sewage pipelines 5. Telecommunication wires 6. Rainwater drain pipes 7. Elevators 8. Fire hydrant systems 9. Air-conditioning ducts 		✓	
	Inside the building	<ol style="list-style-type: none"> 1. Pipes carrying pressurized fluids 2. Fire hydrant piping system 3. Other fluid pipe systems 	Secondary	Primary	✓
	Storage Vessels and Water Heaters	<ol style="list-style-type: none"> 1. Flat bottom containers and vessels 2. Structurally Supported Vessels 	✓		
	Mechanical Equipment	<ol style="list-style-type: none"> 1. Boilers and Furnaces 2. General manufacturing and process machinery 3. HVAC Equipment 	✓		

Category	Sub-category	Non-Structural Element	Sensitivity		
			Acceleration	Deformation	Both
Medical Equipment	Sensitive	1. Ventilator	✓		
		2. Boyles Apparatus	✓		
		3. Bedside Monitors	✓		
		4. Defibrillator	✓		
		5. Peritoneal Dialysis Machine	✓		
		6. Infant Radiant Warmer	✓		
		7. Phototherapy unit	✓		
		8. Operating Microscope	✓		
	Special	1. Colour Doppler	✓		
		2. Endoscopes	✓		
		3. Slit lamp with Applanation Tonometer	✓		
		4. Portable X-Ray machine	✓		
		5. ECG machine	✓		
		6. Ultrasound machine	✓		
		7. Oxygen Concentrator	✓		
		8. Automatic Cell counter	✓		
	Generic	1. CT Scan machine	✓		
		2. Centrifuge machine	✓		
		3. Blood Bank refrigerators	✓		
		4. Deep freezer	✓		
		5. Operating Table	✓		
		6. EEG machine	✓		
		7. Blood Cell Separator	✓		
		8. Impedance Audiometer	✓		
9. Autoclave		✓			

5.5.2 Non-Structural Systems

(a) Non-Structural Elements Prohibited

The following systems shall be *prohibited* for use as NSEs and its connections to the SEs in new hospitals:

- i. False ceilings hung from soffit of RC roof or floor slabs with anchor fasteners embedded in concrete portion of RC slabs; when false ceilings are required from medical safety point of view, exceptions shall be allowed subject to requirements given below;
- ii. Tiles pasted on unreinforced load-bearing masonry walls, unreinforced masonry infill walls, or RC walls,
- iii. Glass façade made of stone, ceramic, glass, etc.; when glass facades are required from medical safety point of view, exceptions shall be allowed subject to requirements given below; and
- iv. Any NSE nailed to or supported by the Unreinforced Masonry Infill walls made of any material.

False Ceilings

- a. False ceilings shall be used only sparingly in hospital buildings.
- b. When the client owner of the hospital insists on providing false ceiling in specific rooms from the point of view of medical safety, the following shall be ensured:
 - (1) The false ceiling system shall be a formal system that is supported from the reinforcement bars of the RC roof slabs or the structural system of the building to counter the effects of strong earthquake shaking,
 - (2) No false ceiling shall be anchored to or supported by unreinforced masonry walls.
 - (3) When false ceilings cannot be supported by the roof or the vertical elements of the structural systems, they shall be supported by an independent system that is supported on the floor slab, but not interfering with the lateral load resisting system.

Structural Glazing

When the client owner of the hospital insists on using structural glazing, such systems shall meet the requirements of this Guideline, and safety compliance shall be established by:

- a. Analytical Methods, through *nonlinear pushover analyses* and *nonlinear time history analyses* under a suite of appropriate strong ground motions; and

- b. Full-scale experimental testing of structural glazing *components, sub-assemblages* and *systems* made of the same to be capable of resisting expected strong earthquake shaking; such tests should be performed at a research laboratory of national importance.

5.5.3 Protection Strategies

Three approaches can be employed to secure NSEs, namely:

- a. *Non-Engineered Practice (Common Sense Approach)*: This approach is based on *common sense* and shall be applicable largely to secure *small and light* objects that cannot be physically connected individually with SEs, *e.g.*, bottles on a shelf. A list is given in Table 3.4 of NSEs that can be secured by this non-engineered strategy.
- b. *Pre-Engineered Practice (Prescriptive Approach)*: This approach is based on design calculations, limited experiments and experiences from past earthquakes and shall be employed to secure moderate sized NSEs that are generic factory-made products and used commonly in houses and offices, *e.g.*, wall mounted TV sets, wall mounted geysers in bathrooms, cupboards rested against walls or completely kept away from them, and electrical and plumbing lines running between floors of buildings or across a construction joint in a building. It is imperative that manufacturers foresee all possible on-site conditions before setting prescriptive standards for securing NSEs. A list is given in Table 5.4 of NSEs that can come under pre-engineered strategy of protection.
- c. *Engineered Design Practice (Calculation-based Approach)*: This approach is based on formal technical considerations. This approach is based on formal engineering design and performance considerations of both the hazard and the capacity of the NSE. The third strategy shall be used to secure massive and/or long (*one-of-its-kind*) NSEs. This chapter provides recruitments for which NSEs and their connections to the SEs shall comply with.

Table 5.4: Some examples of NSEs that require *Non-Engineered* and *Pre-engineered* Methods of securing against earthquake effects

<i>Method of Securing NSE</i>	
<i>Non-Engineered</i>	<i>Pre-Engineered</i>
Cutlery, Crockery, and glasses on shelves; Books on shelves; Small items on supermarket shelves	Cup boards; Small Book Shelves; Televisions on small tables; Desktop computers; Side boards; Air Conditioning units; Refrigerators; Filing Cabinets

5.5.4 Design Guidelines – Acceleration-Sensitive NSEs

The design lateral force F_p for the design of *acceleration-sensitive* NSEs may be taken as:

$$F_p = Z \left(1 + \frac{x}{h} \right) \frac{a_p}{R_p} I_p W_p$$

where Z is the Seismic Zone Factor (as defined in IS:1893 (Part 1)), I_p the Importance Factor of the NSE (Table 3.5), R_p the Component Response Modification Factor (Table 3.6), a_p the Component Amplification Factor (Table 5.6), W_p the Weight of the NSE, x the height of point of attachment of the NSE above top of the foundation of the building, and h the overall height of the building.

Table 5.5: Proposed Importance Factors I_p of NSEs

NSE	I_p
Component containing hazardous contents	2.5
Life safety component required to function after an earthquake (e.g., fire protection sprinklers system)	2.5
Storage racks in structures open to the public	2.5
All other components	2.0

Table 5.6: Coefficients a_p and R_p of Architectural, Mechanical and Electrical NSEs [FEMA 369, 2001]

S. No.	Item	a_p	R_p
1	Architectural Component or Element		
	<i>Interior Non-structural Walls and Partitions</i>		
	Plain (unreinforced) masonry walls	1.0	1.5
	All other walls and partitions	1.0	2.5
	<i>Cantilever Elements (Unbraced or braced to structural frame below its center of mass)</i>		
	Parapets and cantilever interior non-structural walls	2.5	2.5
	Chimneys and stacks where laterally supported by structures.	2.5	2.5
	<i>Cantilever elements (Braced to structural frame above its center of mass)</i>		
	Parapets	1.0	2.5
	Chimneys and stacks	1.0	2.5
	Exterior Non-structural Walls	1.0	2.5
	<i>Exterior Non-structural Wall Elements and Connections</i>		
	Wall Element	1.0	2.5
	Body of wall panel connection	1.0	2.5
Fasteners of the connecting system	1.25	1.0	

	<i>Veneer</i>		
	High deformability elements and attachments	1.0	2.5
	Low deformability and attachments	1.0	1.5
	<i>Penthouses (except when framed by and extension of the building frame)</i>	2.5	3.5
	<i>Ceilings</i>		
	All	1.0	2.5
	<i>Cabinets</i>		
	Storage cabinets and laboratory equipment	1.0	2.5
	<i>Access floors</i>		
	Special access floors	1.0	2.5
	All other	1.0	1.5
	<i>Appendages and Ornamentations</i>	2.5	2.5
	<i>Signs and Billboards</i>	2.5	2.5
	<i>Other Rigid Components</i>		
	High deformability elements and attachments	1.0	3.5
	Limited deformability elements and attachments	1.0	2.5
	Low deformability elements and attachments	1.0	1.5
	<i>Other flexible Components</i>		
	High deformability elements and attachments	2.5	3.5
	Limited deformability elements and attachments	2.5	2.5
	Low deformability elements and attachments	2.5	1.5
2	Mechanical and Electrical Component/Element		
	<i>General Mechanical</i>		
	Boilers and Furnaces	1.0	2.5
	Pressure vessels/ on edges and free-standing	2.5	2.5
	Stacks	2.5	2.5
	Cantilevered chimneys	2.5	2.5
	Others	1.0	2.5
	<i>Manufacturing and Process Machinery</i>		
	General	1.0	2.5
	Conveyors (non-personnel)	2.5	2.5
	<i>Piping Systems</i>		
	High deformability elements and attachments	1.0	2.5
	Limited deformability elements and attachments	1.0	2.5
	Low deformability elements and attachments	1.0	1.5

<i>HVAC System Equipment</i>		
Vibration isolated	2.5	2.5
Non-vibration isolated	1.0	2.5
Mounted in-line with ductwork	1.0	2.5
Other	1.0	2.5
<i>Elevator Components</i>	1.0	2.5
<i>Escalator Components</i>	1.0	2.5
<i>Trussed Towers (free-standing or guyed)</i>	2.5	2.5
<i>General Electrical</i>		
Distributed systems (bus ducts, conduit, cable tray)	2.5	5.0
Equipment	1.0	1.5
<i>Lighting Fixtures</i>	1.0	1.5

5.5.5 Design Guidelines – Displacement-Sensitive NSEs

- a. *Displacement-sensitive* NSEs connected to buildings at multiple levels of the same building or of adjacent buildings, and their supports on the SEs, shall be designed to allow the relative displacements imposed at the ends by the load effects imposed on the NSE.
- b. This imposed relative displacement can arise out of strong earthquake shaking, thermal conditions in the SEs and NSE, imposed live loads, etc. In such cases, the relative displacement imposed by each of these effects shall be cumulated to arrive at the *DESIGN Relative Displacement D*. The effects of earthquake shaking shall be estimated using earthquake demand given by Eq.(6.1) of this guideline.
- c. NSEs shall be designed to accommodate design relative displacement *D* determined by *linear static or linear equivalent static analysis* of the building structure subjected to load effects mentioned in Clause 8.2.5.2 of this Guideline.
- d. Flexibility or clearance of at least the design relative displacement *D* shall be provided
 - i. *within the NSE*, if both supports on the SE offer restraints against relative translation between the SE and the NSE, or
 - ii. at the unrestrained support, if one of the supports on the SE offers no restraint against relative translation between the SE and the NSE, and the other does.
- e. The NSE can be supported between two levels of the same building, or between two different buildings, between a building and the ground, or between building and another system (like an electric pole or communication antenna tower). The design relative displacement *D* shall be estimated as below:

- i. *Design HORIZONTAL and VERTICAL relative displacements DX and DY, respectively, between two levels of the same building (Building A), one at height h_{z1} and other at height h_{z2} from base of the building at which the NSE is supported consecutively, shall be estimated as:*

$$D_X = 1.2(\delta_{z1}^{AX} - \delta_{z2}^{AX})$$

$$D_Y = 1.2(\delta_{z1}^{AY} - \delta_{z2}^{AY})$$

where $(\delta_{z1}^{AX}$ and $\delta_{z2}^{AX})$ and $(\delta_{z1}^{AY}$ and $\delta_{z2}^{AY})$ are the *design HORIZONTAL and VERTICAL displacements*, respectively, at levels z_1 and z_2 of the building A (at heights h_{z1} and h_{z2} from the base of the building) under the application of the load effects in Clause 7.2.5.2 of this Guideline; and

- ii. (ii) HORIZONTAL and VERTICAL relative displacements DX and DY, respectively, between two levels on two adjoining buildings or two adjoining parts of the same building, one on the first building (Building A) at height h_{z1} from its base and other on the second building (Building B) at height h_{z2} from its base, at which the NSE is supported consecutively, shall be estimated as:

$$D_X = |\delta_{z1}^{AX}| + |\delta_{z2}^{BX}|,$$

$$D_Y = 1.2(\delta_{z1}^{AY} - \delta_{z2}^{AY}),$$

where $(\delta_{z1}^{AX}$ and $\delta_{z2}^{AX})$ and $(\delta_{z1}^{AY}$ and $\delta_{z2}^{AY})$ are the *design HORIZONTAL and VERTICAL displacements*, respectively, at level z_1 (height h_{z1}) of building A and at level z_2 (height h_{z2}) of building B, respectively, at which the two ends of the NSE are supported.

5.6 Enabling Environment Towards Ensuring Hospital Safety

5.6.1 Certified Artisans and Licensed Engineers

Construction of hospital buildings shall be performed only by *Certified Artisans and Licensed Engineers*. Towards this end, systems shall be developed for

- Training and certification of all artisans involved in construction, like masons, carpenters, plumbers, electricians, bar-benders, and welders; and
- Capacity building of engineers on essential concepts of structural planning, design, construction and maintenance, along with a system of licensing engineers by examining their competence.

5.6.2 Planning, Design and Construction

Construction of a hospital building shall be started ONLY AFTER the entire design and drawings is completed, and approved for construction by the competent authority. Copies of the design basis report, design calculations, and drawings of all hospitals shall be maintained so long as the building stands by

- a. Owner of the hospital or administrator of the hospital,
- b. Competent authority approving the construction, and
- c. Agency executing the work.

Architectural layouts shall be prepared for typical hospitals of different bed capacities, and promoted for use, especially for government hospitals. Dedicated engineering wings shall be created in various governments for planning, design, construction and maintenance of hospital buildings and structures.

5.6.3 Accountability

Local municipal bodies shall create the necessary implementation system for ensuring that all new health facilities comply with the provisions of this Guideline. In particular, a nodal officer shall be identified to coordinate this. Performance of all artisans involved in construction shall be assessed and recommended or otherwise for participation in future projects.

5.6.4 Peer Review of Safety of Hospital

- a. All safety related designs and drawings shall be peer reviewed by an independent professional engineer or an engineering organisation with competence to undertake the work. For this purpose, the owner of the health facility shall empanel such individuals or organisations, who have a proven record of undertaking design and detailing projects of high demonstrated quality. This requires a major capacity building program for upgrading engineering and architecture practices.
- b. No peer review shall be undertaken by any academic even from an institute of national importance or any technical institute or university. But, in critical cases, where new knowledge is required to be generated or a new situation is encountered that requires specialised knowledge to be applied, services may be sought only to resolve the matter from competent faculty members from Institutes of national importance, but not to approve the designs of the professional engineers.

5.6.5 Test Facilities

The following facilities shall be developed as a long-term mitigation effort towards ensuring safety of health facilities:

- a. Suitable test facilities at national R&D organisations to undertake seismic qualification of medical equipment, and
- b. Appropriate research laboratories across institutes of national importance to undertake R&D on niche and frontier areas of hospital safety, from points of view of both SEs and NSEs.

5.6.6 Pilot Studies

Pilot projects need to be undertaken to prepare the following for typical primary health center buildings (including structural and non-structural elements) in hill and plain areas:

- a. Model designs for new hospitals;
- b. Model retrofit designs of existing hospitals.

5.7 Miscellaneous

5.7.1 Instrumentation of Hospital Structures

All NEW hospital buildings or hospital buildings being retrofitted in seismic zone IV and V, and hospital buildings in wind zones with basic wind speed 42 m/s or more, shall be instrumented with

- (1) Suitable number of triaxial accelerometers at appropriate locations to capture the fundamental lateral translational modes of vibration along the two mutually perpendicular plan directions, and the fundamental torsional mode of vibration, and
- (2) Anemometers to capture the wind speed at the roof of the building along the three principle directions.

5.7.2 Post-Earthquake Assessment of Hospital Structures

Hospital buildings shall be inspected by competent licensed engineers after every damaging earthquake to document damages (if any) to SEs and NSEs of the buildings, along with recommendations for detailed study and suitable retrofitting as found necessary.

5.8 Capacity Building

A number of initiatives are necessary to build the required human resources to take forward the subject of safety of structural and non-structural elements of hospitals. Some urgent ones needed, include:

5.8.1 Quality Control

- (1) Sensitise stakeholders of hospitals in India, especially policy makers and administrators.
- (2) Develop model curriculum for Post-Graduate Program for Disaster Safety of Lifeline Buildings (such as Hospitals and Schools), covering
 - a) Planning, design, construction and maintenance of new hospital buildings
 - b) Vulnerability assessment and retrofitting of existing hospital buildings
 - c) Quality control and quality assurance of technical aspects related to the items in (a) and (b) above of structural and non-structural elements. Special emphasis is required for safety of non-structural elements (including contents, appendages and services) of hospitals.
- (3) Train teachers of technical institutes/colleges on subjects identified in item (2) above.
- (4) Launch post-graduate programs in Disaster Safety of Lifeline Buildings (such as Hospitals and Schools).
- (5) Develop model curriculum for training of practicing engineers and architects in Disaster Safety of Lifeline Buildings, covering
 - a. Planning, design, construction and maintenance of new hospital buildings
 - b. Vulnerability assessment and retrofitting of existing hospital buildings
 - c. Quality control and quality assurance of technical aspects related to the items in (a) and (b) above of structural and non-structural elements. Separate programs shall be organised for construction engineers executing the projects. Special emphasis is required for safety of non-structural elements (including contents, appendages and services) of hospitals.
- (6) Undertake training of practicing engineers and architects on subject identified in item (5) above.

5.8.2 Quality Assurance

Systems need to be developed at each state and urban center level for

1. Certification of artisans,
2. Licensing of engineers,
3. Peer Review of engineering designs, and
4. Field Inspection of constructions.

6

Fire Safety in Hospitals

6.1. Scope

Provisions laid down in this chapter shall establish the minimum requirements for a reasonable degree of safety from fire emergencies in hospitals, such that the probability of injury and loss of life from the effects of fire are reduced. All healthcare facilities shall be so designed, constructed, maintained and operated as to minimize the possibility of a Fire emergency requiring the evacuation of occupants, as safety of hospital occupants cannot be assured adequately by depending on evacuation alone. Hence measures shall be taken to limit the development and spread of a fire by providing appropriate arrangements within the hospital through adequate staffing & careful development of operative and maintenance procedures consisting of:

- (1) Design and Construction;
- (2) Provision of Detection, Alarm and Fire Extinguishment;
- (3) Fire Prevention
- (4) Planning and Training programs for Isolation of Fire; and,
- (5) Transfer of occupants to a place of **comparative safety** or evacuation of the occupants to achieve **ultimate safety**.

6.2 Expected Levels Of Fire Safety In Hospitals

Hospitals shall provision for two levels of safety within their premises:

- (1) **Comparative Safety:** which is protection against heat and smoke within the hospital premises, where removal of the occupants outside the premises is not feasible and/or possible. Comparative Safety may be achieved through:
 - (a) Compartmentation
 - (b) Fire Resistant wall integrated in the Flooring
 - (c) Fire Resistant Door of approved rating

- (d) Pressurized Lobby, Corridor, Staircase
 - (e) Pressurized Shaft (All vertical openings)
 - (f) Refuge Area
 - (g) Independent Ventilation system
 - (h) Fire Dampers
 - (i) Automatic Sprinkler System
 - (j) Automatic Detection System
 - (k) Manual Call Point
 - (l) First Aid
 - (m) Fire Fighting Appliances
 - (n) Fire Alarm System
 - (o) Alternate Power Supply
 - (p) Public Address System
 - (q) Signage
 - (r) Fire Exit Drills and orders
- (2) **Ultimate Safety:** which is the complete removal of the occupants from the affected area to an assembly point outside the hospital building. Ultimate Safety may be achieved through:
- (a) Compartmentation
 - (b) Fire Resistant Door of approved rating
 - (c) Protected Lobby, Corridor, Staircase and Shaft
 - (d) Public Address System
 - (e) Signage
 - (f) Fire Drills and orders

6.3 Structural Elements of Fire Safety

6.3.1 Open Spaces

- (1) Hospitals shall make provisions for sufficient open space in and around the hospital building to facilitate the free movement of patients and emergency/fire vehicles.
- (2) These open spaces shall be kept free of obstructions and shall be motorable.

- (3) Adequate passage way & clearance for fire fighting vehicles to enter the hospital premises shall be provided.
- (4) The width of such entrances shall be not be less than 4.5 mtrs with clear head room not less than 5 mtrs.
- (5) The width of the access road shall be a minimum of 6 mtrs.
- (6) A turning radius of 9 mtrs shall be provided for fire tender movement.
- (7) The covering slab of storage/static water tank shall be able to withstand the total vehicular load of 45 tone equally divided as a four point load (if the slab forms a part of path/drive way).
- (8) The open space around the building shall not be used for parking and/or any other purpose.
- (9) The Set back area shall be a minimum 4.5 mtrs.
- (10) The width of the main street on which the hospital building abuts shall not be less than 12 mtrs & when one end of that street shall join another street, the street shall not be less than 12 mtr wide.
- (11) The roads shall not be terminated in dead ends.

Basements

- (1) Basements, if provided shall be of type-1 construction and material used shall conform to class A material.
- (2) Basements shall be used only for parking vehicles and shall be protected with automatic sprinkler systems.
- (3) Each basement shall be separately ventilated.
- (4) Each vent shall have a cross-sectional area (aggregate) not less than 2.5% of the floor area spread evenly round the perimeter of the basement.
- (5) A system of air inlets and smoke outlets shall be provided & clearly marked as "AIR INLET" & "SMOKE OUTLET".
- (6) Clear headroom of minimum 2.4 mtrs shall be provided for the entire basement.
- (7) A minimum ceiling height of any basement shall be 0.9 mtrs and maximum 1.2 mtrs above the average surrounding ground level.
- (8) The access to the basement shall be separate from the main and alternative staircase providing access and exit from higher floors. Where the staircase continues, in the case of

buildings served by more than one staircase, the same shall be of enclosed type serving as a Fire Separation between the basement and higher floors.

- (9) Open ramps shall be permitted if they are constructed within the building line and surface drainage does not enter the basement.
- (10) The staircase of the basement shall be of enclosed type having fire resistance not less than 02 hrs & shall be situated at the periphery of the basement to be entered at ground level from the open air and in such a position that smoke from any fire in the basement shall not obstruct any exit serving the ground & upper stores of the building. The staircase shall communicate with the basement through a lobby provided with fire resisting, self closing doors of 02 hrs resistance. Additional stairs shall be provided if travel distance does not meet specifications given in Table 22 of the NBC.
- (11) For multi-storey basements, one intake duct may serve all basement levels, but each level & basement compartment shall have a separate smoke outlet duct or ducts. The ducts shall have the same fire resistance rating as the compartment itself.
- (12) Mechanical extractors for smoke venting system from lower basement levels shall also be provided. The actuation of the system shall be incorporated with the detection and sprinkler systems. The performance of the system shall be superior than standard units.
- (13) Mechanical extractors shall have an interlocking arrangement, so that extractors shall continue to operate and supply fans shall stop automatically with the actuation of fire detection system.
- (14) Mechanical extractors shall be designed to permit 30 air changes per hour in case of a fire emergency.
- (15) Mechanical extractors shall have an alternate source of electricity supply.
- (16) Ventilation ducts shall be integrated with the structure of the building and shall be made out of brick masonry or reinforced cement concrete as far as possible. Wherever this duct intersects the transformer area or an electrical switch board, fire dampers shall be provided.
- (17) The basement shall not be permitted below the ward block of a hospital.
- (18) No cut outs to upper floors shall be permitted in the basement.
- (19) An openable window on the external wall shall be fitted with locks that can be easily opened.
- (20) All floors shall be compartmented by a separation wall with 2 hrs fire rating, such that each compartment shall have a surface area not exceeding 750 sq. mtr. Floors which

are fitted with sprinkler systems may have their surface areas increased by 50%. In long building fire separation wall shall be at distances not exceeding 40 mtrs.

- (21) Lift/Elevators shall not normally communicate with basements; if, however, Lifts are in communication, the lift lobby of the basement shall be pressurized. A positive pressure between 25 & 30 Pascal (Pa), shall be maintained in the lobby & a positive pressure of 50 Pa shall be maintained in the Lift shaft. The mechanism for pressurization shall act automatically with the Fire Alarm. Provision shall be made to operate the system manually as well. The Lift car door shall have a Fire resistance rating equal to the Fire resistance of lift enclosure. The material used for interior finishing shall conform to class-1 materials.

6.3.2 Means of Escape/Egress

A means of escape/egress is a continuous and unobstructed way to exit from any point in a building or structure to a public way. Three separate and distinct parts of an escape/egress are:

- (a) The Exit access,
 - (b) The Exit, and
 - (c) The Exit discharge.
- (1) A means of Escape/egress comprises the vertical and horizontal travel and shall include intervening room spaces, doorways, hallways, corridors, passageways, balconies, ramps, stair enclosures, lobbies, and horizontal exits leading to an adjoining building at the same level.
- (2) The exits in Healthcare facilities should be limited to doors leading directly outside the building, internal staircases and smoke proof enclosures, ramps, horizontal exits, external exits and exit passage.
- (3) Exits shall be so arranged that they may be reached without passing through another occupied unit.
- (4) Vertical evacuation of occupants within a health care facility is difficult and time consuming. Therefore, horizontal movement of patient is of primary importance. Because of the time required to move patients, exit access routes should be protected against Fire effects. Spaces open to the corridors shall neither be used for patients' sleeping, as treatment rooms nor for storing hazardous material.

6.3.4 Internal Staircases

- (1) Internal staircases shall be constructed with non-combustible materials

- (2) Internal stairs shall be constructed as self-contained units along an external wall of the building constituting at least one of its sides and shall be completely closed
- (3) A staircase shall not be arranged around a Lift shaft.
- (4) Hollow combustible construction shall not be permitted
- (5) The construction material shall have 02 hrs fire resistance.
- (6) Minimum width of stairs shall be 2 mtrs.
- (7) Width of the tread shall not be less than 300 mm.
- (8) The height of the riser shall not be less than 150 mm and the number of stairs per flight shall not exceed 15
- (9) Handrails shall be provided at a height of 1000 mm, which is to be measured from the base of the middle of the treads to the top of the handrails.
- (10) Banisters or railings shall be provided such that the width of staircase is not reduced.
- (11) Minimum head room in a passage under the landing of a staircase and under the staircase shall be 2.2 mtrs.
- (12) The staircase shall be continuous from ground floor to the terrace and the exit door at the ground level shall open directly to the open spaces or a large lobby.
- (13) The number of people in between floor landings of staircases shall not be less than the population on each floor for the purpose of the design of the staircase.
- (14) Fire/Smoke check doors shall be provided for a minimum of 2 hrs fire resistance rating.
- (15) Lift openings and any other openings shall not be permitted.
- (16) No electrical shaft and panel, AC ducts or gas pipelines, etc. shall pass through or open onto the staircases.
- (17) No combustible material shall be used for decoration/wall panelling in the staircases.

6.3.5 Protected Staircases

Provisions given for internal staircases shall apply to protected staircases. Also, additional safeguards shall be provided as under:

- (1) The staircases shall be enclosed by walls having 02 hrs fire resistance
- (2) The external exit doors at ground floor shall open directly onto open spaces or a lobby and Fire & Smoke check doors shall be provided.
- (3) Protected staircases shall be pressurized. Under no circumstances shall they be connected to a corridor, lobby and staircase which is unpressurized.

- (4) Pressurization systems shall be incorporated in protected staircases where the floor area is more than 500 sq. mtr. The difference in pressurization levels between staircase and lobby/corridor shall not be greater than 5 Pa. Where 2 stage pressurization system is in use the pressure difference shall be as under:
 - (a) In normal conditions - Minimum 8Pa to 15 Pa.
 - (b) In emergency conditions - 50 Pa.
- (5) The pressurization system shall be interconnected with the automatic/manual fire alarm system for actuation.

6.3.6 External Staircases

- (1) External staircases serving as a required means of egress shall be of permanent fixed construction.
- (2) External staircases shall be protected by a railing or guard. The height of such a guard/railing shall not be less than 1200 mm.
- (3) External staircases shall be separated from the interior of the building by walls that are fire resistant and have fixed or self closing opening protectives', as required for enclosed stairs. External staircases shall extend vertically from the ground to a point 3 meters above the topmost landing of the stairway or the roof line whichever is lower, and at least 3 meters horizontally.
- (4) All openings below and outside the external staircases shall be protected with requisite fire resistance rating.
- (5) External staircases shall be so arranged to avoid any discomfort/obstruction for persons with a fear of heights, from using them.
- (6) External staircases shall be so arranged to ensure a clear direction of egress to the street.
- (7) External staircases shall be continuous from the ground floor to the terrace level
- (8) The entrance to the external staircases shall be separate and remote from internal staircases.
- (9) External staircases shall have a straight flight with a width not less than 2 mtrs, a tread not less than 300 mm, a riser not more than 150 mm and the number of risers shall be limited to 15 per flight.
- (10) The handrail shall have a height not less than 1000 mm and not exceeding 1200 mm. Banisters shall be provided with a maximum gap of 150 mm.

- (11) Stair treads shall be uniformly slip resistant and shall be free of projections or lips that could trip stair users
- (12) External staircases used as fire escapes shall not be inclined at an angle greater than 45° from the horizontal
- (13) Unprotected steel frame staircases shall not be acceptable means of egress; however steel staircases in an enclosed compartment with a fire resistance of 2 hrs will be accepted as means of escape.
- (14) Elevators constitute a desirable supplementary facility though they are not counted as required exits. Patient's lifts shall have sufficient space for Stretcher trolley.

6.3.7 Horizontal Exits

A horizontal exit implies that the occupants will be transferred from one side of a partition to the other. Essential fire safety provisions for horizontal exits are as follows:

- (1) Width of the horizontal exits shall be same as the exit doorways.
- (2) A horizontal exit shall be equipped with at least one fire/smoke door of minimum 2 hrs fire resistance of self closing type. Further they shall have direct access to the fire escape staircase for evacuation.
- (3) A refuge area of 15 Sq. Mtr. or an area equivalent to 0.3 Sq Mtr. per person for the number of occupants in two consecutive floors, whichever is more, shall be provided on the periphery of the floor or preferably on an open air cantilever projection with at least one side protected with suitable railings/guards with a height not less than 1 mtr.
- (4) Within the aggregated area of corridors, patient rooms, treatment rooms, lounges, dining area and other low hazards areas on each side of the horizontal exit, a single door may be used in a horizontal exit given that the exit serves one direction only. Such doors shall be swinging doors or a horizontal sliding door.
- (5) Where there is a difference in the level between areas connected by a horizontal exit, ramps not more than 1 in 10 mtr slope shall be provided. The steps shall not be used.
- (6) Doors shall be accessible at all times from both sides.
- (7) A horizontal exit involving a corridor 8 ft or more in width serving as a means of egress from both sides of the doorway shall have the opening protected by a pair of swinging doors arranged to swing in the opposite direction from each other.
- (8) An approved vision panel is required in each horizontal exit. Center mullions are prohibited.

- (9) The total exit capacity of other exits (stairs, ramps, doors leading outside the building) shall not be reduced to below one third of the amount that is required for entire area of the building.

6.3.8 Exit Doors

- (1) Every door and every principal entrance that also serves as an exit shall be so designed and constructed that the way of Exit travel is obvious and direct.
- (2) Width of the doors shall be minimum 2 mtr and other requirements of the door shall comply with the NBC.
- (3) Doors shall not be equipped with a latch or lock that requires the use of tool and/or key from the egress side. Mental hospitals are permitted for door locking arrangements.
- (4) Where door locking arrangements are provided, provision shall be made for the rapid removal of patients by such reliable means as remote control of locks or the keys of all locks made readily available to staff who are in constant attendance.
- (5) Doors in fire resistant walls shall be so installed that they may be normally kept in an open position, but shall close automatically. Corridor doors opening into the smoke barrier shall be not less than 2000 mm in width. Provision shall also be made for double swing single/double leaf type doors.
- (6) The fire resistance rating of doors shall meet fire resistance rating of construction material.

6.3.9 Corridors and Passageways

- (1) The minimum width and height of corridors and passage ways shall be 2.4 mtr. The exit corridor and passage ways shall have a width not less than the aggregate required width of Exit doorways leading from them in the direction of travel to the exterior. Corridors shall be adequately ventilated.
- (2) Corridor walls shall form a barrier to limit the transfer of smoke, toxic gases and heat.
- (3) Transfer grills, regardless of whether protected by fusible link operated dampers, shall not be used in corridor walls or doors.
- (4) Openings if required in corridor walls for specific use, shall be suitably protected.
- (5) Fixed wired glass opening vision panel shall be permitted in corridor walls, provided they don't exceed 0.84 Sq Mtr in area and are mounted in steel or other approved metal frames.

6.3.10 Compartmentation

- (1) In buildings or sections occupied by bed ridden patients where the floor area is over 280 Sq Mtr., facilities shall move patients in Hospital beds to the other side of a smoke barrier from any part of such a building or section not directly served by approved horizontal exits from the floor of a building to outside.
- (2) Any section of the building more than 500 Sq.Mtr. shall be suitably compartmented with fire resistance of not less than 2 hrs.
- (3) Every storey used by inpatients for sleeping or treatment shall be divided into not less than two smoke compartments
- (4) Every storey having an occupant load 50 or more persons, regardless of use, shall be divided into two smoke compartments.
- (5) The size of each smoke compartment shall not exceed 500 Sq Mtrs.

6.3.11 Ramps

- (1) All ramps shall comply with the applicable requirements for stairways regarding enclosure, capacity and limiting dimensions except in certain cases where steeper slopes may be permitted with inclination less than 1 in 8 (under no condition shall the slopes greater than 1 in 8 be used).
- (2) Ramps shall be surfaced with approved non skid & non slippery material.

6.3.12 Service Shafts/Ducts

- (1) Service shafts/ducts shall be enclosed by walls with 2 hr and doors with 1 hr fire resistance rating. All such ducts/shafts shall be properly shielded and facilities shall be available to control fires along these shafts/ducts at all levels.
- (2) A vent opening at the top of a service shaft shall have an area between one fourth and half of the area of the shaft.
- (3) Refuge chutes shall have openings at least 1 mtr above the roof level for venting purpose and they shall have an enclosure wall of non combustible material with fire resistance rating of 2 hrs. They shall not be located within the staircase enclosure or service shaft and be as far away from the exit as possible.
- (4) The inspection panels and doors of air conditioning shafts shall be well fitted, with a fire resistance rating of 1 hr.

6.3.13 Openings in Separation Walls and Floors

- (1) At the time of designing openings in separation walls and floors particular attention shall be paid to all factors that will help limit the spread of fire through these openings and the fire ratings of these structural members shall be maintained.
- (2) For type 1 to 3 construction, a door way or opening in a separation wall on any floor shall be limited to 5.6 Sq.Mtr. in area with a maximum height/width of 2.75 mtr. Every wall opening shall be protected with fire resistant doors having the fire rating of not less than 2 hrs. in accordance with accepted standards.
- (3) Every vertical opening between the floors of a building shall be suitably enclosed or protected as necessary to prevent the spread of fire, smoke and fumes such that there is a reasonable level of safety for the occupants using the means of egress. It shall be ensured to provide a clear height of 2100 mm in the passage/escape path of occupants and thereby limitation of damage to the building and its contents.

6.3.14 Fire Stop or Enclosure of Openings

- (1) Where openings are permitted for external walls they shall not exceed 3/4th the area of the wall and shall be protected with fire resisting assemblies or enclosures with a fire resistance equivalent to that of the wall in which these are situated. Such assemblies and enclosures shall also be capable of preventing the spread of smoke and fumes through the openings so as to facilitate the safe evacuation of building in case of a fire.
- (2) All openings in the floors shall be protected by vertical enclosures extending above and below such openings. The walls of such enclosures shall have a Fire resistance of not less than 2 hrs. and all openings therein shall be protected with a fire resisting assembly.
- (3) For type 4 constructions, openings in separation walls or floors shall be fitted with 2 hrs fire resisting assemblies.
- (4) Openings in the walls and floors which provide access to building services like cables, electrical wiring, telephone cables, plumbing pipe etc. shall be protected by enclosures in the form of ducts/shafts with a fire resistance of not less than 2 hrs.
- (5) The inspection doors for electrical shafts and ducts shall have fire resistance rating not be less than 2 hrs and all other service shafts and ducts shall have a fire resistance rating not less than 1 hr.
- (6) Medium and low voltage wiring in shafts/ducts shall either be armoured or run through a metal conduit. The space in between the conduit pipes and the walls/slabs shall be

filled by a filler material that has a fire resistance rating of not less than 1 hr. The above parameters shall not be applied on patients and goods lift well opening.

6.4 Non-Structural Elements of Fire Safety

6.4.1 Underground Static Water Tank for Fire Fighting

Provisions shall be made for a dedicated fire fighting tank, of suitable capacity as per NBC P-IV, that shall remain full at all times. However, special attention shall be given to calculating the actual capacity of the water tank to ensure its compatibility to the installed fire fighting system.

- (1) A four way collecting head shall be provided at an easily accessible location near the tank.

6.4.2 Fire Pump Room

- (1) Provisions shall be made to have a centralized room to house the pumps that supply water to the various fire fighting systems. The pumps shall be as per NBC P-IV.
- (2) The following pumps shall be installed:
 - (a) Jockey Pump: An electrically driven centrifugal single/two stage pump of 280 LPM capacity shall be installed to maintain the system pressure upto 7 kg/cm². They shall be activated automatically whenever the pressure falls below 5.5 kg/cm².
 - (b) Main Fire Pump: An electrically driven centrifugal Multi stage pump of 2850 LPM capacity shall be installed to feed the Fixed Fire Fighting System. Provisions shall be made for an alternate electric supply with a changeover switch for this pump.
 - (c) Diesel Fire Pump: A diesel driven prime mover multi stage pump of 2850 LPM capacity shall be installed to feed the Fixed Fire Fighting system in case of failure to main Fire Pump.

6.4.3 Yard Hydrant

- (1) Provision shall be made to install a yard hydrant throughout the premises. The distance between two successive hydrants shall not exceed 45 mtr.

6.4.4 Wet Rising Mains

- (1) A vertical rising main of G.I. C class steel pipeline with an internal diameter of 100 mm shall be provided from the ground floor to the top most floor of the hospital along with hydrant outlets fitted at the height of 0.9 mtr from the flooring at each floor.

- (2) First Aid hose reels with a diameter of 25 mm and length of 45mtrs, shall be provided at each floor fitted with a 6.5mm diameter shut off type nozzle.
- (3) An air release valve shall be provided at the top of the rising main.
- (4) A Fire service inlet shall be provided at the ground floor.

6.4.5 Hose Box

- (1) A glass front cabinet containing two RRL type delivery hoses, each 15 mtrs in length and with a diameter of 63mm instantaneous coupling fitted with associated branch pipe, shall be provided.

6.4.6 Automatic Sprinkler System

- (1) The entire building including the basements shall be fitted with sprinklers connected to a gong bell/fire detection panel, which shall be located in the central control room.
- (2) The entire building including the basement shall be fitted with an Automatic Fire Detection and Alarm system comprising of smoke detectors, and manual call points which shall be connected to the fire alarm panel in the central control room.
- (3) The sprinkler, fire detection and alarm systems shall be provided with an alternative source of power supply.
- (4) Initiation of required fire alarm system shall be by manual means or by means of any detection device.
- (5) An internal audible alarm shall be incorporated.
- (6) Pre-signal systems are prohibited.
- (7) Corridors shall have an approved automatic detection system.

6.4.7 Emergency and Escape Lighting

- (1) Emergency lighting shall be powered from a source independent of the normal lighting system.
- (2) Emergency lights shall clearly and unambiguously indicate the escape routes.
- (3) Emergency lighting shall provide adequate illumination along escape routes to allow the safe movement of persons towards and through the exits.
- (4) Emergency lighting shall be provided in a manner to ensure that fire alarm call points and fire fighting equipments provided along the escape routes are readily located.

- (5) The horizontal luminance at floor level on the center line of an escape route shall be not less than 10 lux. Additionally, for escape routes that are upto 2 mtrs in width, 50% of the route width shall be lit to a minimum of 5 lux.
- (6) The emergency lighting shall be activated within one second of the failure of the normal lighting.
- (7) The luminaries shall be mounted as low as possible but at least 2 mtrs above the floor level.
- (8) Emergency lighting shall be designed to ensure that a fault or failure in any open luminaries does not further reduce the effectiveness of the system.
- (9) Emergency lighting luminaries and their fittings shall be of non flammable type.
- (10) The emergency lighting system shall be capable of continuous operation for a minimum of 1 and a half hours (90 minutes).

7

Maintenance and Inspection for Safe Hospitals

7.1 Maintenance and Inspection

In a post disaster scenario, a hospital is expected to provide safe and qualitative service to its patients. This objective requires that the hospital building (i.e. Structural Elements -SE) and its facilities (occupational and functional components i.e. Non Structural Elements - NSE) are safe from various natural and man-made disasters. A hospital is also expected to periodically carry out its maintenance to ensure that the safety and service quality to patients is not compromised.

The performance of hospitals, especially in a post disaster scenario, is largely dependent on continuous and planned maintenance. Periodic drill of inspection is essential to ensure compliance with the service objectives of the hospital and to ensure that the maintenance schedule is implemented in right earnest. This requires precise planning so that the maintenance needs are predicted in advance. It also requires a well-structured maintenance program to facilitate compliance with the maintenance objectives at optimal cost.

It is generally expected that the responsibility for maintenance lies with the hospital management. However, the hospital managements often lack skill to evaluate the interdependency of the Structural Elements (SE), functional components and occupational components (Non Structural Elements) of a hospital. The maintenance plan in such situation reduces to minimal upkeep of critical equipments and facilities under normal working environment. The maintenance strategy not only fails to consider the enhanced needs due to patient surge in the event of a disaster, but also fails to consider the likely vulnerability of the hospital building & services to the disaster. Experience has shown that intuitive maintenance strategy often results in degradation or loss of hospital functionality during & after a major disaster, when the hospital is most critically required to cater to the consequences.

It is therefore imperative that hospitals follow maintenance policies that are holistic, consider the various potential hazards, take into account the highest priority needs and are economical.

Development of the maintenance policies without broad guidelines should not be left to the hospital management or owners. It is recommended that the suggested policy guideline be adopted by the hospitals as the basis to develop their maintenance policy.

7.2 Maintenance of Occupational and Functional Components

The occupational and functional components consist of two distinct types - The occupational components, also sometimes known as non-structural components, are those that fulfil important functional or aesthetic function, but do not constitute a part of the structural system. Examples of occupational components include partition walls, false ceiling, etc. The occupational components are often not explicitly designed to resist the various hazards in the same way as the structural system, and are thus prone to easier damage. At the same time, their damage, such as collapse of false ceiling, may jeopardise the use of the facility itself. Proper maintenance and inspection of the occupational components is very important for ensuring the safety of the hospital. Often, it is preferable to carry out inspection of the occupational components along with that of the structural system.

The functional components are non-structural components that fulfil functional need of the hospital. Examples of functional components include oxygen and vacuum lines. This also includes all equipments and accessories that are used in the hospital, such as X-ray machines, centrifuges, furniture, water coolers, Air-Conditioners, Roof Top Tanks etc.

The hospital should maintain a list of all occupational and functional components, and prepare their maintenance schedule. For equipment, the maintenance schedule may be prescribed by their manufacturers themselves. Care should be taken to comply with the prescribed maintenance schedule in these cases. For functional components that do not have a manufacturer's schedule, the maintenance schedule should consider the importance of the component, the number of such functional components, the vulnerability of ease of damage, etc.

Apart from the maintenance, the equipments such as CT Scan, X-Ray machines, Tread Mills, Path-Lab Equipments (including chemical containers), Cath-Lab Equipments, operation Theatre Equipments, Computers and all such machines & storage arrangement, which are vulnerable to damage during a strong shaking, need to be secured in position properly.

Similarly, Roof Top Water Tanks, Air-Conditioners, Air Coolers, Water Coolers, Bio degradable/ Non Bio Degradable Waste Containers, Almirahs/racks containing equipments/chemicals, hospital beds, side shelves etc can cause a lot of damage, during a strong shaking, to life &

property. These elements need some arrangement to secure them in place to avoid their movement/falling.

It has also been noticed that during a strong shaking the electrical conduits, medical gas pipelines, water supply lines & others services get damaged at the location of expansion joint. Detailing of these services should be improved to avoid disruption of services during and post disaster scenario.

Generally, these elements are not covered under a routine maintenance program. It is therefore imperative that these aspects are first covered under the program of non-structural retrofitting and then reviewed periodically under maintenance inspection through a check-list.

7.3 The Maintenance Policy & Plan

Hospitals should adopt a stated maintenance policy to ensure effective response to disasters and emergencies. The maintenance policy should supplement the hospital mission in its intention to provide adequate-level medical support as intended during disasters and emergencies. The hospitals should also prepare their maintenance plan to address their role during major relevant phases of disaster management activities, viz. mitigation, preparedness, response and recovery.

7.4 Maintenance of Structural Systems

It is important that the hospital building itself must not be unsafe or appear to be unsafe after a disaster. Structure of each hospital building has a certain capacity to resist forces due to different causes. Vulnerability assessment of the hospital building provides the required information regarding the likely state of damage due to a particular disastrous event. The maintenance systems developed for the hospital shall ensure that the strength of the structural elements (SEs) shall not further deteriorate compared to their intended level.

The structural systems of all buildings also require routine maintenance.

The maintenance systems of hospitals should also include structural safety assessment or structural audit at pre-determined intervals (say, every five years to revalidate the structural audit carried out earlier) using more detailed evaluation. The detailed evaluation is intended to identify sources of structural distress, assess the need to take remedial measures and recommend possible remedial measures. Since the structural system of hospitals are typically of reinforced concrete, steel or masonry, different methods for safety assessment will need to be evaluated in each case.

7.5 Inspection of Structural Components

Key points:

- Inspection procedure and frequency shall be as per the maintenance policy.
- All structural components shall be covered in the inspection procedure.
- Inspection reporting shall be based on standard checklists.
- Inspection shall also identify situations requiring irregular (Special) maintenance.

The inspection of structural components could be on following format:

- (1) Date of detailed vulnerability assessment (structural deficiency assessment) carried out earlier.
- (2) List of deficient Structural Elements found during the earlier detailed vulnerability assessment.
- (3) List of structural elements attended during the earlier retrofitting & their design parameter achieved.
- (4) Date of retrofitting completed earlier, if the same was required as per the detailed vulnerability assessment carried out earlier.
- (5) The standard (EQ Code of practice) on which the structure became compliant as a result of the earlier retrofitting.
- (6) Present condition of those structural elements strengthened during the previous retrofitting and whether strengthening is required?
- (7) Present standard (latest version of the EQ code of practice) and whether the structure is still compliant or requires strengthening/retrofitting.

The above exercise can be in a tabular form also.

7.6 Inspection of Occupational and Functional Components

Key points:

- Inspection procedure and frequency shall be as per maintenance policy and shall consider the vulnerability of the occupational and functional component.
- Every occupational and functional component shall be covered in the inspection procedure.
- Standard checklists shall be prepared for implementing inspection reporting.

The procedure of inspection could be standardized in the following format:

- (1) Whether non structural deficiency assessment has been done earlier (if not done, the same should be done now and rectification of deficiency should be carried out immediately)
- (2) In case non structural deficiency assessment and retrofitting thereafter was carried out earlier, what was the date of completion of the same?
- (3) List of non structural elements which were attended during the previous non structural retrofitting.
- (4) What is the present status of those non structural elements attended earlier and whether further intervention is required now?
- (5) In case, further intervention is required, what are the suggestions/ recommendations?

The above exercise can be in a tabular form also.

NOTE: In case of structural and non structural changes have been carried out after previous detailed vulnerability assessment (Deficiency assessment) and retrofitting, fresh detailed vulnerability assessment (Deficiency assessment) shall be essential.

8

Licensing and Accreditation

8.1 Scope

The challenges of disaster preparedness and management are twofold – one, to have a detailed Hospital Disaster Management Plan and second, to ensure that the said plan is well practiced and rehearsed so that it may be implemented when disaster strikes, without any lapses.

Both these issues are adequately provided for and addressed if Licensing and Accreditation requirements are complied with.

This Chapter provides an overview of the standard Licensing and Accreditation requirements that shall be followed by hospitals to ensure disaster preparedness.

8.2 Important Definitions

- (1) **Licensing:** is a non-voluntary process by which an agency of government regulates. Licensing is always based on the action of a legislative body. Once a licensing law has been passed it becomes illegal for anyone to engage in that process unless he or she has a license. Maintenance of licensure is an ongoing requirement for health care organizations.
- (2) **Accreditation:** is a voluntary process of external quality assessment based upon the following principles -
 - a) It is based on published standards that are contemporary and synchronous with the prevailing knowledge and practices
 - b) It is carried out by specifically trained peers
 - c) It is carried out by an independent and autonomous agency
 - d) It aims at organisational development
- (3) **Objective element:** is that component of a standard which can be measured objectively on a rating scale. The acceptable compliance with the measureable elements will determine the overall compliance with the standard.

- (4) **Standards:** are statements of expectation that define the structures and process that must be substantially in place in an organisation to enhance the quality of care.
- (5) **Strategic Planning:** is an organisation’s process of defining its strategy or direction and making decisions on allocating its resources to pursue this strategy, including its capital and people. Various business analysis techniques can be used in strategic planning, including SWOT analysis (Strengths, Weaknesses, Opportunities and Threats) e.g. Organisations can have a strategic plan to become market leader in provision of cardiothoracic and vascular services. The resource allocation will have to follow the pattern to achieve the target. The process by which an organisation envisions its future and develops strategies, goals, objectives and action plans to achieve that future. (ASQ).
- (6) **Risk Assessment:** is the determination of quantitative or qualitative value of risk related to a concrete situation and a recognised threat (also called hazard). Risk assessment is a step in a risk management procedure.
- (7) **Risk Management:** refers to clinical and administrative activities to identify, evaluate and reduce the risk of injury.
- (8) **Risk Reduction:** is the conceptual framework of elements considered with the possibilities to minimise vulnerabilities and disaster risks throughout a society to avoid (prevention) or to limit (mitigation and preparedness) the adverse impacts of hazards, within the broad context of sustainable development. It is the decrease in the risk of a healthcare facility, given activity, and treatment process with respect to patient, staff, visitors and community.
- (9) **Occupational Health Hazards:** are the hazards to which an individual is exposed to during the course of performance of his job. These include physical, chemical, biological, mechanical and psychosocial hazards.

Table 8.1: Basics of Licensing and Accreditation

Process	Issuing organization	Effect of evaluation	Component/ requirements	Standards
Accreditation (Voluntary)	Recognized body usually an NGO	Organization	Compliance with published standard, on-site evaluation, compliance not required by law and/or regulation	Set at a minimum achievable level to stimulate importance
Licensure (Involuntary)	Governmental authority	Individual or Organization	Regulations to ensure minimum standard , onsite inspection, obtain on proof of competence	Set at a minimum level

8.3 Licensing Requirements

The requirements, structural and procedural, of all the Licenses to be complied with for running a hospital, if followed in letter and spirit should make any health institution safe and secure for the patient in any disaster condition.

The licensing requirements for hospitals vary in each State and also on the basis of the type of Health Care Facility.

Hospitals shall acquire the necessary permits, certificates and approvals as follows:

1. Building Permit (From the Municipality)
2. No Objection Certificate from the Chief Fire officer
3. No Objection Certificate under Pollution Control Act
4. Radiation Protection Certificate in respect of all X-ray, Cath lab, CT Scanners, Nuclear Medicine from BARC
5. Atomic Energy Regulatory Body approvals
6. Excise Permit to store spirits.
7. PAN number and other Tax documents
8. Permit to operate lifts under the Lifts and Escalators Act
9. Licenses under the Narcotics and Psychotropic Substances Act and License
10. Sales Tax Registration Certificate
11. Vehicle Registration Certificates for Ambulances
12. Retail and Bulk Drug License (Pharmacy)
13. Wireless Operation Certificate from Indian Post and Telegraphs(if applicable)

Hospitals shall also comply with the provisions laid down under the following Acts, Rules and Regulations:

1. Air (Prevention and Control of Pollution) Act, 1981
2. Arms Act, 1950 (if guards have weapons)
3. Bio- Medical Management and Handling Rules, 1998
4. Cable Television Networks Act 1995
5. Central Sales Tax Act, 1956
6. Constitution of Atomic Energy Regulatory Board, 1983
7. Consumer Protection Act, 1986

8. Contract Act, 1982
9. Copyright Act, 1982
10. Customs Act, 1962
11. Dentist Regulations, 1976
12. Drugs and Cosmetics Act, 1940
13. Electricity Act, 1998
14. Electricity Rules, 1956
15. Employees Provident Fund Act, 1952
16. ESI Act, 1948
17. Employment Exchange Act, 1969
18. Environment Protection Act, 1986
19. Equal Remuneration Act, 1976
20. Explosives Act 1884
21. Fatal Accidents Act 1855
22. Gift Tax Act, 1958
23. Hire Purchase Act, 1972
24. Income Tax Act, 1961
25. Indian Lunacy Act, 1912
26. Indian Medical Council Act and Code of Medical Ethics, 1956
27. Indian Nursing council Act, 1947
28. Indian Penal Code, 1860
29. Indian Trade Unions Act, 1926
30. Industrial Disputes Act, 1947
31. Insecticides Act, 1968
32. Lepers Act
33. Lifts and Escalators Act
34. Maternity Benefit Act, 1961
35. MTP Act, 1971
36. Mental Health Act, 1987
37. Minimum Wages Act, 1948

38. Narcotics and Psychotropic Substances Act
39. National Building Code
40. National Holidays Under Shops Act
41. Negotiable Instruments Act, 1881
42. Payment of Bonus Act, 1965
43. Payment of Gratuity Act, 1972
44. Payment of Wages Act, 1936
45. Persons with Disability Act, 1995
46. Pharmacy Act, 1948
47. PNDT Act, 1996
48. Prevention of Food Adulteration Act, 1954
49. Protection of Human Rights Act, 1993
50. PPF Act, 1968
51. Radiation Protection Rules, 1971
52. Radiation Surveillance Procedures for Medical Applications of Radiation, 1989
53. Registration of Births and Deaths Act, 1969
54. Sale of Goods Act, 1930
55. The Transplantation of Human Organs Act and Rules
56. Tax deducted at Source Act.
57. Safe Disposal of Radioactive Waste Rules, 1987
58. Sales Tax Act.
59. The Water (Prevention and Control of Pollution) Act, 1974

8.4 Accreditation Requirements

To ensure the continued functioning of the disaster preparedness and mitigation measures that are undertaken as per the standards mentioned in the preceding chapters of this guideline, hospitals shall be evaluated and thereby accredited by recognized and established accreditation organizations, regularly. The aim of accreditation of hospitals shall be to ensure effective and immediate response by hospital personnel to meet the needs of affected populations during disasters. The key aspects of disaster management for which hospitals shall be accredited for, are detailed (but not limited to) as follows.

8.4.1 Disaster Preparedness Measures

All hospitals shall be evaluated and accredited for the preparedness measures undertaken by them to respond to both internal and external disasters. Aside from having a written Hospital Disaster Management Plan, hospitals shall also have detailed protocols for addressing the following components of Hospital Disaster Management (details of each of these components have been addressed in Chapter 4 – ‘Hospital Disaster Preparedness and Response’ - of this guideline). They shall be evaluated and accredited for the same.

- (1) Coordination and Management (including the Hospital Incident Response System)
- (2) Hospital Disaster Management Plan
- (3) Information, Communication and Documentation
- (4) Safety and Security
- (5) Human Resource Planning and Management
- (6) Logistics and Supply (of medicines, equipment, blood and blood products, medical gases, transport facilities, linen, food, etc)
- (7) Financial Management
- (8) Continuity of Essential Services
- (9) Triage
- (10) Surge Capacity and Medical Response
- (11) Post Disaster Recovery
- (12) Patient Handling
- (13) Volunteer Involvement and Management
- (14) Area Level Networking of Hospitals
- (15) Coordination and Collaboration with Wider Disaster Preparedness Initiatives

8.4.2 Disaster Mitigation Measures

All Hospitals should be evaluated and accredited for the Structural and Non-Structural Mitigation measures required to be undertaken by them as per Chapter 5 and 6 – ‘Design and Safety of Hospital Buildings’ and ‘Fire Safety in Hospitals’ – of this guideline. They shall also be evaluated and accredited for their maintenance and inspection methodology of the hospital buildings, as detailed in Chapter 7 – ‘Maintenance and Inspection’.

8.4.3 Licensing requirements

All Hospitals shall be evaluated and accredited for their compliance with relevant Acts, Rules and Regulations governing Hospitals and Healthcare Facilities. Hospitals shall also be able furnish copies of all the necessary licenses and permits required for the facility, to the evaluators and accreditators during an evaluation cycle.

8.4.3 Capacity Building

Hospitals shall be evaluated and accredited on the levels of awareness of their staff on hospital disaster management. This shall include their awareness of the potential hazards to the facility, awareness of the hospital's disaster response strategy and awareness of their own role and responsibility during disasters.

Hospitals shall also be evaluated and accredited on the training undertaken by them for preparedness to respond to disasters in a hospital. An important aspect of training shall be the drills undertaken by the hospital (as detailed in Chapter 4 – 'Hospital Disaster Preparedness and Response' - of this guideline).

9

National Action Framework for Hospital Safety

9.1 Scope

This guideline has been formulated to ensure that when implemented at all levels, the risks to human life and infrastructure are minimised; and hospitals are not only better prepared but are optimally **functional** immediately after disastrous events, such that they are able to respond immediately to the medical requirements of the affected community.

It is strongly recommended that the interventions suggested in this guideline are approached and implemented in a systematic and time bound manner, since disastrous events can happen anytime, anywhere and at any scale. Given this, conscious efforts need to be made to achieve the goal of 'safer and functional hospitals' in the country at the earliest; and towards this end, this chapter lays down the 'National Action Framework for Hospital Safety', as a focused strategy which should be followed to achieve this goal.

The Action framework has been developed on the basis of the five priority areas that need to be addressed to ensure hospital safety. These are as follows:

Priority Area I	Strengthening Institutional Mechanisms
Priority Area II	Advocacy, Awareness Generation and Education
Priority Area III	Capacity Building
Priority Area IV	Preparedness, Response and Recovery
Priority Area V	Risk Reduction and Structural Mitigation

9.2 Priority Areas and Outcomes

Priority Area I – Strengthening Institutional Mechanisms

Currently the institutional mechanisms dealing with hospitals have inadequate inputs on safety. Therefore, priority shall be given, first and foremost, to strengthening and developing the necessary institutional mechanisms required for ensuring high safety standards in hospitals. Under this priority area, the necessary policies, guidelines and ministerial directives required

to enforce safety need to be developed and issued as per procedure. At the same time, existing building codes (specifically for hospitals and their contents) accreditation and licensing parameters need to be reviewed and updated in order to achieve high levels of safety – for all structural, non-structural and functional parameters (Table 9.1).

By doing this, the necessary legal framework required to enforce hospital safety will be in place, thereby making safety provisions mandatory in the design, construction and functioning of hospitals.

Table 9.1: Priority Area I: Strengthening Institutional Mechanisms

Priority Area I	Outcomes	Baseline (Current Status)	Recommended Interventions	Timeline*	Responsible Agencies
Strengthening Institutional Mechanisms	Policies, Guidelines and ministerial directives enforcing safety as a mandatory requirement in all hospitals in the country are in place	At present safety has not been enforced as a mandatory requirement in hospitals by any policy, guideline or ministerial directive.	Issue of Policies / Directives from Relevant Ministry mandating Hospital Safety	Short - Term	Lead: MoHFW
	New Codes mandating higher standards of safety in the design and construction of Hospitals (for both structural and non-structural elements) are in place	Current IS Codes do not address the continuity of services in a hospital during and immediately after disastrous events	Higher Standards for Structural Safety of Critical Health Facilities	Short - Medium Term	Lead: BIS
			Higher Standards for Architectural Elements, Utility Systems, Equipment and Contents in Health Facilities	Short - Medium Term	Lead: BIS
Regulatory Framework to ensure Hospital Safety is in place	Current Accreditation Standards for Hospitals do not include Safety parameters	Accreditation and Licensing	Medium	Lead: QCI/ NABH and MoHFW	

*The Action Framework suggests timelines of Short Term, Medium Term and Long Term indicative of time periods of “within 5 years”, “5 to 10 years” and “more than 10 years (preferably not longer than 20 years)”.

Outcome 1.1 – Policies, Guidelines and Ministerial Directives enforcing safety as a mandatory requirement in all hospitals in the country are in place

The necessary policies, guidelines and ministerial directives that will legally enforce hospital safety in the country need to be framed and implemented at the earliest, under the aegis of the Ministry of Health and Family Welfare. Towards this end, some of the key policies, guidelines, directives that need to be reviewed and updated accordingly are outlined in the following table (Table 9.2).

Table 9.2: Activities to be undertaken under Outcome 1.1

Recommended Intervention	Activities	Timeline	Responsible Agencies
Issue of Policies / Directives from Relevant Ministry mandating Hospital Safety	Inclusion of Hospital Safety parameters in the Clinical Establishment Act and Rules	Short - Term	Lead: MoHFW
	Inclusion of Hospital Safety parameters in Indian Public Health Standard (IPHS) Guidelines	Short - Term	Lead: MoHFW
	Inclusion of Hospital Safety parameters in the National Health Mission and all similar future programmes/projects	Short - Term	Lead: MoHFW
	Ministry issued Directives mandating standards for safety	Short - Term	Lead: MoHFW
	Ministry issued Directives mandating Accreditation	Short - Term	Lead: MoHFW

The above mentioned activities are only indicative and any other policy, guideline or directive as deemed necessary, to take the agenda of hospital safety forward by the Ministry, need to be framed and implemented.

Outcome 1.2 – New Codes mandating higher standards of safety in the design and construction of Hospitals (for structural elements, architectural elements, utility systems, equipment and contents) are in place

One of the most important criteria for safety in hospitals is the structural resilience of the hospital buildings which determines the performance of the buildings when exposed to severe stress (like that exerted by earthquakes). Likewise, the resilience of architectural elements, utility systems, equipment and contents within the hospital premises is also crucial in ensuring

continuity of services. At present, the codes being followed to design, construct and maintain hospital structures and the architectural elements, utility systems, equipment and contents, fall short of the required performance level i.e. ‘fully functional’. Hence it is crucial that new codes are developed to ensure continuity in the services of hospitals during and immediately after disastrous events.

For this purpose, the following activities need to be undertaken. (Table 9.3 and Table 9.4)

Table 9.3 : Activities to be undertaken for structural safety under Outcome 1.2

Recommended Intervention	Activities	Timeline	Responsible Agencies
Higher Standards for Structural Safety	New codes for Hospitals (mandating higher performance levels)	Short-Medium Term	Lead: BIS
	Guidelines for Retrofitting of Hospitals (mandating higher performance levels)	Short - Medium Term	Lead: BIS

Table 9.4: Activities to be undertaken for the safety of Architectural Elements, Utility Systems, Equipment and Contents under Outcome 1.2

Recommended Intervention	Activities	Timeline	Responsible Agencies
Higher Standards for Architectural Elements, Utility Systems, Equipment and Contents	New codes for architectural elements, utility systems, equipment and contents (mandating uninterrupted services)	Short - Medium Term	Lead: BIS
	Development of additional guideline documents mandating higher standards for elements such as glass facades, false ceilings, pipelines, etc.	Short - Medium Term	Lead: BIS
	Development of guidelines for Retrofitting Architectural Elements, Utility Systems, Equipment and Contents	Short - Medium Term	Lead: BIS

Outcome 1.3 – Regulatory Framework to ensure Hospital Safety is in place

Aside from framing and implementing the necessary policies, guidelines, ministerial directives and building codes to enforce safety parameters in hospitals, it is also important to develop

appropriate regulatory mechanisms that will ensure the continued adherence to the said safety parameters. As already mentioned as a part of Outcome 1.1, the Ministry needs to issue directives to make regular licensing and accreditation a mandatory requirement for continued functioning of hospitals post disastrous events. However, only issuing directives to mandate licensing and accreditation will not be enough. In order to ensure high standards of safety in hospitals, the current standards that need to be fulfilled for hospitals to receive legitimate licenses and accreditation certificates need to be reviewed and upgraded to incorporate safety standards.

The following activities in Table 9.5 are suggested in this regard.

Table 9.5: Activities to be undertaken under Outcome 1.3

Recommended Intervention	Activities	Timeline	Responsible Agencies
Accreditation and Licensing	Revision/ Up-gradation of Standards required to be met for Licensing to ensure safety in Hospitals	Short - Term	MoHFW or Agency designated by MoHFW
	Revision/Up-gradation of Accreditation Standards to Incorporate Safety measures that ensure the continuity of services	Medium - Long Term	MoHFW or Agency designated by MoHFW
	Accreditation of all hospitals	Long Term	MoHFW or Agency designated by MoHFW

Priority Area II – Advocacy, Awareness Generation and Education

At the individual level, except for a small proportion of the medical fraternity who are voluntarily involved in Hospital Disaster Management, the larger group of stakeholders have limited or no knowledge and/or interest in hospital safety and its constituent concepts. However, if Hospital Safety is to become a topic of national concern then very focused and strategic campaigns for advocacy, awareness generation and education (as described in Table 9.6 and the following section) need to be undertaken in the country, so that a culture of safety prevails in the hospital sector.

Table 9.6: Priority Area II: Advocacy, Awareness Generation and Education

Priority Area II	Outcomes	Baseline (Current Status)	Recommended Interventions	Timeline*	Responsible Agencies
Advocacy, Awareness Generation and Education	Key Decision makers (at ministerial and institutional level) are aware and are in agreement that Safety parameters for hospitals need to be incorporated at all levels and as a part of all processes of healthcare delivery in the country	Currently, a very small proportion of the stakeholders are aware of the need for hospital safety	Advocacy for Hospital Safety	Short - Term	Lead: MoHFW
	All stakeholders at the grass-root level, engaged in design, construction and operation of hospitals are aware of the concept of Hospital Safety and its need		Awareness Generation for Hospital Safety	Short – Medium – Long Term	Lead: MoHFW
			Incorporation of 'Safe Hospital' concepts in medical, public health, hospital administration, engineering, architecture, paramedic and nursing curriculum	Short - Term	Lead: MoHFW

Outcome 2.1 – Key Decision Makers (at ministerial and institutional level) are aware and are in agreement that safety parameters for hospitals need to be incorporated at all levels and as a part of all processes of healthcare delivery in the country

The attention and support of key decision makers at the ministerial level will be required to ensure that hospital safety parameters are mainstreamed in such a manner that “safe and

functional hospitals” become a natural by-product of the health sector in the country. To achieve this, a robust advocacy campaign needs to be designed.

Towards this end, the following activities need to be undertaken.

Table 9.7: Activities to be undertaken under Outcome 2.1

Recommended Intervention	Activities	Timeline	Responsible Agencies
Advocacy for Hospital Safety	Development of Advocacy Strategy	Short - Term	Lead: MoHFW
	Preparation of IEC Material for Advocacy	Short - Term	Lead: MoHFW
	High Level Advocacy Meetings at relevant ministries and institutions (eg. CPWD, IITs, NIITs, Architectural Colleges, Medical Colleges and other Institutions running Hospital Administration courses, etc.)	Short - Term	Lead: MoHFW

Outcome 2.2 – All stakeholders at the grass-root level, engaged in design, construction and operation of hospitals, are aware of the concept of Hospital Safety and its need

To bring about a culture of safety into the hospital sector, it is necessary to make everyone who is engaged in the sector, either directly or indirectly (such as doctors, nurses, administrators, attendants, engineers, architects and other support staff like electricians, plumbers, etc.) aware of the basic concepts of safety with respect to hospitals. Towards this end well-planned awareness generation campaigns needs to be undertaken. Activities recommended in this direction are as represented in Table 9.8.

Table 9.8: Awareness Generation Activities to be undertaken under Outcome 2.2

Recommended Intervention	Activities	Timeline	Responsible Agencies
Awareness Generation for Hospital Safety	Development of Awareness Generation Strategy	Short - Term	Lead: MoHFW
	Preparation of IEC Material for Awareness Generation	Short - Term	Lead: MoHFW
	Grass-Root Level Awareness Generation Exercises	Short - Medium Term	Lead: MoHFW

However, hospitals being entities that demand highly specialised and scientific use and management of space, an awareness generation campaign alone will not suffice to develop the skills required to make hospitals safe. Decisive steps need to be taken to incorporate ‘Hospital Safety’ concepts into the curriculum of relevant academic courses that are pursued by professionals involved in the design, construction and operation of hospitals. Some suggestive professional courses in which this inclusion can be made is given in Table 9.9 below.

Table 9.9: Activities to be undertaken for Education under Outcome 2.2

Recommended Intervention	Activities	Timeline	Responsible Agencies
Incorporation of 'Safe Hospital' concepts in curriculum	Incorporation of hospital safety parameters in design and construction curriculum for engineering	Short - Term	Lead: MoHFW
	Incorporation of hospital safety parameters in design and construction curriculum for architecture	Short - Term	Lead: MoHFW
	Incorporation of hospital preparedness measures in curriculum of Hospital Administration	Short - Term	Lead: MoHFW
	Also in the academic curriculum of nursing, public health and paramedic cadres	Short - Term	Lead: MoHFW

Priority Area III – Capacity Building

There is a need to build capacities for Preparedness and Mitigation, of practitioners who are currently engaged in designing, constructing, maintaining and operating hospitals, so that current practices which are leading to unsafe hospitals are arrested and reversed with immediate effect; and proactive measures can be taken to achieve the goal of ‘safe and functional hospitals’ without any delay.

Table 9.10: Priority Area III: Capacity Building

Priority Area III	Outcomes	Baseline (Current Status)	Recommended Interventions	Timeline*	Responsible Agencies
Capacity Building	Capacities of engineers, architects and hospital	Currently, very few hospital administrators	Capacity Building for Preparedness	Short - Medium Term	Lead: MoHFW

	administrators engaged in designing, constructing, maintaining and	have the required capacities for preparedness			
	operating hospitals are developed to address and include safety parameters to ensure safe and functional hospitals	Currently, no engineer or architect have the capacity to design, construct and maintain hospitals to meet higher performance levels	Capacity Building for Mitigation	Short - Medium Term	Lead: MoHFW Partnered with: IITs and CPWD.

Outcome 3.1 – Capacities of engineers, architects and hospital administrators engaged in designing, constructing, maintaining and operating hospitals are developed to address and include safety parameters to ensure safe and functional hospitals

A series of ministry driven trainings need to be undertaken to build the capacities of hospital administrators, hospital staff, engineers and architects for preparedness and mitigation, respectively. However, before these trainings are undertaken, a preliminary round of capacity building may also be necessary at the relevant Ministries to ensure that senior ministry officials are made aware of the content of the trainings, so that the future policy level initiatives are undertaken along the same lines. Detailed activities to be undertaken for both preparedness and mitigation have been presented in Table 9.11 and 9.12.

Table 9.11: Capacity Building activities to be undertaken for Preparedness under Outcome 3.1

Recommended Intervention	Activities	Timeline	Responsible Agencies
Capacity Building for Preparedness	Development of Capacity Building Strategy	Short - Term	Lead: MoHFW
	Capacity Building at Key Ministry Levels	Short - Term	Lead: MoHFW
	Capacity Building for Hospital Administrators	Short - Medium Term	Lead: MoHFW
	Capacity Building for Hospital Staff	Short - Medium Term	Lead: MoHFW

Table 9.12: Capacity Building activities to be undertaken for Mitigation under Outcome 3.1

Recommended Intervention	Activities	Timeline	Responsible Agencies
Capacity Building for Mitigation	Development of Capacity Building Strategy	Short - Term	Lead: MoHFW Partnered with: IITs & CPWD
	Capacity Building at Key Ministry Levels	Short - Term	Lead: MoHFW Partnered with: IITs & CPWD
	Capacity Building for Engineers	Short – Medium Term	Lead: MoHFW Partnered with: IITs & CPWD
	Capacity Building for Architects	Short - Medium Term	Lead: MoHFW Partnered with: IITs & CPWD
	Capacity Building of Support Services (Eg. Plumbers, Electricians, etc.)	Short – Medium Term	Lead: MoHFW Partnered with: IITs & CPWD/NIITs/ITIs

Priority Area IV – Preparedness, Response and Recovery

Most of the mitigation measures that will be required for hospital safety will take time to come into effect, by virtue of the processes that need to be followed to put them in place. In the meantime, preparedness measures (outlined in Table 9.13), that address the processes involved in the functioning of hospitals, will play a crucial role in reducing the impact of hazards and saving hospitals from the imminent loss of life and injuries, should a hazard manifest, in the interim period.

Table 9.13: Priority Area IV: Preparedness, Response and Recovery

Priority Area IV	Outcomes	Baseline (Current Status)	Recommended Interventions	Timeline*	Responsible Agencies
Preparedness, Response and Recovery	All Hospitals in the country will have well documented Disaster Management Plans, which are regularly tested and updated	Most hospitals do not have a well documented Disaster Management Plan. Those who do have a plan, do so only to meet accreditation standards, which are not tested and updated regularly.	Hospital Disaster Management Planning	Short - Term	Lead: Individual Hospitals
			Testing Hospital Disaster Management Plans	Ongoing	Lead: Individual Hospitals
	A comprehensive system of Hospital Networks are established to enable resource sharing during emergencies	Currently there is no Hospital Networking system	Hospital Networking and Coordination	Short – Term	Lead: MoHFW

Outcome 4.1 – All hospitals in the country will have well documented Disaster Management Plans, which are regularly tested and updated

The first step of preparedness, after building the capacities of the administrators and staff is to formulate detailed preparedness, response and recovery plans (as given in Table 9.14) for the hospitals. While a standardized format will be developed at the national level as a suggestive template, each hospital should adapt the template to develop plans best suited to their respective circumstances and needs. These plans should be written documents, preferably in the language understood by all levels of staff in the hospital and should be accessible to all.

Table 9.14: Activities to be undertaken for Hospital Disaster Management Planning under Outcome 4.1

Recommended Intervention	Activities	Timeline	Responsible Agencies
Hospital Disaster Management Planning	Formulation of Hospital Incident Command Systems	Short – Term	Lead: Individual Hospitals
	Formulation of Hospital Communication Plans	Short - Term	Lead: Individual Hospitals
	Formulation of Hospital Evacuation Plans	Short – Term	Lead: Individual Hospitals
	Formulation of Hospital Response Plans	Short – Term	Lead: Individual Hospitals
	Formulation of Hospital Recovery Plans	Short – Term	Lead: Individual Hospitals
	Review/Updation of Plans	Ongoing	Lead: Individual Hospitals

Once the detailed plans for preparedness, response and recovery have been developed by each hospital to meet their own necessities, based on their unique circumstances, it is important to remember that these plans are never completely final. In other words, the plan once written, needs to be tested on ground (through the activities mentioned in Table 9.15) and accordingly the short-falls/gaps need to be reduced by altering and updating the same. Through this process of trial and error, the plans will be able to represent the reality on the ground better.

Another reason for testing plans on a regular basis, is to keep the plans alive in the minds of the hospital staff, who will ultimately put it into action, during the time of an actual exigency. However, at times like this, if people are unused to/unaware of what to do, how to do and when to respond to a situation, as a matter of course, they will fail to respond and recover from the hazard event and will remain unprepared.

Table 9.15: Activities to be undertaken for Testing Hospital Disaster Management Plans under Outcome 4.1

Recommended Intervention	Activities	Timeline	Responsible Agencies
Testing Hospital Disaster Management Plans	Table-Top Exercises	Ongoing	Lead: Individual Hospitals
	Preparedness Drills	Ongoing	Lead: Individual Hospitals

Outcome 4.2 – A comprehensive system of Hospital Networks are established to enable resource sharing during emergencies

One of the key directives of this guideline is that hospitals establish a comprehensive system of hospital networks so that at the time of emergencies, hospitals can share resources freely and thereby adequately respond to the medical requirements of the affected community. This will also help in easing the disproportionate and/or high demand placed on nodal hospitals, while the capacities of other hospitals in the vicinity are under-utilised or unutilised altogether, which results in unnecessary loss of lives, that can be avoided if timely medical care is available. Activities recommended in this regard are presented in Table 9.16.

Table 9.16: Activities to be undertaken under Outcome 4.2

Recommended Intervention	Activities	Timeline	Responsible Agencies
Hospital Networking and Coordination	Identify plausible groups of hospitals that may be networked	Short - Term	Lead: MoHFW/ State Govt.
	Development of MoU's for Resource Sharing among networked hospitals	Short - Term	Lead: MoHFW/ State Govt.
	Formally establish networks of hospitals	Short - Term	Lead: MoHFW/ State Govt.

Priority Area V – Risk Reduction and Structural Mitigation

One of the main concerns with regard to the safety of hospitals is that hospital structures (i.e. the buildings) are themselves vulnerable to collapse in the face of extreme forces (such as those experienced during earthquakes). Therefore, to ensure the safety of hospitals and achieve the goal of 'safer and functional hospitals', mitigation measures (as presented in Table 9.17) need to be undertaken in a programmatic manner by the Ministry on an urgent basis.

Table 9.17: Priority Area V: Mitigation

Priority Area V	Outcomes	Baseline (Current Status)	Recommended Interventions	Timeline*	Responsible Agencies
Mitigation	All New Hospitals (after a defined date) will be built	Currently all hospitals and their contents	New Hospital Structures	Variable	Lead: MoHFW/ State Govts

	to meet higher performance standards	(new and old) only meet the performance level of			Lead: MoHFW / State Govts
	All Existing Hospitals will be retrofitted to meet higher performance standards	'collapse prevention'	Existing Hospital Structures	Long - Term	Lead: MoHFW / State Govts
				Cyclical	Lead: MoHFW / State Govts
	All Architectural Elements, Utility Systems, Equipment and Contents in Hospitals to be built and/or retrofitted to higher performance levels to remain fully functional		Architectural Elements, Utility Systems, Equipment and Contents in Hospitals	Short - Medium Term	Lead: MoHFW / State Govts
				Short - Term	Lead: MoHFW / State Govts

Outcome 5.1 – All new hospitals (after a defined date) will be built to meet higher performance standards

Once new codes requiring better performance, are made available by the BIS for hospitals, the Ministry will identify a date, after which all new hospitals will have to be built mandatorily to meet the new standards, thus ensuring the safety of these structures in the face of extreme forces. Table 9.18 represents the activities that need to be undertaken towards this end.

Table 9.18: Activities to be undertaken under Outcome 5.1

Recommended Intervention	Activities	Timeline	Responsible Agencies
New Hospital Structures	Building new hospitals to new (higher) standards	Short - Medium Term	Lead: MoHFW / State Govts
	Maintenance and Inspection for continued adherence to higher standards	Ongoing	Lead: MoHFW / State Govts

Outcome 5.2 – All Existing Hospitals will be retrofitted to meet higher performance standards

Since, most of the current hospital structures are vulnerable to collapse when exposed to extreme forces, it is crucial that they are retrofitted to meet the higher standards set for new hospitals. Towards this end the activities outlined in Table 9.19 will be undertaken.

Table 9.19: Activities to be undertaken under Outcome 5.2

Recommended Intervention	Activities	Timeline	Responsible Agencies
Existing Hospital Structures	Retrofitting existing hospitals structures to new (higher) standards	Long - Term	Lead: MoHFW / State Govts
	Maintenance and Inspection for continued adherence to higher standards	Ongoing	Lead: MoHFW / State Govts

Outcome 5.3 – All Architectural Elements, Utility Systems, Equipment and Contents in Hospitals to be built and/or retrofitted to higher performance levels to remain fully functional

Retrofitting hospital structures is a time-consuming and lengthy process. In the meantime, Architectural Elements, Utility Systems, Equipment and Contents that comprise 70 percent of the structure of hospitals, should be retrofitted/built so that disruption of services can be avoided. This intervention (Table 9.20) can be undertaken with immediate effect.

Table 9.20: Activities to be undertaken under Outcome 5.3

Recommended Intervention	Activities	Timeline	Responsible Agencies
Architectural Elements, Utility Systems, Equipment and Contents in Hospitals	Retrofitting Architectural Elements, Utility Systems, Equipment and Contents in existing hospitals structures to new (higher) standards	Short - Medium Term	Lead: MoHFW/ State Govt.
	Designing and setting up Architectural Elements, Utility Systems, Equipment and Contents in new hospitals structures to new (higher) standards	Short - Term	Lead: MoHFW

In conclusion, it may be said that the National Disaster Management Guidelines on Hospital Safety are setting new standards for Hospitals in the country with the sole aim of protecting life and preventing the loss of valuable resources. And, to make these Guidelines implementable in the most logical and judicious manner possible, the National Action Framework on Hospital Safety has been developed. By following the systematic flow of activities given in the Action framework, the ultimate goal of “safer and functional hospitals” will be achieved.

Annexures – 1

Refers to Chapter 3

Table 3.1 Key Approaches and Activities for Awareness Generation for Hospital Safety

Target Group	Topics to be covered	Communication Approach	IEC material	Awareness Exercises
Hospital Administration & Management	<p>Sensitization on the need for hospital safety</p> <p>Awareness on vulnerability/risks</p> <p>Awareness on structural safety/ retrofitting/ hazard resistant construction</p> <p>Awareness on non structural safety measures</p> <p>Awareness on Fire Safety</p> <p>Awareness on training needs of health professionals</p> <p>Awareness on preparation of Hospital Disaster Management Plan</p> <p>Awareness on various regulations on hospital Safety Audits</p>	<p>Nondirective participatory communication, two-way communication to assess the situation and jointly define objectives and design strategy</p> <p>Education and Training, aimed at increasing knowledge and improving professional skills</p>	<p>Posters, Banners, Leaflets, Brochures on Hospital Safety</p> <p>Information material on Retrofitting, hazard safe construction practices (structural and non-structural)</p> <p>Presentations on Hospital Safety/Exit Routes/Hospital DM plan</p> <p>Advocacy materials (a) emergency preparedness; (b) epidemic and pandemic prevention and control; (c) disaster warning; (d) safety measures</p> <p>Training material on first-aid, preparation of DM Plans</p> <p>Hospital Safety Tool-kit</p> <p>Who can do what?</p> <p>Basic dos and don'ts during disasters</p>	<p>Using Annual Meetings/ Conferences as platform to talk about Hospital safety and distributing IEC Material</p> <p>Awareness Session for Hospital management on structural/non structural safety of hospitals with help of experts</p> <p>Awareness session on preparation of DM Plan</p> <p>Advocacy with stakeholders on elements of hospital safety</p> <p>Implementing safe structure features (structural and non-structural) to ensure facilities are strengthened, introducing mandatory certification for doctors/ staff in hospital safety trainings</p> <p>Publishing messages/ advertisement on hospital safety in magazines/journals</p>

Target Group	Topics to be covered	Communication Approach	IEC material	Awareness Exercises
				<p>Putting IEC material in the reception, hospital bulletin boards</p> <p>Information dissemination through state governments and community volunteers</p> <p>Appropriate training with provisions for clear roles, cooperation and accountability to be established and mock drills to be conducted regularly to test preparedness level</p> <p>Table Top exercises and demonstrative mock drills</p>
<p>Medical Professionals (Doctors, Nurses) and Paramedical Staff</p>	<p>Sensitization on need for hospital safety</p> <p>Awareness sessions on Disaster/ Emergency Response /Rescue, First-aid, trauma counseling</p> <p>Purpose of DM plans</p> <p>Mock drills</p> <p>Knowledge on various exit routes, Emergency numbers</p> <p>Use of Fire Extinguishers</p> <p>Awareness on different types of training as required for the medical professionals and paramedic staff</p>	<p>Information dissemination and campaigns, targeted dissemination of information to fill specific knowledge gaps</p> <p>Information, Education and Communication (IEC) , disseminating information through various forms of media such as knowledge products, newspapers, radio, television</p>	<p>Posters, leaflets, publicity material such as pens, jackets, caps with messages on hospital safety</p> <p>Training modules on disaster/emergency response and rescue, First-aid, Trauma Counseling</p> <p>Videos on Hospital Safety</p> <p>Posters on Exit routes/ Emergency Numbers</p>	<p>Awareness Sessions on basic life saving skills, trauma counseling</p> <p>Mock Drills</p> <p>Awareness sessions on basic dos and don'ts during disasters</p> <p>Launching mass awareness campaigns during functions/ doctor's day</p>

Target Group	Topics to be covered	Communication Approach	IEC material	Awareness Exercises
Students / teachers (Medical, engineering / architectural students)	<p>Sensitization on need for hospital safety</p> <p>Importance of Safe Structures</p> <p>Awareness on basic life saving skills</p> <p>Basic Dos and Don'ts during disasters</p>	<p>Information dissemination and campaigns, targeted dissemination of information to fill specific knowledge gaps</p> <p>Information, Education and Communication (IEC), disseminating information through various forms of media such as knowledge products, newspapers, radio, television</p>	<p>Posters</p> <p>Banners</p> <p>Leaflets</p> <p>Videos</p> <p>Develop modules/ courses with the help of professionals to incorporate emergency preparedness in to curriculum and integrate the knowledge and practice of safe health facilities (architecture and engineering courses)</p> <p>Basic dos and don'ts during disasters</p>	<p>Awareness Campaigns during annual day/College fairs</p> <p>Training session on life saving skills</p> <p>Street plays by students</p> <p>Awareness session on need for safe hospitals</p>
Policy Makers	<p>Sensitization on need for safe hospitals</p> <p>Advocacy on hospital safety so as to include it in larger development agenda of government</p>	<p>Advocacy, directed at improvising policies on safety of lifeline structures.</p>	<p>Posters</p> <p>Advertisements on Newspapers</p> <p>Tool-kit on Hospital Safety</p>	<p>Launching awareness campaign on hospital safety in association with concerned ministry</p> <p>Sensitization workshop of key stakeholders</p> <p>Presentations on good practices of other countries</p>

Annexures – 2

Refers to Chapter 4

Capacity Building for Hospital Managers

Hospital managers and members of Hospital Disaster Management Planning Committee (HDMPC) should extensively be trained to understand the basic concepts of healthcare disaster preparedness, roles of District/State/ National DM authorities and Emergency Management Exercises.

They should also keep an account of the unique need of healthcare systems faced with disasters (recent National and International), an analysis of what went right and what went wrong and understand whether these lessons could be interpreted in their institutional perspective.

The core areas of training should include but not limited to

1. Terminologies in Disaster Medicine
2. Hazard Vulnerability Analysis and use of HVA tool(s)
3. Overview of Hospital Incident Response System and Use of HIRS Templates & job action sheets (JAS).
4. Hospital Emergency Operation Planning
5. Disaster Management in the ICU
6. Managing Medical Operations in Disaster
7. Inter-agency Communication in Disaster
8. Handling Logistics in hospital disaster planning
9. Radiation & Nuclear Incident medical preparedness
10. Triage
11. Surge handling and surge capacity planning
12. Public Relation in healthcare setups during disasters
13. Crisis Communication in healthcare setups during disasters

14. Mental Well Being in Disasters
15. HR issues in disasters
16. Handling children & elderly in disasters
17. Disaster & Quality control
18. Business Continuity & Recovery
19. Hospital Evacuation
20. Setting up alternate care area and establishing crisis standard of care
21. Biological Incidents & Pandemics –Special needs
22. Chemical safety in healthcare
23. Handling Casualties in Disasters
24. Documentation in Disasters
25. Hospital Safety
26. Hospital to community approach to cluster based integration in DM
27. Disaster Drills, Table top exercises, Emergency management exercises (EMEx)

Each member; depending on the Job Action Sheets (JAS) as defined in the HDMP should at least undergo training and retraining as specified.

Level of Training	Description	Credit Hours	Course Name	Certification Validity (In Years)	QC Metrics and Monitoring
Basic (Awareness)	<ul style="list-style-type: none"> • Personal preparedness • Staff role within department 	8	Hospital Disaster Management (HDM) BASIC	2	Pre Test Post Test
Mid Level	<ul style="list-style-type: none"> • Leadership level within department • Department role within hospital 	24	HDM INTERMEDIATE	2	Pre Test Post Test Evaluation of independent completion of HVA Exercise Population of HIRS tree

Level of Training	Description	Credit Hours	Course Name	Certification Validity (In Years)	QC Metrics and Monitoring
					Group performance of Table top HIRS Exercise (1 external and 1 internal scenario)
Advanced Level	<ul style="list-style-type: none"> • Leadership level within hospital • Hospital role within community 	48	HDM ADVANCED	1	Pre Test Post Test Evaluation of independent completion of HVA Exercise Population of HIRS tree Group performance of Table top HIRS Exercise (2 external and 2 internal scenarios) Evaluation of Sample planning Performance Monitoring in a Hospital Drill

Annexures – 3

Refers to Chapter 4

Capacity Building Matrix for Doctors and Senior Nurses

Initial surge areas in an MCI consist of the Emergency Department (ED), Operating Room (OR), Post-Operative Care Unit (POCU) and Intensive Care Units (ICU). Staffing will need to be supported in these clinical treatment areas. Clinical and other support staff may also be required. It is within the higher acuity level treatment areas where dedicated staff may be needed to provide safe, quality care.

The training grid will also be guided by the type of disaster the hospital is anticipating as per hospital, District, State HVA. For example

Types of Medical and Nursing Staffing Needed per MCI Type														
MCI Category	Trauma Surgeon	General Surgeon	Orthopaedic Surgeon	Neurological	Thor Surgeon	Vacs Surgeon	Internal Medicine	Pulmonary	Infectious Disease	Paediatric	OB-GYN	Hem-Oncology	Radiation Oncology	Behavioural Health
Chemical				X			X	X		X	X	X		X
Bio							X	X	X	X	X			X
Radiological							X			X	X	X	X	X
Nuclear	X	X	X				X			X	X	X	X	X
Explosive	X	X	X	X	X	X	X	X		X	X			X
Cyclone	X	X	X	X		X	X	X		X	X			X
Flooding							X		X	X	X			X
Earthquake	X	X	X	X	X	X	X			X	X			X
Fire	X	X					X	X		X	X			X
Traffic Accident	X	X	X	X	X	X	X	X		X	X			X

Training on specific injuries / medical problems should also be guided by HVA report. For example

MCI Category	Blunt Trauma	Penetrating Trauma	Burns	Crush	Exacerbation of Chronic Disease	Gastrointestinal (GI) Illness	Respiratory Impact	Submersion Injury	Infected Wounds	Contaminated Wounds
Chemical			X				X			X
Biological					X	X	X		X	X
Radiological			X			X	X			X
Nuclear	X	X	X	X	X	X			X	X
Explosive	X	X	X	X			X		X	X
Cyclone	X	X		X	X	X	X	X	X	
Flooding	X	X					X	X	X	X
Earthquake	X	X	X	X	X	X	X		X	
Fire			X				X			
Plane Crash	X	X	X				X			
Bus Crash	X	X		X						
Traffic Accident	X	X	X	X			X			X
Mass Shooting	X	X								

The training needs should also be guided by the area in which the physician is assigned to. For example

Acuity Level	Staffing Capabilities
Red	Advanced Cardiac Life Support (ACLS) / Basic Life Support (BLS), Paediatric Advanced Life Support (PALS), Trauma certification and/or ED experience; Critical Care Certification and/or experience.
Yellow	ACLS (preferred but not required); BLS; Speciality experience if needed (psychosocial support, paediatrics, Obstetrics (OB), other)
Green	Basic Life Support (BLS); Speciality experience if needed (paediatric, obstetric, wound, orthopaedic, other).

Each physician depending on the Job Action Sheets (JAS) as defined in the HDMP should also undergo training and retraining as specified.

TRAINING COMPONENT	Hospital Incident Response (HIRS)	Information, Communication and documentation	Triage	Surge Capacity and handling	Continuity of Essential Services	Psychosocial First Aid
DOCTORS						
Emergency Medicine	✓	✓	✓	✓	✓	✓
Intensivist	✓	✓		✓	✓	✓
General Surgeons		✓		✓	✓	✓
Neurosurgeons		✓		✓	✓	✓
Orthopedic Surgeons		✓		✓	✓	✓
Anesthesiologist	✓	✓	✓	✓	✓	✓
Internists	✓	✓	✓	✓	✓	✓
Mental Health		✓				✓
Radiologist				✓	✓	
Hospitalists	✓	✓	✓	✓	✓	✓
OBGYN		✓		✓	✓	✓
Pediatrics		✓		✓	✓	✓
Junior Doctors		✓	✓	✓	✓	✓

Annexures – 4

Refers to Chapter 4

Knowledge and Skill Matrix of Nurses and Support Staff

Nurses

Training Component	Hospital Incident Response (HIRS)	Information, Communication And Documentation	Triage	Basic Life Support	Advanced Life Support	Continuity Of Essential Services	Trauma Care And Blood Bank Training
NURSES							
Basic Level		✓	✓	✓		✓	
Intermediate Level		✓	✓	✓	✓	✓	✓
Highest Level	✓	✓	✓	✓	✓	✓	✓

Housekeeping Staff

TRAINING COMPONENT	Hospital Incident Response (HIRS)	Communication	First Aid, immobilization and transport of injured	Basic Life support
House keeping staff				
Basic Level		✓	✓	✓
Intermediate Level		✓	✓	✓
Highest Level	✓	✓	✓	✓

Security

TRAINING COMPONENT	Hospital Incident Response (HIRS)	Information and Communication	Crowd and traffic management	Basic Life support	Fire fighting and rescue training	Intrinsic co-ordination
SECURITY						
Basic Level		✓	✓	✓		✓
Intermediate Level		✓	✓	✓	✓	✓
Highest Level	✓	✓	✓	✓	✓	✓

Annexures – 5

Refers to Chapter 6

Building Information Form

The Building Information Form shall include the following information:

- a) Building addressPin Code
- b) Owner or person in-charge of building — Name, Address and Telephone Number.
- c) Fire Safety Officer and Deputy Fire Safety Officer Name and Telephone Number.
- d) Certificate of occupancy. Location where posted, or duplicate attached.
- e) Height, area, class of construction
- f) Number, type and location of fire stairs and/ or fire towers
- g) Number, type and location of horizontal exits or other areas of refuge.
- h) Number, type, location and operation of elevators and escalators.
- i) Interior fire alarms, or alarms to central stations.
- j) Communications systems and/or walkie talkie, telephones, etc.
- k) Standpipe system; size and location of risers, gravity or pressure tank, fire pump, name of employee with certificate of qualification and number of certificate.
- l) Sprinkler system; name of employee with Certificate of Fitness and certificate number. Primary and secondary water supply, fire pump and areas protected.
- m) Special extinguishing system, if any, components and operation.
- n) Average number of persons normally employed in building. Daytime and night time.
- o) Average number of handicapped people in building. Location. Daytime and night time.

- p) Number of persons normally visiting the building. Daytime and night time.
- q) Service equipment such as:
 - i. Electric power, primary, auxiliary;
 - ii. Lighting, normal, emergency, type and location;
 - iii. Heating, type, fuel, location of heating unit;
 - iv. Ventilation — with fixed windows, emergency means of exhausting heat and smoke;
 - v. Air-Conditioning Systems — Brief description of the system, including ducts and floors serviced;
 - vi. Refuse storage and disposal; Fire-fighting equipment and appliances,
 - vii. other than standpipe and sprinkler system; and
 - viii. Other pertinent building equipment.
- r) Alterations and repair operations, if any, and the protective and preventive measures necessary to safeguard such operations with attention to torch operations.
- s) Storage and use of flammable solids, liquids and/ or gases.
- t) Special occupancies in the building and the proper protection and maintenance thereof. Places of public assembly, studios, and theatrical occupancies.

Annexures – 6

Refers to Chapter 6

Instructions for Fire Safety for Hospital Staff

Instructions for Personal Safety

All Hospital Staff should know:

- (1) The location of MOEFA push button fire alarm boxes. They should read the operating instructions.
- (2) Location of the fire extinguishers, hose reel, etc. provided on their respective floors.
- (3) The nearest exit from their work area,
- (4) Their assembly point.

Matters to be reported to the Fire/Deputy Fire Warden

- (1) If any exit door/route is obstructed by loose materials, goods, boxes, etc.
- (2) If any staircase door, lift lobby door does not close automatically, or does not close completely.
- (3) If any push button fire alarm point or fire extinguisher is obstructed, damaged or apparently out of order.

Instructions for Fire Incidents

During any fire incident in the hospital premises, staff should:

- (1) Break the glass of the nearest fire alarm (if they are the first ones to discover the fire)
- (2) Attack the fire with fire extinguishers/hose reel provided on the floor (after taking guidance from the Fire Warden)
- (3) Evacuate, as directed by the fire warden.

Annexures – 7

Refers to Chapter 8

Accreditation Standards-Useful Resources and Tools

NABH Accreditation Standards addresses all the requirements related to hospital safety, risk management, disaster planning, monitoring and evaluation under various chapters. These standards provide a framework for quality assurance and quality improvement and focus on patient safety, employee safety, community and environment safety and quality of patient care.

NABH Accreditation Standards for Hospitals 3rd Edition in a Nutshell contains 636 Objective Elements under 102 Standards.

The standards encompass patient safety aspects in all the 10 chapters. However, the chapter on Facility Management & Safety (FMS) provides criteria for implementation of Emergency Management Plans. The intent of this Chapter FMS is to provide safe and secure environment for patients, development and implementation of Plans for emergencies within the facilities and the community and well established Program for clinical and support service equipment and management. Standard FMS 6, FMS 7 & FMS 8 include requirements for developing, maintaining, and implementing a comprehensive Emergency Operations Plan that covers the critical areas in emergency management.

Emergency Response capacity and Preparedness of a hospital can be achieved by complying with NABH Accreditation Standards.

The accreditation standard through various chapters covers following aspects of disaster mitigation and management:

S.No	Action	NABH Chapter
4.1	Current disaster planning strategy	FMS
4.2	Regular Testing and Evaluation of the Plan	CQI
4.3	Resources and Assets	ROM

S.No	Action	NABH Chapter
4.4	Staff Responsibilities	HRM
4.5	Patient and Clinical Support Activities	AAC & COP
4.6	Blood transfusion resources	COP
4.7	Communication	IMS
4.8	Transport availability	COP

NABH Accreditation Standards and objective elements specifically related to aforementioned topics are divided into two categories **Standards specific to Disaster Management** and **Associated standards for effective implementation of Disaster management plans and strategy**. They are as follows:

Standards Specific to Disaster Management:

NABH Standards and objective elements of Chapters namely Facility Management & Safety (FMS) and Continuous Quality Improvement (CQI) directly focuses on Emergency response and management including disaster management and relevant indicators and their monitoring to check the compliance to these standards on continuous basis.

The standards and objective elements ensuring the compliance to Current disaster planning strategy and Regular Testing and Evaluation of the plan are as following:

The Associated Standards for Effective Implementation of Disaster Management Plans and Strategy.

These Standards are from Chapters Care of Patient (COP), Responsibility of Management (ROM), Human Resource Management (HRM), Information Management System (IMS) etc.

Compliance to these standards ensures that essential requirements for Disaster mitigation and management like availability of Resources and assets, Staff trainings on roles and responsibilities during emergency, availability of patient and clinical support activities, Transport Facility, Blood transfusion facility and management and communication facilities required are available in the HCO.

Standards also ensure that the organization timely and regularly tests the availability of these resources for effective implementation when the disaster strikes.

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When the criteria indicated in the above standards are less stringent than those specified in this document, *the requirements stated in this Guideline shall govern.*

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(Jan 2012 - April 2014)

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10. Prof. C.V.R. Murty, Department of Civil Engineering, IIT Madras, Chennai-600036
11. Prof. Ravi Sinha, Department of Civil Engineering, IIT Mumbai, Powai, Mumbai - 400076
12. Dr. D.K. Paul, Department of Earthquake Engineering, IIT Roorkee,, Uttarakhand.
13. Mr. Hari Kumar, National Coordinator, Geo Hazards Society, New Delhi
14. CEO, HSCC (Hospital Service Consultancy Corporation Limited)

15. DG, CPWD or Representative, CPWD-A-Wing, Room No-111, Nirman Bhawan, New Delhi-110011
16. Dr. Shakti Gupta, Hospital Administration Department, AIIMS, New Delhi-110029
17. DG Armed Forces Medical Services, Ministry of Defence, M-Block, New Delhi-110001
18. Director Fire Services Welfare.
19. Director College of Fire Services, Nagpur.
20. Dr. V.K. Ramtake, DG, Medical Services, Ministry of Railways, Railway Bhawan, Rafi Marg, New Delhi.
21. Director, Fire Services, Shankar Market, Cannuaght Place, New Delhi - 110001
22. Director College of Fire Services, Palm Road, Civil Lines, Nagpur-440001
23. Medical Superintendent, Ram Manohar Lohia Hospital, New Delhi
24. Dr. Subhash Solanki, Ex DG, Health, Maharashtra
25. Principal Secretary (Health)/DG, Health Services State of Maharashtra/Andhra Pradesh/Chennai/West Bengal
26. Dr. R.K. Srivastava, Sr. Policy Analyst, National Institute of Health and Family Welfare, New Delhi
27. Dr. Kavita Narayan, Associate Head, Hospital Services Unit, Public Health Foundation of India, New Delhi
28. Dr. Girdhar J. Gyani, C.E.O. National Accreditation Board for Hospital and Healthcare Providers, New Delhi
29. Dr. J.K. Das, Director, National Institute of Health and Family Welfare, New Delhi
30. Maj. Gen (Retd.) M.A. Naik
31. Lt Col. Manish Mehrotra, Classified Spl. Military Hospital, Shillong.
32. Medical Superintendent, E.S.I.C. New Delhi.
33. Joint Secretary, Indian Red Cross Society, New Delhi.
34. Medical Superintendent, Lok Nayak Jai Prakash Hospital New Delhi
35. Dr. Tamorish Kole, Max Super Specialty Hospital, West Wing. Saket, New Delhi
36. Dr. Raman Sardana, Additional Medical Director, Indraprastha Apollo Hospitals, New Delhi
37. Medical Director, Fortis Escorts Heart Institute, New Delhi

38. Medical Director, Medanta – The Medicity Hospital, Gurgaon, Haryana
39. Medical Superintendent, BARC Hospital, Chembur, Mumbai.
40. Prof. Anil K. Gupta, Medical Superintendent, Postgraduate Institute of Medical Education and Research, Chandigarh.
41. Medical Director, Sir Ganga Ram Hospital, New Delhi
42. Medical Superintendent, Christian Medical College, Vellore
43. Medical Superintendent, Nizam's Institute of Medical Sciences, Hyderabad.
44. DG BIS

Contact Us

For further information on *Guidelines* on Hospital Safety,

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