



Government of the People's Republic of Bangladesh

National Earthquake Contingency Plan

**Disaster Management Bureau (DMB)
Ministry of Food and Disaster Management (MoFDM)**

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Executive Summary

The overall goal of the Contingency Planning Process will be to develop a comprehensive geo-hazard risk reduction “Contingency Planning” strategy that is linked to an easy implementation framework. The framework should be able to address the current needs and issues, which would be implementable at all levels from national, city and agency levels and cover all the phases of disaster risk management from preparedness to response.

The project on Contingency planning with regard to earthquake hazard is comprised of two main Tasks:

- *Task I:* Determine status of contingency planning and design of interim contingency plan
- *Task II:* Turn interim contingency plans into final versions (using maps for selected urban areas that highlight earthquake-vulnerable school/hospital/emergency response and control buildings etc.)

Planning requires the active participation of the stakeholders in planning stage as well as in implementation stage of activities including the post- disaster stage when a review process to be undertaken to identify the effectiveness of plan operations and new challenges. Time becomes more valuable once an emergency occurs, so planning before the emergency is very important, when workloads may be less and institutions involved are more flexible in accommodating the needs. Earthquake happens without any early warning and although stakeholder community in Bangladesh is quite capable of responding to events such as floods, cyclones etc, there is a need for conducting contingency planning in advance. One reason for conducting contingency planning is because it will facilitate a ***rapid emergency response*** by allowing planners more time for advance preparedness measures for response. In advance of an earthquake emergency the planners will be able to:

- Consider different risk scenarios to identify spatial planning needs to suit the distribution of risk
- Consider the likely consequences of an emergency before it occurs
- Conduct capacity assessment to Identify the key resources, both human and physical, which may be available to respond to the emergency
- Identify the critical areas for immediate action
- Build and train the emergency response teams in advance
- Define the policy changes/revisions, new strategies and approaches for responding to emergency in advance

All of these measures allow constructive intervention immediately after the emergency. Team building is particularly useful, as the ability to act as a team may be critical to the success of the initial emergency response. Another benefit to contingency planning is that, before an emergency, there is comparatively more time

to consider all the aspects of problems that are likely to arise. Once the emergency has occurred, it may be very difficult to bring all of the players together to discuss the needs. Agreement on policies in the contingency planning stage may help clarify applicability and resolve contradictions that may occur. It will help in filling the policy gaps in providing institutional mandates where needed. **Rapid decision making** on operational issues after an emergency is important because delays may cost lives.

The Contingency Planning also serves as a tool for ***maintaining control over events or limiting the risk of loss of control***. Because of the scale of the problems that they pose, earthquakes sometimes provoke erratic or unpredictable responses. Well-intentioned but ill-equipped agencies may rush to help, leading some agencies to over-react to the emergency. The risk of inappropriate responses is much lower when clear plans are in place. The contingency planning process also allows identification of projected needs that may arise as a result of an emergency and the resources that will be immediately available to meet those needs. One benefit of a realistic contingency plan is that it may encourage donors and other development agencies to make arrangements to supplement additional resources for enhancement of available resource base of the agencies involved in plan implementation.

Although the objective of contingency planning is usually the production of a contingency plan, many useful outputs of contingency planning come from the ***process*** through which the plan is developed. Therefore, there are many advantages in a plan prepared through a participatory process through involvement of all major potential actors, agreeing on the broad policies and working groups filling the details of the plan. The final measure of the success of contingency plan should not be a Plan. It does not mean that the plan is not important but the plan should not be a rigid one. The plan should be a measure of the quality of the process and success indicator essentially should be the process as a good planning process will result in a good plan. Even though the earthquake that occurs may be very different from the one planned for, the plan will still be useful. A good contingency plan ensures better preparedness for any emergency that may occur, even one that is very different from the scenario in the plan.

General Aspects of National Earthquake Contingency Plan

1.1 The need for National Earthquake Contingency Plan

The earthquake risk of the urban centre is growing with every passing moment because of the unabated growth of human settlement and industrial and other economic activities. The rapid increase in vulnerability of urban areas is evident from the rapid urbanization, population growth in most of large urban centers, population migration and development of major economic zones in and around major cities like Dhaka, Chittagong; one of the major causes behind such ever increasing earthquake risk being the haphazard urbanization and sub-standard construction of buildings, residential houses and other infrastructures without any consideration of underlying earthquake hazards. Major reclamation efforts in and around Dhaka increases the potential for liquefaction. During sustained strong shaking, poorly consolidated, water saturated sediments can liquefy and loose their ability to support loads. The foundations and supports of structures built on liquefiable sediments can fail, causing damage or destruction during major earthquakes. Much of the country is of loose sandy soil and most of it remains in saturated condition round the year, thereby increasing the vulnerability to liquefaction in case of sustained ground motions. Possibility of fire outbreaks in an event of an earthquake as a secondary hazard is another source related to possible high economic losses.

On the Contrary, present capacities in disaster management in Bangladesh are largely centered on emergency response and post disaster recovery, which is evident from the flood and cyclone events of high magnitude. But there is a need for a comprehensive geo-hazard risk reduction “Contingency Planning” strategy for low frequency high magnitude events, which occur without warning. Such Contingency Planning efforts should be linked to an easy implementation framework to be able to address the related issues.

Government and Institutional structures, policy and legal framework are some vital features in ensuring clear delineation of aspects of contingency plan preparation and implementation. This is an important step towards longer-term investment in plan preparation and in effective implementation. To achieve further benefits from such an endeavour appropriate spatial planning at all levels is also needed to ensure that the disaster preparedness is considered early on in the physical planning process. Review of existing legislations and present organizational structure for natural disaster reduction policy making is essential for addressing the need for simplification of procedures, identify future planning strategies and to identify immediate response actions for their effective implementation.

In these circumstances, a Contingency Plan is needed for ensuring better response towards earthquake hazard. ***Contingency Planning is a forward planning process, in a state of uncertainty, in which scenarios and objectives are agreed, managerial and technical actions defined, and potential response systems put in place in order to prevent, or better respond to, an emergency or critical situation.***

Realizing this, the Ministry of Food and Disaster Management (MoFDM) through the Comprehensive Disaster Management Program (CDMP) is implementing a project on “Earthquake Risk Assessment and Preparedness in Dhaka, Chittagong and Sylhet City Corporation areas”, which is supported by UNDP, UK Department for International Development – Bangladesh (DFID-B) and the European Commission (EC). In August 2006, the European Commission signed a contribution agreement

with UNDP Bangladesh for providing technical assistance to facilitate the preparation of earthquake risk assessments and contingency plans within Dhaka, Chittagong and Sylhet cities. The development of contingency plan for earthquake hazard preparedness and mitigation is assisted by Asian Disaster Preparedness Center (ADPC) in association with the National Society for Earthquake Technology – Nepal (NSET) that aims at developing a comprehensive geo-hazard risk reduction “Contingency Planning” strategy that is linked to an easy implementation framework by accomplishing the following two Tasks as shown in the Box 1.

Contingency Planning Tasks

- *Task I: Determine status of contingency planning and design of interim contingency plan*
- *Task II: Turn interim contingency plans into final versions (using geo-hazard vulnerability map)*

Box 1

1.2 Legal provisions, authority and planning responsibility for development and implementation of the National Earthquake Contingency Plan

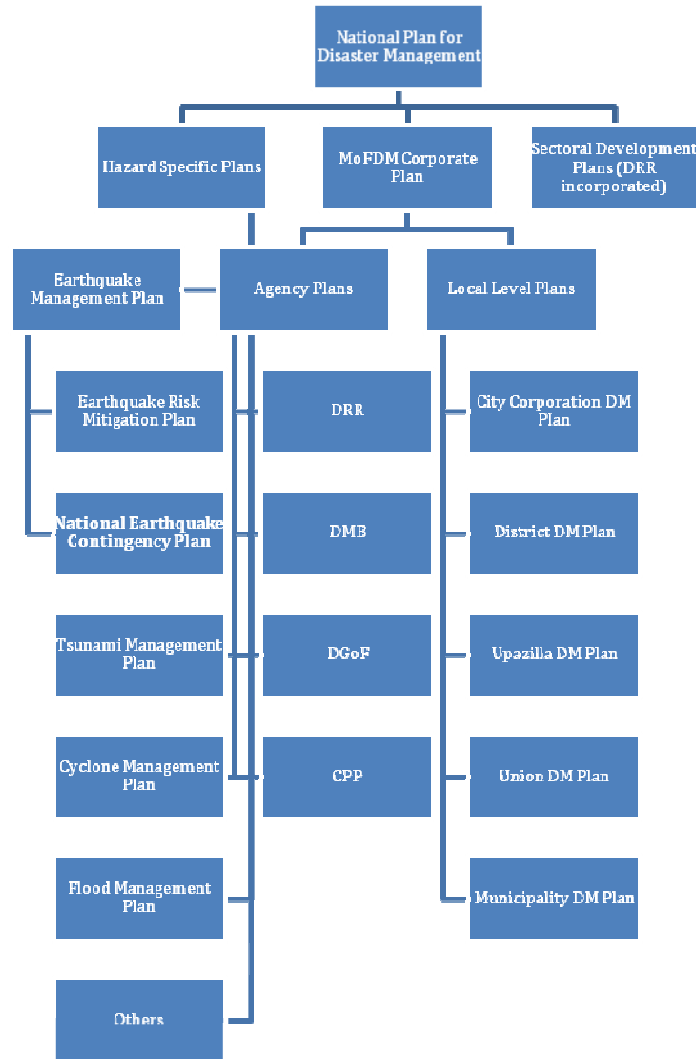
According to the Standing Orders on Disaster (SOD), Disaster Management Bureau under Ministry of Food and Disaster Management (MoFDM) is responsible for:

- Advising the government on all matters relating to disaster management;
- Maintaining liaison with different government agencies, aid-giving agencies, NGOs and Voluntary Organizations and ensure their maximum cooperation and coordination in all matters of disaster management;

Under this mandate, the Disaster Management Bureau developed the draft National Plan for Disaster Management 2008-2015, where a Disaster Management Planning Framework has been incorporated. Within this framework, there are a few hazard-specific management plans, such as Earthquake Management Plan. It is also indicated that this type of plans is multi-sectoral and being divided into two components: risk reduction and emergency response. The earthquake contingency plans at different levels (national, city and agency levels) have been prepared under the broad framework of the above legal provisions and plans; and are meant for enhancing the effectiveness of earthquake emergency response.

Given the existing situation, the National Earthquake Contingency Plan can be incorporated into the overall disaster management planning framework that is presented below:

Figure 1.1 Disaster Management Planning Framework in Bangladesh



Given the national regulative framework, it is envisaged that, the National Earthquake Contingency Plan would address emergency response phase of Earthquake Management Plan that would act as a complementary plan to implement National Plan for Disaster Management.

1.3 Aim of the National Earthquake Contingency Plan

The Aim of the National Earthquake Contingency Plan is to create an efficient and effective collaborative national approach to National Earthquake Emergency Response & Management at all levels with the participation of all stakeholders

considering seismic hazard which has a potential to create an impact within Bangladesh of various magnitudes and intensity.

Optimization of efforts by First Responder Org. in order to:

1. Save lives
2. Provide humanitarian assistance
3. Restoring the lifeline facilities and utilities to bring normalcy within a fastest possible time

Box 2

National Earthquake Contingency Plan Promotes

1. Appropriate command and control mechanism
2. Efficient, effective collaboration & coordination,
3. Partnerships,
4. Trust, mutual respect and understanding among all stakeholders,
5. Arrangements for sharing of resources and experience that will result in a highest level of safety and security of citizens of Bangladesh

Box 3

Through this planning it is aimed at developing process to ensure maximum utilization of available resources, optimisation of efforts by first responder organization in order to do following as shown in Box 2.

A strong National Earthquake Contingency Plan is considered to be a one that is built on a foundation for DRM that promotes following as shown in Box 3.

1.4 Goal and Objectives of National Earthquake Contingency Plan

The ultimate goal of this earthquake contingency plan is to minimize adverse effects (loss of lives and properties, damage and disruption of critical facilities etc.) of potential earthquakes in Bangladesh by establishing and implementing a system of preparedness activities through efficient and effective contingency planning process.

Following major objectives are envisioned to achieve the goal:

- Establish a comprehensive geo-hazard risk reduction “Contingency Planning Strategy” that is linked to an easy implementation framework by ensuring appropriate spatial planning at all levels so that disaster preparedness is considered early on in the decision planning process.
- Define Earthquake Contingency Management relationships at all levels of government and create effective coordination mechanisms among all stakeholders at all levels
- Identify the earthquake contingency management roles and responsibilities of Ministry of Food and Disaster Management, DMB, first responder organizations, humanitarian assistance providers, life line and utility agencies, at national, city and agency levels based on their existing mandates, and assigned duties and responsibilities for disaster response

- Provide an organizational structure to integrate those roles and responsibilities into a collaborative national capability to facilitate preparedness, response and recovery to ensure management of earthquake emergencies
- Establish and maintain a fully operational contingency planning process with necessary manpower and resources and ensure clear delineation of the process for contingency plan preparation, review , revision within government and other relevant institutional structures

Following are additional objectives:

- Define the tasks that support the National Disaster Management System, such as vulnerability and risk assessment, data base management, partner relationships, capacity building, public awareness creation for mainstreaming disaster management into development practice
- Help enhance essential support services such as Emergency Operations Center, S&R capacities, Medical First Responder teams, procurement of rescue equipment, establishment of emergency services, training and education opportunities etc.
- Institutionalize an operational Incident Command System (ICS), organizational structure for earthquake emergency management and the concept of operations be incorporated in all Disaster Preparedness and Response Plans, Standing Orders on Disasters as a first step in establishing the National Contingency Management System (NCMS) in Bangladesh
- Extend the organizational structure to facilitate coordination with Academia, NGOs, INGOs, media, private sector and donor agencies etc. to support an effective, contingency management capacity

- *Adopt a comprehensive geo-hazard risk reduction “Contingency Planning” strategy that is linked to an easy implementation framework by ensuring appropriate spatial planning at all level so that disaster preparedness is considered early on in the decision planning process.*
- *Establish and maintain a fully operational contingency planning process with necessary manpower and resources*
- *Define the mandates of the Ministry of Food and Disaster Management, DMB, First Responder agencies, support agencies such as line departments, relevant other ministries and institutions, NGOs and private sector to ensure undertaking earthquake emergency management tasks and enhance the National Level capability for meeting any type of emergency situations arising due to occurrence of an earthquake and potential collateral hazards, after shocks etc, irrespective of organizational responsibilities.*
- *Create an effective coordination mechanism among all stakeholders at all levels*
- *Enhance essential support services such as Emergency Operations Center, Development of S&R capacity, Medical First Responder teams, procurement of rescue equipment, Establishment of Emergency Services, training and education opportunities etc.*
- *Institutionalize an operational Incident Command System (ICS), organizational structure for earthquake emergency management and the concept of operations be incorporated in all Disaster Preparedness and Response Plans, Standing Orders on Disasters as a first step in establishing the National Contingency Management System (NCMS) in Bangladesh*
- *Establish functioning mechanism to facilitate technical assistance to help other levels of administration to adopt the National Earthquake Contingency Plan and prepare Contingency plans to complement the Emergency Operations Plans at all levels including community*
- *Prepare and deliver training and education programs to support the development and implementation of Earthquake Contingency Plans at all levels*

1.5 Scope of the National Earthquake Contingency Plan

This plan details *Emergency Response Functions* immediately following a damaging earthquake. It describes the **response system** in place for responding to the situation created and needs required due to the event of a major earthquake in Bangladesh, and also describes a holistic **response structure**, which should be activated from the national level to the affected community. It also provides a **framework for coordination and optimum utilization** of national resources and **mechanism for obtaining support** as arranged by the government, from internal organizations (such as from ministries, line agencies, departments, NGOs, private sector etc.) and international assistance. It covers four specific areas respectively as given below.

- General information that identifies legal provision, authorities & responsibilities, planning objectives and scope for response in the situation related to earthquake hazard;
- Coordination mechanism and extended functions of relevant agencies for the specific earthquake response within the authority of the government. The Response structure is divided into 9 functional clusters and each cluster is headed by one institution and supported by several institutions. It outlines the SOPs, tasks to be accomplished by the respective institutions (ministries and agencies,) and the type of support to be provided to them by others at the national level;
- Support interventions needed for plan implementation;
- Reporting structure for Readiness by concerned first responder institutions

The Contingency Plan for each functional cluster also identifies the preparedness actions to be carried out for better response during the earthquake events (during the pre-disaster period) and review process and actions for planning for long term recovery (during the post disaster period).

1.6 Planning Assumptions

This national earthquake contingency plan has been developed with following assumptions in the background:

- Earthquakes are impact type events and provide no warning preventing any pre-event response activities
- Earthquakes within the three cities of Dhaka, Sylhet and Chittagong will cause large numbers of deaths and injuries and extensive damage and destruction of buildings, emergency facilities and infrastructure as outlined in Chapter 1 of this plan
- There is likelihood of secondary effects following an earthquake or aftershocks which may include tsunami, fire, flood, liquefactions, subsidence, damming of rivers, landslides, and dam failure, release of hazardous and toxic chemicals

- Strong aftershocks will continue for several days resulting in further building collapse
- Large numbers of persons (hundreds of thousands) will be in need of shelter, welfare, relief assistance, medical care etc
- Access will be severely restricted due to debris, landslides, collapsed bridges etc.
- Many national and international response and humanitarian organizations other than the government institutions will also be involved during response and recovery to earthquake disaster

1.7 Plan Implementation Strategies

The following strategy will be adopted in plan implementation as shown in Box 5:

- *Set up a system for regular reporting and updates on the readiness of first responder institutions*
- *Plan & development of national capabilities to translate earthquake risk reduction into Preparedness and Response Plans*
- *Establish a consistent, collaborative national approach to the Mitigation of impacts of earthquake disasters*
- *Propose a mechanism to integrate disaster management into national education system*
- *Propose a mechanism to build the capacity of government and non-government partners by providing training and education on earthquake risk reduction*
- *Develop a mechanism to improve the relationships among government and non-government organizations during preparedness, response and recovery phases*
- *Transfer knowledge and state of the art of technologies necessary to support institutional operations and implement operations plans*
- *Ensure a system for linking contingency planning process with the earthquake hazard and risk assessment system and studies*
- *Ensure continued functioning and monitoring of the contingency planning process established during the development of this national earthquake contingency plan*
- *Develop plans, programs and establish mechanisms for raising awareness of common people, professionals and authorities on earthquake contingency plans to ensure wide dissemination and effective implementation*

Box 5

1.8 Plan Limitations

- The National Earthquake Contingency Management plan will not, and cannot, address all circumstances
- Bangladesh is prone to many other types of hazards such as floods, cyclones etc and National Earthquake Contingency Management plan should be incorporated with other Contingency Management plans to create a Multi-hazard contingency management framework.
- The Plan assumes that the line agencies will have mandatory provisions and national capacity to deal with assigned tasks. Mandatory provisions for First Responder Organizations, line agencies, ministries, local governments, District authorities etc has to be granted through appropriate policy and legal instruments.
- The National Earthquake Contingency plan requires a complementary planning process at other levels of administrative bodies (i.e Upazila, Union, Community level) of the government. While respective agencies need to have dedicated champions to undertake planning and implementation, the DMB under the Ministry of Food & Disaster Management will have a difficult task in coordinating and providing technical assistance unless its capacity is strengthened.
- The relevant Ministries are responsible for provision of resources to carry out earthquake emergency management functions by relevant institutions. Especially institutions involved may need additional resources in terms of qualified manpower, technical as well as financial resources to undertake assigned tasks.
- The National Earthquake Contingency Management process is linked to a specified time lag to become fully functional as an integrated system
- The Plan requires that the National Emergency Operations Center is to be established on priority basis to have service functions for a 24/7 schedule with duty officers in place with clearly identified notification protocols.
- The Plan cannot ensure that emergency assistance to communities will arrive in time following a rapid on-set disaster such as earthquake unless the government will have emergency declarations in time. It will depend on effective emergency management system which depends on application of advanced state of the art technology.
- Capable and committed staff with appropriate financial resources, facilities, equipment and supplies is required to implement an effective, long-term program based on the Action Plan.

1.9 Intended Users of the Plan

The direct users of this National Earthquake Contingency Plan will be the first, second as well as third level Responder Organizations in order to save human-lives, provide humanitarian assistance, and restore the lifeline facilities and utilities respectively.

The term 'First Responder' refers to those institutions and individuals who in the early stages of an incident are responsible for the protection and preservation of life, property, and the environment, including emergency response providers as well as emergency management, search and rescue, fire safety, public health, clinical care, and other skilled support personnel

(such as equipment operators) that provide immediate support services during emergency operations. In this contingency planning process, the following agencies are identified as First Responder Organizations as shown in Box 6.

First Responder Organizations

- *Armed Forces Division (AFD)*
- *Fire Service & Civil Defense (FSCD)*
- *Directorate General of Health Services (DGHS)*
- *Disaster Management Bureau (DMB)*
- *Department of Relief and Rehabilitation (DRR)*
- *City Corporations*

Box 6

In addition to above, the second level will consist of the utility and life line institutions (water supply, electricity, gas supply, telecommunications, waste disposal etc) transportation systems (road, air, rail, and sea), Para military forces and Police which will be engaged in security, law and order functions. Third Responder Organizations are the others such as line Ministries, Departments, City Authorities, NGOs/ INGOs, electronic and paper Media, Community Based Organizations (CBOs), Civil Society Organizations (CSOs), Academia, Development Partners will be the passive users of the plan as they will be providing support services for plan implementation. The ultimate beneficiaries would be the communities at risk to bring normalcy within a fastest possible time.

Earthquake Threat and Possible Scenarios in Bangladesh with Special Reference to Dhaka, Chittagong and Sylhet City

2.1 Introduction

Over the past decades, urbanization in Bangladesh has been rapidly taking place without proper guidance. As a result many of the urban centers have developed haphazardly. These urban centers are fast growing and influence the economic developments of the country. It is therefore essential to have a realistic understanding on the nature, severity and consequences of likely damage/loss that a possible event of earthquake could cause. A strong earthquake affecting a major urban center like Dhaka, Chittagong, or Sylhet may result in damage and destructions of massive proportions and may have disastrous consequences for the entire nation.

Geographically Bangladesh is located close to the boundary of two active plates: the Indian plate in the west and the Eurasian plate in the east and north. In the past there were several earthquakes that caused severe damages to life and properties. Some of the major earthquakes around the region includes the 1548 earthquake, the 1664 earthquake, the 1762 earthquake, the 1869 Cachin earthquake (Ms 7.5), the 1885 Bengal earthquake (Ms 7.0), the 1897 Great Assam earthquake (Ms 8.1), and the 1918 Srimangal earthquake (Ms 7.6) (Earthquake in website “Banglapedia”; Oldham, 1883; Ambraseys, 2004; Bilham and Hough, 2006 etc). Following is a list of major earthquakes in and around Bangladesh.

Table 2.1 Earthquakes in Bangladesh

Year	Description of the Earthquake
1548	The first recorded earthquake was a terrible one. Sylhet and Chittagong were violently shaken, the earth opened in many places and threw up water and mud of a sulphurous smell.
1642	More severe damage occurred in Sylhet district. Buildings were cracked but there was no loss of life.
1663	Severe earthquake in ASSAM , which continued for half an hour and Sylhet district was not free from its shock.
1762	The great earthquake of April 2, which raised the coast of Foul island by 2.74m and the northwest coast of Chedua island by 6.71m above sea level and also caused a permanent submergence of 155.40 sq km near Chittagong. The earthquake proved very violent in Dhaka and along the eastern bank of the MEGHNA as far as Chittagong. In Dhaka 500 persons lost their lives, the RIVERS and JHEELS were agitated and rose high above their usual levels and when they receded their banks were strewn with dead fish. A large river dried up, a tract of land sank and 200 people with all their CATTLE were lost. Two volcanoes were said to have opened in the Sitakunda hills.
1775	Severe earthquake in Dhaka around April 10, but no loss of life.
1812	Severe earthquake in many places of Bangladesh around May 11. The earthquake proved violent in Sylhet
1865	Terrible shock was felt, during the second earthquake occurred in the winter of 1865, although no serious damage occurred.
1869	Known as Cachar Earthquake. Severely felt in Sylhet but no loss of life. The steeple of the church was shattered, the walls of the courthouse and the circuit bungalow cracked and in the eastern part of the district the banks of many rivers caved in.
1885	Known as the Bengal Earthquake. Occurred on 14 July with 7.0 magnitude and the epicentre was at Manikganj. This event was generally associated with the deep-seated Jamuna Fault.
1889	Occurred on 10 January with 7.5 magnitude and the epicentre at Jaintia Hills. It affected Sylhet town and surrounding areas.
1897	Known as the Great India Earthquake with a magnitude of 8.7 and epicentre at Shillong

Year	Description of the Earthquake
	Plateau. The great earthquake occurred on 12 June at 5.15 pm, caused serious damage to masonry buildings in Sylhet town where the death toll rose to 545. This was due to the collapse of the masonry buildings. The tremor was felt throughout Bengal, from the south Lushai Hills on the east to Shahbad on the west. In Mymensingh, many public buildings of the district town, including the Justice House, were wrecked and very few of the two-storied brick-built houses belonging to ZAMINDARS survived. Heavy damage was done to the bridges on the Dhaka-Mymensingh railway and traffic was suspended for about a fortnight. The river communication of the district was seriously affected (BRAHMAPUTRA). Loss of life was not great, but loss of property was estimated at five million Rupees. Rajshahi suffered severe shocks, especially on the eastern side, and 15 persons died. In Dhaka damage to property was heavy. In Tippera masonry buildings and old temples suffered a lot and the total damage was estimated at Rs 9,000.
1918	Known as the Srimangal Earthquake. Occurred on 18 July with a magnitude of 7.6 and epicentre at Srimangal, Maulvi Bazar. Intense damage occurred in Srimangal, but in Dhaka only minor effects were observed.
1930	Known as the Dhubri Earthquake. Occurred on 3 July with a magnitude of 7.1 and the epicentre at Dhubri, Assam. The earthquake caused major damage in the eastern parts of Rangpur district.
1934	Known as the Bihar-Nepal Earthquake. Occurred on 15 January with a magnitude of 8.3 and the epicentre at Darbhanga of Bihar, India. The earthquake caused great damage in Bihar, Nepal and Uttar Pradesh but did not affect any part of Bangladesh.
	Another earthquake occurred on 3 July with a magnitude of 7.1 and the epicentre at Dhubri of Assam, India. The earthquake caused considerable damages in greater Rangpur district of Bangladesh.
1950	Known as the Assam Earthquake. Occurred on 15 August with a magnitude of 8.4 with the epicentre in Assam, India. The tremor was felt throughout Bangladesh but no damage was reported.
1997	Occurred on 22 November in Chittagong with a magnitude of 6.0. It caused minor damage around Chittagong town.
1999	Occurred on 22 July at Maheshkhali Island with the epicentre in the same place, a magnitude of 5.2. Severely felt around Maheshkhali island and the adjoining SEA . Houses cracked and in some cases collapsed.
2003	Occurred on 27 July at Kolabunia union of Barkal upazila, Rangamati district with magnitude 5.1. The time was at 05:17:26.8 hours.

Source: Banglapedia, 2007

However, it seems that Bangladesh did not experience any large earthquake since 20th century for about 100 years. The 1918 earthquake is thought not to be a characteristic one, since the magnitude is small for the plate boundary fault. This may mean that Bangladesh has a high risk of large earthquake occurrence in near future. Several major active faults, e.g. the plate boundary fault (the northern extension of subduction fault) and the Dauki Fault, are inferred in Bangladesh. These faults must generate large earthquakes over M 8. However, the nature, detailed location, and the faulting history on these faults are not well known yet (Morino, 2009).

2.2 Earthquake Damage in Bangladesh in Different Period



Damage to house in 1997 Earthquake in Moshekhali



Damage to an under construction building in Chittagong City in 1997



BDR Club, Kalabunia, Rangamati after 2003 EQ



Union Parishad, Kalabunia, Rangamati after 2003 EQ



Landslide, Kalabunia, Rangamati after 2003 EQ



Big Crack on the earthen Road at BDR CAMP, after 2003 EQ



Sand vent at Rowmari, 1897 Earthquake



Rail Truck at Rangpur, 1897 Earthquake



Collapse of building in Armanitola Dhaka after 1897 Earthquake



Court-Kachari Building Collapsed at Mymensing after 1897 Earthquake

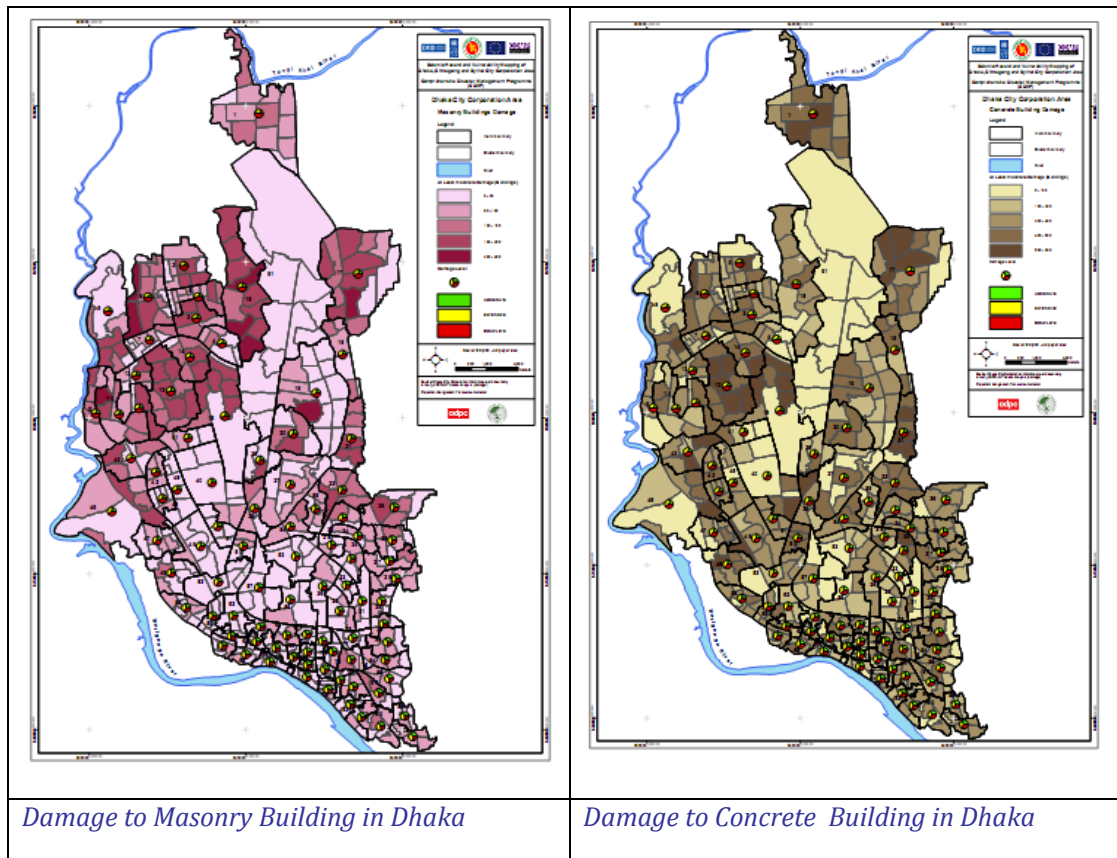
2.3 Elements at Risk

In the current study three different scenarios have been developed to identify the possible damage to infrastructures, buildings, transportation and number of casualties. The scenarios are least, moderate and worst case as assumed based on different magnitude of earthquake. Following are the scenarios of elements at risk in the city of Dhaka, Sylhet and Chittagong.

2.3.1 Buildings Damage

Buildings Damage in Chittagong City Corporation Area

It is estimated that about 142,856 buildings will be completely damaged at 8.5 Mw earthquake originated from plate boundary fault-1. This is about 92.00 % of the total number of buildings in the Chittagong city. During this time about 13,146 buildings will be moderately damaged. About 26,929 buildings will be moderately damaged at Mw 8.0 earthquake originated from plate boundary fault-2. The earthquake at Mw 6.0 originated under the city will completely damage about 128,104 buildings which are about 70.00 % of the total buildings of the city.



Buildings Damage in Dhaka City Corporation Area

During an earthquake at 7.5 Mw originated from Madhupur fault, about 53,166 buildings will be moderately damaged. This is about 15.00 % of the total number of buildings in the city. About 72,316 buildings will be totally damaged during this time. If the magnitude of the earthquake is 8.0 Mw, about 34,326 buildings will be at least moderately damaged. During an earthquake originated from under the city at 6.0 Mw about 78,323 buildings will be completely damaged. An earthquake at 8.5 originated from plate boundary fault-2 will completely destroy 238,164 buildings.

Buildings Damage in Sylhet City Corporation Area

It is estimated that about 41,173 buildings will be damaged during an earthquake at 8.0 Mw originated from Dauki Fault. This is about 79.00 % of the total number of buildings in the Sylhet city. During this time about 24,944 buildings will be damaged beyond repair. About 7854 buildings will be moderately damaged at Mw 8.3 earthquake originated from Plate boundary fault-3. An earthquake at Mw 6.0 will damage about 36,693 buildings which are about 70.00 % of the total number of buildings of the city. At the same time an estimated 11,891 buildings will be damaged beyond repair. An earthquake at Mw 8.0 originated from Dauki fault will damage about 45,216 buildings which are about 87% of total building of the city. During this time 4,721 buildings will be moderately damaged. An earthquake at Mw

8.5 originated from Dauki fault will damage about 51,858 buildings which are about 99.50% of total building of the city.

2.3.2 Essential Facilities Damage

Essential Facilities Damage in Dhaka City Corporation Area

There will be severe damage to essential facilities like Hospital, schools, police stations after different level of earthquakes. An earthquake at 7.5 Mw in Dhaka City, originated from Madhupur fault will moderately damage about 241 hospital or clinics. At the same time 10 hospitals will be completely damaged. About 90 schools will be totally damages at the same time. However 30 police stations and 4 fire service stations will be moderately damaged during this earthquake.

Table 2.2 Expected Damage to Essential Facilities in Dhaka City Corporation Area

<i>Classification</i>	<i>Total</i>	<i>Facilities</i>		
		<i>At Least Moderate Damage >50%</i>	<i>Complete Damage >50%</i>	<i>With Functionality >50% on day 1</i>
Case 1				
Hospitals	600	241	10	224
Schools	2,737	1,173	90	895
EOCs	18	8	2	7
Police Stations	62	30	0	15
Fire Stations	10	4	0	3
Case 2				
Hospitals	600	22	0	431
Schools	2,737	99	2	2,029
EOCs	18	7	0	11
Police Stations	62	1	0	46
Fire Stations	10	0	0	7
Case 3				
Hospitals	600	364	23	128
Schools	2,737	1,567	165	495
EOCs	18	9	0	4
Police Stations	62	39	0	2
Fire Stations	10	6	0	0
Case 4				
Hospitals	600	483	482	114
Schools	2,737	2,292	2,268	406
EOCs	18	14	14	4
Police Stations	62	61	61	1
Fire Stations	10	10	10	0

An earthquake at 8.0 Mw from plate boundary Fault-2 will moderately damage 22 hospitals. However 431 hospital or clinics will be fully functional on the first day. During this situation 99 schools will be moderately damaged and fire service & police station will remain normal. During an earthquake originated from under the city at 6.0 Mw, about 364 hospital or clinics will be moderately damaged. About

1567 schools, 39 police station and 6 fire service station will be also moderately damage at the same time

Chittagong City Corporation Area

During an earthquake at 8.5 Mw originated from Plate Boundary, 127 out 162 hospitals/ clinics will be completely damaged. At the same time 739 schools, 06 EOC, 10 out of 11 police stations and 8 out of 12 fire stations will be totally damaged. None of the facilities will be functional on the first day of earthquake.

Table 2.3 Expected Damage to Essential Facilities in Chittagong City Corporation Area

Classification	Total	# Facilities		
		At Least Moderate Damage >50%	Complete Damage >50%	With Functionality >50% on day 1
Case 01				
Hospitals	162	158	127	0
Schools	1,033	1,011	739	0
EOCs	11	11	6	0
Police Stations	11	11	10	0
Fire Stations	12	12	8	0
Case 02				
Hospitals	162	13	0	123
Schools	1,033	78	3	818
EOCs	11	0	0	8
Police Stations	11	1	0	7
Fire Stations	12	1	0	11
Case 03				
Hospitals	162	65	15	0
Schools	1,033	471	121	0
EOCs	11	3	0	0
Police Stations	11	6	2	0
Fire Stations	12	6	2	0
Case 04				
Hospitals	162	57	0	75
Schools	1,033	349	0	297
EOCs	11	3	0	8
Police Stations	11	5	0	5
Fire Stations	12	5	0	2

About 13 hospital and clinics, 78 schools and one each of police and fire stations will be moderately damaged if there is an earthquake at 8.0 Mw from plate boundary Fault-2. During an earthquake originated from under the city at 6.0 Mw, 121 schools and 15 hospitals will be completely damaged. However, during this situation most of the facilities will remain under operation one the first day of the earthquake.

Sylhet City Corporation Area

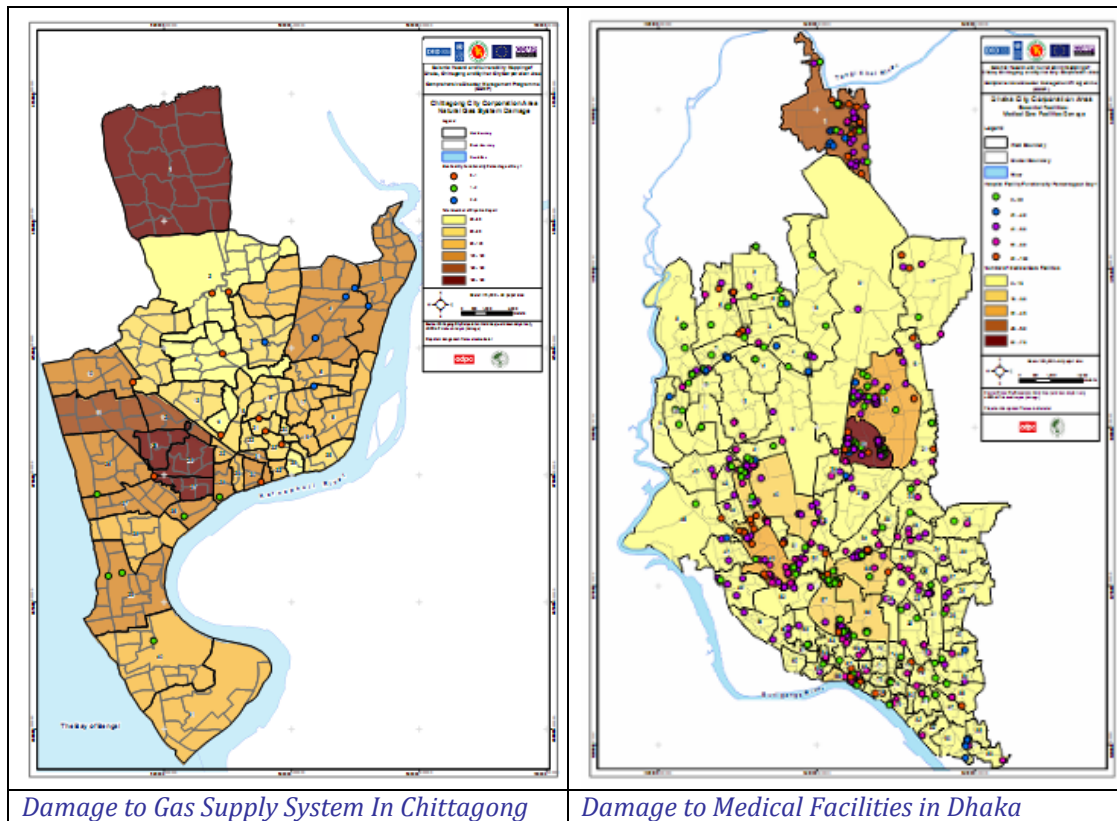
In Sylhet, during an earthquake of 8.0 Mw originated from Dauki fault, 43 hospital & clinics will be totally damaged. During same period 105 schools and 4 police stations

will also be damaged totally. On the other hand an earthquake originated from Plate Boundary fault-3 at 8.3 Mw will be responsible for moderate damage to 3 hospitals and 5 schools.

Table 2.4 Expected Damage to Essential Facilities in Sylhet City Corporation Area

<i>Classification</i>	<i>Total</i>	<i># Facilities</i>		
		<i>At Least Moderate Damage >50%</i>	<i>Complete Damage >50%</i>	<i>With Functionality >50% on day 1</i>
<i>Case 1</i>				
Hospitals	87	47	43	4
Schools	211	111	105	13
EOCs	9	3	3	0
Police Stations	6	4	4	0
Fire Stations	2	0	0	0
<i>Case 2</i>				
Hospitals	87	3	0	59
Schools	211	5	0	172
EOCs	9	2	0	7
Police Stations	6	0	0	6
Fire Stations	2	0	0	2
<i>Case 3</i>				
Hospitals	87	47	5	4
Schools	211	111	26	8
EOCs	9	2	1	1
Police Stations	6	4	0	0
Fire Stations	2	0	0	0
<i>Case 4</i>				
Hospitals	87	59	59	0
Schools	211	148	139	2
EOCs	9	5	4	0
Police Stations	6	4	4	0
Fire Stations	2	1	0	0
<i>Case 5</i>				
Hospitals	87	87	86	0
Schools	211	211	209	0
EOCs	9	9	9	0
Police Stations	6	6	6	0
Fire Stations	2	2	2	0

During this time other facilities will remain under operation from first day of the earthquake. The earthquake if originated from under the city of 6.0 Mw will moderately damage 47 hospitals, 111 schools and 4 police stations.



2.3.3 Availability of Hospital Facilities after Earthquake

Chittagong City Corporation Area

Currently in Chittagong there are about 21,664 hospital beds available for use. On the day after an earthquake at 8.5 Mw, only 923 hospital beds (4%) will be available for use by patients already in the hospital and those injured by the earthquake. After one week, 11% of the beds will be back in service. By 30 days, 17% will be operational. After an earthquake at 8.0 Mw, about 13,900 hospital beds (64%) will be available for use by patients already in the hospital and those injured by the earthquake on the first day. Gradually after one week, 80% of the beds will be back in service and by 30 days, 91% will be operational. After an earthquake at 6.0 Mw, the model estimates that only 5,769 hospital beds (27%) will be available for use by patients already in the hospital and those injured by the earthquake. After one week, 44% of the beds will be back in service. By 30 days, 64% will be operational.

Dhaka City Corporation Area

In Dhaka there are about 59,849 hospital beds available for use. On the day after an earthquake of 7.5 Mw, it is estimated that only 24,242 hospital beds (41%) will be available for use by patients already in the hospital and those injured by the earthquake. After one week, 54% of the beds will be back in service. By 30 days, 72% will be operational. After an earthquake at 8.0 Mw only about 37,625 hospital beds (63%) are available for use by patients already in the hospital and those

injured by the earthquake. During this situation after one week, about 76% of the beds will be back in service and by 30 days, 87% will be fully operational. During an earthquake at 6.0 Mw about 18,561 hospital beds (31%) will be available for use by patients already in the hospital and those injured by the earthquake during first day. After one week, 45% of the beds will be back in service. By 30 days, 66% will be operational. After an earthquake at 6.0 (depth to Top of 22 km) Mw only about 7,441 hospital beds (12%) are available for use by patients already in the hospital and those injured by the earthquake. During this situation after one week, about 16% of the beds will be back in service and by 30 days, 20% will be fully operational.

Sylhet City Corporation Area

Currently in Sylhet there are about 8,722 hospital beds available for use. On the day after an earthquake at 8.0 Mw, only 1,742 hospital beds (20%) will be available for use by patients already in the hospital and those injured by the earthquake. After one week, 33% of the beds will be back in service. By 30 days, 46% will be operational. After an earthquake at 8.3 Mw, about 5148 hospital beds (59%) will be available for use by patients already in the hospital and those injured by the earthquake on the first day. Gradually after one week, 78% of the beds will be back in service and by 30 days, 91% will be operational. After and earthquake at 6.0 Mw , the model estimates that only 1890 hospital beds (22%) will be available for use by patients already in the hospital and those injured by the earthquake. After one week, 38% of the beds will be back in service. By 30 days, 61% will be operational.

2.3.4 Utility Services Damage

Utility Services Damage in Dhaka City Corporation Area

An earthquake at 7.5 Mw originated from Madhupur fault will be responsible for moderate damage to potable water at 153 points, waste water at 2, natural gas at 2 points, electrical power at 15,200 and communications at 5 places. During this period there will be 79 leaks and 272 breaks in water supply system, 107 leaks & 360 breaks in waste water system and 56 leaks & 191 breaks in gas supply network.

Table 2.5 Expected Utility System Facility Damage in Dhaka City Corporation Area

System	Scenario 1				Scenario 2				Scenario 3				Scenario 4			
	Number of Locations				Number of Locations				Number of Locations				Number of Locations			
	Total Number	With at Least Moderate Damage	With Complete Damage	With Functionality >50%	Total Number	With at Least Moderate Damage	With Complete Damage	With Functionality >50%	Total Number	With at Least Moderate Damage	With Complete Damage	With Functionality >50%	Total Number	With at Least Moderate Damage	With Complete Damage	With Functionality >50%
				After Day 1				After Day 7				After Day 1				After Day 7
Potable Water	748	153	0	74	748	0	0	748	748	74	0	457	748	748	13	0
Waste Water	14	2	0	12	14	0	0	14	14	14	0	0	14	14	3	0

Natural Gas	7	2	0	0	7	7	0	0	0	7	7	7	0	0	1	7	7	2	0	0
Electrical Power	54,815	15,200	0	0	0	54,815	0	0	0	0	54,815	0	0	0	0	54,815	54,815	0	0	0
Communication	30	5	0	0	29	30	0	0	10	29	30	29	0	0	29	30	29	6	0	3

Table 2.6 Expected Utility System Pipeline Damage in Dhaka City Corporation Area

Syst em	Scenario 1			Scenario 2			Scenario 3			Scenario 4		
	Total Pipelines Length (km)	Number of Leaks	Number of Breaks	Total Pipelines Length (km)	Number of Leaks	Number of Breaks	Total Pipelines Length (km)	Number of Leaks	Number of Breaks	Total Pipelines Length (km)	Number of Leaks	Number of Breaks
Potable Water	1,118	79	272	1,118	39	132	1,118	83	290	1,118	311	705
Waste Water	630	107	360	630	62	202	630	122	418	630	520	1020
Natural Gas	834	56	191	834	26	86	834	56	195	834	209	475

An earthquake at 8.0 Mw from plate boundary Fault-2 all facilities will remain under operations from the first day of earthquake. During an earthquake originated from under the city at 6.0 Mw, all 7 points of natural gas system will be completely damaged. During this period there will be moderate damage to electrical power at 405 places. Waste water operation will remain under operation after seven days in all 14 points and potable water will be functional after 7 days in all places. During this period there will be 39 leaks and 139 breaks in water supply system, 58 leaks & 202 breaks in waste water system and 26 leaks & 94 breaks in gas supply network.

Utility Services Damage in Chittagong City Corporation Area

During an earthquake at 8.5 Mw originated from Plate Boundary, there will be moderate damage in all systems like potable water, natural gas, electric power and communication. During this time potable water system will be completely damaged in 4 locations and natural gas system in 2 points. At the same time there will be 320 leaks and 407 breaks in water supply network, 131 leaks and 59 breaks in waste water network and 104 leaks and 125 breaks in gas supply network.

Table 2.7 Expected Utility System Facility Damage in Chittagong City Corporation Area

System	Scenario 1				Scenario 2				Scenario 3				Scenario 4							
	Number of Locations				Number of Locations				Number of Locations				Number of Locations							
	Total Number	With at Least Moderate Damage	With Complete Damage		Total Number	With at Least Moderate Damage	With Complete Damage		Total Number	With at Least Moderate Damage	With Complete Damage		Total Number	With at Least Moderate Damage	With Complete Damage					
			After Day 1	After Day 7			After Day 1	After Day 7			After Day 1	After Day 7			After Day 1	After Day 7				
Potable Water	72	72	4	0	0	72	0	0	46	72	72	72	0	0	28	72	25	0	0	72
Natural Gas	22	22	2	0	0	22	0	0	9	22	22	22	0	0	10	22	13	0	0	22
Electrical Power	28,407	28,407	0	0	19,237	28,407	0	0	15,084	28,407	28,407	28,407	0	0	28,405	28,407	14,555	0	96	28,407
Communication	5	5	0	0	3	5	0	0	4	5	5	5	0	0	5	5	1	0	0	5

Table 2.8 Expected Utility System Pipeline Damage in Chittagong City Corporation Area

System	Scenario 1			Scenario 2			Scenario 3			Scenario 4		
	Total Pipeline Length (km)	Number of Leaks	Number of Breaks	Total Pipeline Length (km)	Number of Leaks	Number of Breaks	Total Pipeline Length (km)	Number of Leaks	Number of Breaks	Total Pipeline Length (km)	Number of Leaks	Number of Breaks
Potable Water	542	320	407	542	17	53	542	45	129	542	25	81
Natural Gas	217	104	125	217	5	16	217	13	37	217	7	24

During an earthquake originated from under the city at 6.0 Mw, there will be 38 leaks and 120 breaks in water supply network, 5 leaks and 6 breaks in waste water network and 11 leaks and 34 breaks in gas supply network.

Utility Services Damage in Sylhet City Corporation Area

In Sylhet, during an earthquake of 8.0 Mw originated from Dauki fault, will be responsible for moderate damage to potable water at 18 points, natural gas at 1 points, electrical power at 9057 and communications at 7 places. During this period there will be 10 leaks and 21 breaks in water supply system and 7 leaks & 15 breaks in gas supply network. On the other hand an earthquake originated from Plate Boundary fault-3 at 8.3 Mw will be responsible for 2 leaks and 21 breaks in water supply system and 1 leak & 2 breaks in gas supply network. The earthquake if originated from under the city of 6.0 Mw there will be 3 leaks and 7 breaks in potable water network.

Table 2.9 Expected Utility System Facility Damage in Sylhet City Corporation Area

System	Scenario 1				Scenario 2				Scenario 3				Scenario 4				Scenario 5							
	Number of Locations				Number of Locations				Number of Locations				Number of Locations				Number of Locations							
	Total Number	With at Least Moderate Damage	With Complete Damage		Total Number	With at Least Moderate Damage	With Complete Damage		Total Number	With at Least Moderate Damage	With Complete Damage		Total Number	With at Least Moderate Damage	With Complete Damage		Total Number	With at Least Moderate Damage	With Complete Damage					
After Day 1			After Day 7	After Day 1			After Day 7	After Day 1			After Day 7	After Day 1			After Day 7	After Day 1			After Day 7					
Potable Water	18	18	0	0	5	18	0	0	0	18	18	0	0	5	18	18	0	0	0	18	18	9	0	0
Natural Gas	1	1	0	0	1	1	0	0	0	1	1	0	0	0	1	1	0	0	0	1	1	1	0	0
Electrical Power	9.057	9.057	0	0	9.056	9.057	0	0	8.830	9.057	9.057	8.885	0	0	9.056	9.057	9.057	0	0	9.056	9.057	9.057	0	0
Communication	7	7	0	0	7	7	0	0	5	7	7	7	0	0	7	7	7	0	0	7	7	2	0	0

Table 2.10 Expected Utility System Pipeline Damage in Sylhet City Corporation Area

System	Scenario 1			Scenario 2			Scenario 3			Scenario 4			Scenario 5		
	Total Pipeline Length (km)	Number of Leaks	Number of Breaks	Total Pipeline Length (km)	Number of Leaks	Number of Breaks	Total Pipeline Length (km)	Number of Leaks	Number of Breaks	Total Pipeline Length (km)	Number of Leaks	Number of Breaks	Total Pipeline Length (km)	Number of Leaks	Number of Breaks
Potable Water	128	10	21	128	2	4	128	5	11	128	14	25	128	74	48
Natural Gas	141	7	15	141	1	2	141	4	8	141	11	21	141	56	41

2.3.5 Economic Loss

Earthquake may make substantial economic losses to economy through damaging different infrastructures. These losses include structural, non-structural, different materials inside a building, transportation, utility services etc. Following is the detail of possible economic loss estimated based on different earthquake scenarios in Dhaka, Chittagong and Sylhet.

Dhaka City Corporation Area

There will be significant losses to the buildings if there is earthquake in Dhaka. During an earthquake at 7.5 Mw originated from Madhupur fault, there will be economic loss of about 1112 million USD for structures. Economic loss to the structure will be 650 and 1075 million USD respectively during the earthquake at 8.0 Mw from plate boundary Fault-2 and an earthquake originated from under the city at 6.0 Mw.

Table 2.11 Building-Related Economic Loss Estimates (Millions of dollars) in Dhaka City Corporation Area

Case	Capital Stock Loses	Single Family Dwelling (SFD) Residential	Non-SFD	Commercial	Industrial	Others	Total
1	Structural	2.11	506.99	499.53	38.22	65.31	1,112.15
	Non_Structural	6.07	2,548.89	755.94	154.86	238.45	3,704.21
	Content	1.59	685.41	461.56	114.56	129.86	1,392.99
2	Structural	1.10	316.55	278.97	19.71	33.71	650.04
	Non_Structural	3.31	1,524.76	405.95	80.28	123.13	2,137.43
	Content	0.89	393.10	253.3	59.21	69.07	775.57
3	Structural	2.33	533.91	439.56	37.15	62.99	1,075.93
	Non_Structural	6.92	2,797.11	670.53	158.32	221.42	3,854.31
	Content	1.95	820.14	427.30	118.46	125.78	1,493.63
4	Structural	5.39	1,216.98	1,071.05	88.15	154.42	2,535.99
	Non_Structural	17.34	6,352.31	2,000.20	439.14	634.52	9,443.52
	Content	4.45	1,703.53	1,245.12	317.48	352.66	3,623.24

Source: Hazus calculation based on database, engineering geology and seismic hazard

Similarly the loss of Non-Structural items will be 3704, 2137, 3854 and 9443 million USD respectively for the earthquakes at 7.5 Mw originated from Madhupur fault, at 8.0 Mw from plate boundary Fault-2, earthquake originated from under the city at 6.0 Mw and an earthquake at 8.5 originated from under the city. Building contain loss will be 1393, 775, 1493 and 3623 million USD respectively for the three earthquakes as described sequentially.

Chittagong City Corporation Area

An earthquake in Chittagong at 8.5 Mw originated from Plate Boundary Fault-1, will bring economic loss to structural, non-structural and building contain that costs respectively 711, 2077 and 323 million USD. Similarly there will be loss of 135, 313 and 48 million USD respectively for structural, non-structural and house content during an earthquake at 8.0 Mw from plate boundary Fault-2.

Table 2.12 Building-Related Economic Loss Estimates (Millions of dollars) in Chittagong City Corporation Area

Case	Capital Stock Loses	Single Family Dwelling(SFD) Residential	Non-SFD	Commercial	Industrial	Others	Total
1	Structural	173.10	228.45	263.40	26.74	19.32	711.00
	Non_Structural	553.71	971.86	348.75	135.30	67.63	2,077.25
	Content	0	0	186.30	100.41	37.17	323.88
2	Structural	35.06	39.72	51.09	6.74	2.96	135.58
	Non_Structural	85.49	150.69	45.85	23.52	8.37	313.93
	Content	0	0	25.63	17.72	4.82	48.17
3	Structural	93.43	109.9	139.77	15.80	8.16	367.05
	Non_Structural	260.69	456.03	154.30	69.41	25.98	966.41
	Content	0	0	87.59	52.69	16.08	156.36
4	Structural	55.70	69.15	85.60	8.91	5.12	224.47
	Non_Structural	142.53	266.08	87.67	34.82	15.44	546.54
	Content	0	0	51.15	26.77	9.67	87.59

Source: Hazus calculation based on database, engineering geology and seismic hazard

The earthquake originated from under the city at 6.0 Mw may bring economic loss of about 367, 966 and 156 million USD respectively for structural, non-structural and building contain.

Sylhet City Corporation Area

An earthquake in Sylhet at 8.0 Mw originated from Dauky Fault, will bring economic loss to structural, non-structural and building contain that costs respectively 124, 365 and 113 million USD. Similarly there will be loss of 19, 39 and 14 million USD respectively for structural, non-structural and house content during an earthquake at 8.3 Mw from plate boundary Fault-3.

Table 2.13 Building-Related Economic Loss Estimates (Millions of dollars) in Sylhet City Corporation Area

Case	Capital Stock Loses	Single Family Dwelling(SFD) Residential	Non-SFD	Commercial	Industrial	Others	Total
1	Structural	69.50	18.45	30.06	1.51	4.69	124.21
	Non_Structural	201.09	94.78	45.29	6.68	17.98	365.82
	Content	48.89	23.79	25.52	4.91	10.72	113.84
2	Structural	8.80	3.33	5.96	0.27	0.90	19.26
	Non_Structural	16.73	13.04	6.27	0.88	2.69	39.61
	Content	5.21	3.49	3.75	0.69	1.70	14.84
3	Structural	41.94	12.49	21.06	0.98	3.26	79.73
	Non_Structural	105.61	60.32	29.38	4.01	11.39	210.71
	Content	28.48	16.44	17.69	3.05	7.33	73.00
4	Structural	84.03	24.64	38.47	1.88	6.14	155.15
	Non_Structural	256.72	131.06	61.90	9.17	24.47	483.32
	Content	63.67	32.24	34.44	6.60	14.24	151.19
5	Structural	110.51	38.01	53.89	2.40	8.97	213.77
	Non_Structural	351.02	197.79	87.92	12.43	36.93	686.09
	Content	85.33	45.15	46.64	8.70	19.70	205.51

Source: Hazus calculation based on database, engineering geology and seismic hazard

The earthquake originated from under the city at 6.0 Mw may bring economic loss of about 79, 210 and 73 million USD respectively for structural, non-structural and building contain.

2.3.6 Economic Loss in Transportation and Utility Service Sector

There will be huge economic losses in transport and Utility services sector during the earthquake of different magnitude. Transport sector covers the infrastructures like highways, railways, bus and ferry. While utility services cover water supply, waste water treatment system, gas supply network, electric supply and communication. Following are the economic losses estimated for Dhaka, Chittagong and Sylhet City in different magnitude of earthquake.

Dhaka City Corporation Area

In Dhaka an earthquake of 7.5 Mw originated from Madhupur fault, will bring economic loss of 97, 4.2, 0.9 and 0.1 million USD respectively for highway, railway, bus and ferry sector.

Table 2.14 Transportation System Economic Losses in Dhaka City Corporation Area (in million of dollars)

System	Component	Scenario 1			Scenario 2			Scenario 3			Scenario 4		
		Inventory Value	Economics Loss	Loss Ratio (%)	Inventory Value	Economics Loss	Loss Ratio (%)	Inventory Value	Economics Loss	Loss Ratio (%)	Inventory Value	Economics Loss	Loss Ratio (%)
Highway	Roads	1,479.39	95.43	6.45	1,479.39	36.73	2.48	1479.39	101.71	6.88	1,479.39	311.43	21.05
	Bridges	26.53	1.24	4.66	26.53	0.86	3.23	26.53	1.17	4.40	26.53	2.66	10.04
	Subtotal	1,505.90	96.7		1,505.90	37.6		1505.90	102.9		1505.90	314.10	
Railways	Tracks	66.52	2.04	3.07	66.52	0.76	1.15	66.52	0.46	4.62	66.52	12.42	18.67
	Facilities	9.20	2.11	22.92	9.20	1.24	13.5	9.20	3.52	38.22	9.20	6.04	65.61
	Subtotal	75.7	4.20		75.7	2.00		75.70	6.60		75.70	18.50	
Bus	Facilities	3.68	0.93	25.37	3.68	0.53	14.53	3.68	1.41	38.30	3.68	2.83	77.02
	Subtotal	3.70	0.90		3.70	0.50		3.70	1.40		3.70	2.80	
Ferry	Facilities	0.80	0.14	17.78	0.80	0.10	12.51	0.80	0.24	29.98	0.80	0.51	63.89
	Subtotal	0.80	0.10		0.80	0.10		0.80	0.20		0.80	0.50	
	Total	1586.1	101.9		1,586.10	40.2		1586.1	111.1		1586.10	335.90	

Source: Hazus calculation based on database, engineering geology and seismic hazard

Table 2.15 Utility System Economic Losses in Dhaka City Corporation Area (in million of dollars)

System	Component	Scenario 1			Scenario 2			Scenario 3			Scenario 4		
		Inventory Value	Economics Loss	Loss Ratio (%)	Inventory Value	Economics Loss	Loss Ratio (%)	Inventory Value	Economics Loss	Loss Ratio (%)	Inventory Value	Economics Loss	Loss Ratio (%)
Potable Water	Pipelines	13.10	1.61	12.32	13.10	0.80	6.13	13.10	1.74	13.29	13.09	0.80	6.13
	Facilities	140.20	20.58	14.68	140.20	10.18	7.26	140.20	36.32	25.91	140.19	10.18	7.26
	Subtotal	153.28	22.19		153.28	10.99		153.28	38.06		153.28	10.99	
Waste Water	Pipelines	2.90	3.18	111.13	2.90	1.98	69.15	2.90	3.92	137.22	2.86	1.98	69.15
	Facilities	60.60	5.33	8.79	60.6	4.13	6.81	60.60	10.02	16.53	60.62	4.13	6.81
	Subtotal	63.48	8.51		63.48	6.10		63.48	13.94		63.48	6.10	
Natural Gas	Pipelines	7.70	0.43	5.66	7.70	0.20	2.58	7.70	0.45	5.82	7.66	0.20	2.58
	Facilities	7.00	1.28	18.35	7.00	0.49	6.94	7.00	1.94	27.72	7.00	0.49	6.94
	Subtotal	14.66	1.72		14.66	0.68		14.66	2.39		14.66	0.68	
Electrical Power	Facilities	75.80	15.6	20.59	75.80	5.40	7.13	75.80	21.77	28.74	75.76	5.40	7.13
	Subtotal	75.76	15.6		75.76	5.40		75.76	21.77		75.76	5.40	
Communication	Facilities	81.00	11.24	13.87	81.00	5.20	6.42	81.00	19.79	24.44	81.00	5.20	6.42
	Subtotal	81.00	11.24		81.00	5.20		81.00	19.79		81.00	5.20	
	Total	388.18	59.25		388.18	28.37		388.18	95.96		388.18	28.37	

Source: Hazus calculation based on database, engineering geology and seismic hazard

The aggregate of the economic loss in these four sectors would be 40 and 111 million USD respectively during the earthquake of 8.0 Mw from plate boundary Fault-2 and the earthquake originated from under the city at 6.0 Mw. Similarly for four different scenarios economic loss in utility system would be respectively 59, 28, 96 and 28 million USD (please see table 2.15 for detail).

Chittagong City Corporation Area

In Chittagong an earthquake of 8.5 Mw originated from Plate Boundary fault-1, will bring economic loss of 166, 14 and 0.7 million USD respectively for highway, railway and bus sector.

Table 2.16 Transportation System Economic Losses in Chittagong City Corporation Area (in million of dollars)

System	Component	Scenario 1			Scenario 2			Scenario 3			Scenario 4		
		Inventory Value	Economics Loss	Loss Ratio (%)	Inventory Value	Economics Loss	Loss Ratio (%)	Inventory Value	Economics Loss	Loss Ratio (%)	Inventory Value	Economics Loss	Loss Ratio (%)
Highway	Roads	725.67	164.49	22.67	725.67	11.81	1.63	725.67	26.04	3.59	725.67	15.54	2.14
	Bridges	6.56	1.23	18.84	6.56	0.08	1.24	6.56	0.36	5.49	6.56	0.15	2.30
	Subtotal	732.2	165.7		732.2	11.9		732.2	26.4		732.2	15.70	
Railways	Tracks	98.2	9.09	9.25	98.2	0.18	0.19	98.2	0.59	0.6	98.20	0.27	0.27
	Facilities	7.36	4.88	66.25	7.36	0.52	7.03	7.36	2.97	40.3	7.36	1.47	20.00
	Subtotal	105.6	14		105.6	0.7		105.6	3.6		105.6	1.70	
Bus	Facilities	1.55	0.71	45.53	1.55	0.25	15.88	1.55	0.48	31.12	1.55	0.43	27.74
	Subtotal	1.6	0.7		1.6	0.2		1.6	0.5		1.6	0.40	
Total		839.3	180.4		839.3	12.8		839.3	30.4		839.3	17.90	

Source: Hazus calculation based on database, engineering geology and seismic hazard

Table 2.17 Utility System Economic Losses in Chittagong City Corporation Area (in million of dollars)

System	Component	Scenario 1			Scenario 2			Scenario 3			Scenario 4		
		Inventory Value	Economics Loss	Loss Ratio (%)	Inventory Value	Economics Loss	Loss Ratio (%)	Inventory Value	Economics Loss	Loss Ratio (%)	Inventory Value	Economics Loss	Loss Ratio (%)
Potable Water	Pipelines	3.6	2.47	68.38	3.6	0.25	6.94	3.6	0.67	18.4	3.6	0.41	11.19
	Facilities	69.6	24.76	35.6	69.6	5.87	8.44	69.6	15.56	22.37	69.6	11.87	17.07
	Subtotal	73.18	27.24		73.18	6.12		73.18	16.23		73.18	12.28	
Natural Gas	Pipelines	0.4	0	0	0.4	0	0	0.4	0	0	0.4	0.00	0.00

	Facilities	22.00	10.52	47.82	22.00	1.57	7.14	22.00	5.67	25.76	22.00	3.58	16.26
	Subtotal	22.36	10.52		22.36	1.58		22.36	5.67		22.36	3.58	
Electrical Power	Facilities	33.4	15.94	47.8	33.4	1.47	4.42	33.4	9.58	28.73	33.4	3.99	11.97
	Subtotal	33.35	15.94		33.35	1.47		33.35	9.58		33.35	3.99	
Communication	Facilities	19.00	9.53	50.16	19.00	0.77	4.05	19.00	5.31	27.97	19.00	2.20	11.60
	Subtotal	19.00	9.53		19.00	0.77		19.00	5.31		19.00	2.20	
	Total	147.89	63.23		147.89	9.94		147.89	36.79		147.89	22.05	

Source: Hazus calculation based on database, engineering geology and seismic hazard

The aggregate of the economic loss in these three sectors would be 13 and 30 million USD respectively during the earthquake of 8.0 Mw from plate boundary Fault-2 and the earthquake originated from under the city at 6.0 Mw. Similarly for four different scenarios economic loss in utility system would be respectively 63, 10, 37 and 22 million USD (please see table 2.17 for detail).

Sylhet City Corporation Area

In Sylhet, an earthquake of 8.0 Mw originated from Dauki fault, will bring economic loss of 7.2, 1.4 and 0.1 million USD respectively for highway, railway and bus sector.

Table 2.18 Transportation System Economic Losses in Sylhet City Corporation Area (in million of dollars)

System	Component	Scenario 1			Scenario 2			Scenario 3			Scenario 4			Scenario 5		
		Inventory Value	Economics Loss	Loss Ratio (%)	Inventory Value	Economics Loss	Loss Ratio (%)	Inventory Value	Economics Loss	Loss Ratio (%)	Inventory Value	Economics Loss	Loss Ratio (%)	Inventory Value	Economics Loss	Loss Ratio (%)
Highway	Roads	178.35	6.78	3.8	178.35	1.27	0.71	178.35	4.03	2.26	178.35	11.00	6.17	178.35	75.31	42.23
	Bridges	2.55	0.41	15.9	2.55	0.16	6.2	2.55	0.32	12.34	2.55	0.45	17.57	2.55	0.58	22.85
	Subtotal	180.9	7.2		180.9	1.4		180.9	4.3		180.90	11.50		180.90	75.90	
Railways	Tracks	6.99	9.2	2.84	6.99	0.01	0.15	6.99	0.06	0.89	6.99	0.34	4.89	6.99	6.15	88.07
	Facilities	3.44	1.2	34.76	3.44	0.35	10.18	3.44	1.33	38.63	3.44	1.58	45.90	3.44	3.44	10.00
	Subtotal	10.4	1.4		10.4	0.4		10.4	1.4		10.40	1.90		10.40	9.60	
Bus	Facilities	0.16	0.06	34.88	0.16	0.02	10.25	0.16	0.06	38.63	0.16	0.07	46.66	0.16	0.16	10.00
	Subtotal	0.2	0.1		0.2	0		0.2	0.1		0.20	0.10		0.20	0.20	
	Total	191.5	8.6		191.5	1.8		191.5	5.8		191.50	13.40		191.50	85.70	

Source: Hazus calculation based on database, engineering geology and seismic hazard

Table 2.19 Utility System Economic Losses in Sylhet City Corporation Area (in million of dollars)

System	Component	Scenario 1			Scenario 2			Scenario 3			Scenario 4			Scenario 5		
		Inventory Value	Economics Loss	Loss Ratio (%)	Inventory Value	Economics Loss	Loss Ratio (%)	Inventory Value	Economics Loss	Loss Ratio (%)	Inventory Value	Economics Loss	Loss Ratio (%)	Inventory Value	Economics Loss	Loss Ratio (%)
Potable Water	Pipelines	0.5	0.92	168.15	0.5	0.16	29.12	0.5	0.47	86.41	0.5	1.15	209.89	0.5	2.53	461.52
	Facilities	2.4	0.63	26.73	2.4	0.12	5.17	2.4	0.64	27.29	2.4	0.90	38.37	2.4	1.91	81.03
	Subtotal	2.9	1.55		2.9	0.28		2.9	1.12		2.9	2.06		2.9	4.44	
Natural Gas	Pipelines	0.4	0.3	72.13	0.4	0.04	8.6	0.4	0.16	38.44	0.4	0.43	102.55	0.4	0.99	236.96
	Facilities	1	0.23	23.16	1	0.05	5.06	1	0.28	27.95	1.0	0.34	34.31	1.0	1.00	100.00
	Subtotal	1.4	0.53		1.4	0.09		1.4	0.44		1.4	0.77		1.4	1.99	
Electrical Power	Facilities	14.3	3.66	25.69	14.3	0.76	5.34	14.3	3.9	27.37	14.3	5.00	35.09	14.3	9.09	63.73
	Subtotal	14.26	3.66		14.26	0.76		14.26	3.9		14.30	5.00		14.26	0.09	
Communication	Facilities	23	5.49	23.85	23	1.53	6.65	23	5.81	25.25	23	7.30	31.75	23	15.71	68.32
	Subtotal	23	5.49		23	1.53		23	5.81		23.00	7.30		23.00	15.71	
	Total	41.58	11.23		41.58	2.66		41.58	11.27		41.58	15.13		41.58	31.23	

Source: Hazus calculation based on database, engineering geology and seismic hazard

The aggregate of the economic loss in these five sectors would be 7.2, 1.4 and 0.1 million USD respectively during the earthquake of 8.3 Mw from plate boundary Fault-3 and the earthquake originated from under the city at 6.0 Mw. Similarly for five different scenarios economic loss in utility system would be respectively 1011, 2.66, 11.27, 15 and 31 million USD.

2.3.7 Casualties

During this study, the numbers of people that will be injured and killed by the earthquake have been estimated into four (4) severity levels that describe the extent of the injuries. The levels are described as follows;

- *Severity Level 1:* Injuries will require medical attention but hospitalization is not needed.
- *Severity Level 2:* Injuries will require hospitalization but are not considered life-threatening
- *Severity Level 3:* Injuries will require hospitalization and can become life threatening if not promptly treated.
- *Severity Level 4:* Victims are killed by the earthquake.

The casualty estimations are for two times of day: 2:00 AM and 2:00 PM. These

times represent the periods of the day that different sectors of the community are at their peak occupancy loads. The 2:00 AM estimate considers that the residential occupancy load is maximum and the 2:00 PM estimate considers that the educational, commercial and industrial sector loads are maximum. Following are the description on the casualties in the city of Chittagong, Dhaka and Sylhet in different time on different scenarios.

Dhaka City Corporation Area

During an earthquake at 7.5 Mw originated from Madhupur fault at day time, about 131,029 people will be killed immediately after the earthquake. About 25,905 people will require hospitalization and can become life threatening if not promptly treated, about 7043 people will require hospitalization but are not considered life-threatening and about 61,288 people will require medical attention like first aid or some kind of treatment. Similarly about 69874 people will be killed, 13628 people need to be hospitalized on a critical condition, 3525 people need to be hospitalized on moderate injuries and about 36195 people will require medical attention if there is an earthquake at 8.0 Mw from plate boundary Fault-2 during day time. During an earthquake originated from under the city at 6.0 Mw at day time, about 122,271 people will die immediately, about 24,086 people will need to be hospitalized on a critical condition, about 6590 people will require taking admission in hospital with moderate injuries and about 58862 people will require medical attention.

Table 2.20 Casualties in Dhaka during different cases in Different Time

Time and Case	Level of casualties			
	Level 1	Level 2	Level 3	Level 4
2 AM				
Case 1	121,815	21,355	5,287	88,503
Case 2	75,391	13,011	3,069	58,858
Case 3	127,042	22,054	5,383	95,267
Case 4	336,547	61,093	16,227	260,788
2 PM				
Case 1	131,029	25,905	7,043	61,288
Case 2	69,874	13,628	3,525	36,195
Case 3	122,271	24,086	6,590	58,862
Case 4	364,292	76,191	22,589	183,450

Source: Hazus calculation based on database, engineering geology and seismic hazard

An earthquake at 7.5 Mw originated from Madhupur fault at night time, will kill about 121,815 people immediately after the earthquake. About 21,355 people will require hospitalization and can become life threatening if not promptly treated, about 5,287 people will require hospitalization but are not considered life-threatening and 88,503 people will require medical attention like first aid or some kind of treatment. Similarly about 75,391 people will be killed, 13,011 need to be hospitalized on a critical condition, 3,525 people will need to be hospitalized on moderate injuries and about 36,195 people will require medical attention if there is an earthquake at 8.0 Mw from plate boundary Fault-2. During an earthquake originated from under the city at 6.0 Mw, about 122,271 people will die immediately, about 24,086 people will need to be hospitalized on a critical condition, about 6,590 people will require taking admission in hospital with moderate injuries and 58,862 people will require medical attention.

Chittagong City Corporation Area

During an earthquake at 8.5 Mw originated from Plate Boundary Fault-1 at night time, about 137,063 people will be killed immediately after the earthquake. About 25,712 people will require hospitalization and can become life threatening if not promptly treated, about 7,275 people will require hospitalization but are not considered life-threatening and about 95,183 people will require medical attention like first aid or some kind of treatment. Similarly about 19,185 people will be killed, about 3,215 will need to be hospitalized on a critical condition, 765 people will need to be hospitalized on moderate injuries and about 13,932 people will require medical attention if there is an earthquake at 8.0 Mw from plate boundary Fault-2. During an earthquake originated from under the city at 6.0 Mw, about 59,684 people will die immediately, about 10,550 people will need to be hospitalized on a critical condition, about 2,799 people will require taking admission in hospital with moderate injuries and about 40,453 people will require medical attention.

Table 2.21 Casualties in Chittagong during different cases in Different Time

Time and Case	Level of casualties			
	Level 1	Level 2	Level 3	Level 4
<i>2 AM</i>				
<i>Case 1</i>	137,063	25,712	7,275	95,183
<i>Case 2</i>	19,185	3,215	765	13,932
<i>Case 3</i>	59,684	10,550	2,799	40,453
<i>Case 4</i>	33,176	5,697	1,451	21,889
<i>2 PM</i>				
<i>Case 1</i>	104,566	20,781	5,790	73,212
<i>Case 2</i>	14,442	2,616	618	9,993
<i>Case 3</i>	44,751	8,473	2,224	29,771
<i>Case 4</i>	24,598	4,517	1,143	15,863

Source: Hazus calculation based on database, engineering geology and seismic hazard

An earthquake at 8.5 Mw originated from Plate Boundary Fault-1 at day time, will kill about 104,566 people will be killed immediately after the earthquake. About 20,781 people will require hospitalization and can become life threatening if not promptly treated, about 5,790 people will require hospitalization but are not considered life-threatening and about 73,212 people will require medical attention like first aid or some kind of treatment. Similarly about 14,442 people will be killed, 2,616 need to be hospitalized on a critical condition, 618 need to be hospitalized on moderate injuries and about 9,993 people will require medical attention if there is an earthquake at 8.0 Mw from plate boundary Fault-2. During an earthquake originated from under the city at 6.0 Mw, about 44,751 people will die immediately, about 8,473 people will need to be hospitalized on a critical condition, about 2,224 people will require taking admission in hospital with moderate injuries and about 29,771 people will require medical attention.

Sylhet City Corporation Area

During an earthquake at 8.0 Mw originated from Dauki Fault at night time, about 14,689 people will be killed immediately after the earthquake. About 2,761 people will require hospitalization and can become life threatening if not promptly treated, about 958 people will require hospitalization but are not considered life-threatening and about 9,506 people will require medical attention like first aid or some kind of

treatment. Similarly about 1,363 people will be killed, 212 need to be hospitalized on a critical condition, 51 to be hospitalized on moderate injuries and 892 people will require medical attention if there is an earthquake at 8.3 Mw from plate boundary Fault-3. During an earthquake originated from under the city at 6.0 Mw, about 7,508 people will die immediately, about 1,329 people will need to be hospitalized on a critical condition, about 417 people will require taking admission in hospital with moderate injuries and about 4,723 people will require medical attention.

Table 2.22 Casualties in Sylhet during different cases in Different Time

Time and Cases	Level 1	Level 2	Level 3	Level 4
<i>2 AM</i>				
<i>Case 1</i>	14,689	2,761	958	9,506
<i>Case 2</i>	1,363	212	51	892
<i>Case 3</i>	7,508	1,329	417	4,723
<i>Case 4</i>	19,455	3,701	1,275	13,107
<i>Case 5</i>	28,226	5,370	1,814	20,708
<i>2 PM</i>				
<i>Case 1</i>	9,665	1,910	608	6,151
<i>Case 2</i>	1,041	177	42	667
<i>Case 3</i>	5,173	966	282	3,242
<i>Case 4</i>	13,005	2,586	817	8,724
<i>Case 5</i>	19,414	3,850	1,190	14,276

Source: Hazus calculation based on database, engineering geology and seismic hazard

An earthquake at 8.0 Mw originated from Dauki Fault, during day time, will kill about 9,665 people immediately after the earthquake. About 1,910 people will require hospitalization and can become life threatening if not promptly treated, about 608 people will require hospitalization but are not considered life-threatening and about 6,151 people will require medical attention like first aid or some kind of treatment. Similarly about 1,041 people will be killed, 177 need to be hospitalized on a critical condition, 42 need to be hospitalized on moderate injuries and about 667 people will require medical attention if there is an earthquake at 8.3 Mw from plate boundary Fault-3. During an earthquake originated from under the city at 6.0 Mw, about 5,173 people will die immediately, about 966 people will need to be hospitalized on a critical condition, about 282 people will require taking admission in hospital with moderate injuries and about 3,242 people will require medical attention.

2.3.8 Collateral Hazards

There might be several hazards due to earthquake which may affect structures as well as may cause damage to human life and increase economic losses. These collateral hazards include fire, landslides, tsunami, debris generations etc. Following are the possible fire hazards that may appear due to earthquake in Dhaka, Sylhet and Chittagong City.

Debris Generation

HAZUS (the software used for this study) estimates the amount of debris that will be generated by the earthquake. The model breaks the debris into two general categories:

- a) Brick/Wood
- b) Reinforced Concrete/Steel.

This distinction is made because of the different types of material handling equipment required to handle the debris.

Dhaka City Corporation Area

During an earthquake of 7.5 Mw originated from Madhpur Fault a total of 30 million tons of debris will be generated. Out of this, Brick/Wood comprises 27% of the total, with the remaining being Reinforced Concrete/Steel of 73%. If the debris tonnage is converted to an estimated number of truckloads, it will require 1,200,000 truckloads (@25 tons/truck) to remove the debris generated by the earthquake. Similarly an earthquake originated from Plate boundary fault-2 will generate a total of 18 million tons of debris of which Brick/Wood comprises 24% of the total, with the remaining being Reinforced Concrete/Steel of 76%. If the debris tonnage is converted to an estimated number of truckloads, it will require 720,000 truckloads (@25 tons/truck) to remove the debris generated by the earthquake. The earthquake if originated from under the city of 6.0 Mw, will be responsible for generation of a total of 30 million tons. Out of this, Brick/Wood comprises 28% of the total, with the remaining being Reinforced Concrete/Steel of 72%. If the debris tonnage is converted to an estimated number of truckloads, it will require 2,880,000 truckloads (@25 tons/truck) to remove the debris generated by the earthquake.

Chittagong City Corporation Area

During an earthquake of 8.5 Mw originated from Plate boundary fault-1, a total of 17 million tons of debris will be generated. Out of this, Brick/Wood comprises 26%, with the remaining being Reinforced Concrete/Steel. If the debris tonnage is converted to an estimated number of truckloads, it will require 680,000 truckloads (@25 tons/truck) to remove the debris generated by the earthquake. On the other hand an earthquake originated from Plate Boundary fault-2 at 8.0 Mw will be responsible for 3 million tons of debris of which Brick/Wood comprises 27% , with remaining being Reinforced Concrete/Steel. If the debris tonnage is converted to an estimated number of truckloads, it will require 120,000 truckloads (@25 tons/truck) to remove the debris generated by the earthquake. The earthquake if originated from under the city of 6.0 Mw, will generate an estimated 8 million tons of debris. Out of the total amount, Brick/Wood comprises 28 % of the total, with the remaining being Reinforced Concrete/Steel. If the debris tonnage is converted to an estimated number of truckloads, it will require 320,000 truckloads (@25 tons/truck) to remove the debris generated by the earthquake.

Sylhet City Corporation Area

During an earthquake of 8.0 Mw originated from Dauki fault, a total of 2 million tons of debris will be generated. Out of this, Brick/Wood comprises 29%, with the remaining being Reinforced Concrete/Steel. If the debris tonnage is converted to an estimated number of truckloads, it will require 80,000 truckloads (@25 tons/truck) to remove the debris generated by the earthquake. The earthquake if originated from under the city of 6.0 Mw, will generate an estimated 1 million tons of debris. Out of the total amount, Brick/Wood comprises 30% of the total, with the remaining being Reinforced Concrete/Steel. If the debris tonnage is converted to an estimated number of truckloads, it will require 40,000 truckloads (@25 tons/truck) to remove the debris generated by the earthquake.

Concept of Operations

3.1 General Operations

Much has been written in regards to Bangladesh's vulnerability to a number of natural and man made disasters. While cyclones and floods may pose the greatest risk to Bangladesh at a national level, it has been identified that the North Eastern and South Eastern regions of Bangladesh are vulnerable to earthquake (Bangladesh Disaster Risk Management Profile 2006). As per the seismic macro-zonation studies, urban areas such as Chittagong, Sylhet, Dhaka, Rangpur, Bogra, Mymensingh, Comilla, Rajshahi are located within possible seismic active zone. Although some level of awareness is raised among population by various institutions the country is far behind the minimum preparedness level to face such a disaster occurrence in any of such urban areas. This chapter provides a more detailed indication of the current situation with regards to potential earthquake emergencies under which this plan operates and the principles of operation that are utilised within Bangladesh.

3.1.1 Management Principles

In the draft National Policy for DM, the highest priority during and after a disaster has been accorded to response, relief and immediate recovery of essential services, and to medium and longer term reconstruction and rehabilitation to a higher standard than before the occurrence of the disaster.

In the emergency phase, main focus of the agencies involved in first responder functions and managing the earthquake emergency situation will be to:

- Save lives
- Provide humanitarian assistance to victims
- Restoration of life line facilities to reduce or minimize the hardships

3.1.2 Operations Principles

In the **pre-disaster phase** the **DMB will play a lead role in coordinating and ensuring preparedness of first responder organizations** for effective management of response activities in partnership with other stakeholder agencies. **During disasters the Armed Force Division will take the lead role** in responding to the emergency situation. The main function of Search and Rescue of victims will be handled by AFD with support from FSCD. Para- military forces, Police and community first responders will assist the professional S&R personnel employed by FSCD and AFD.

The Relief and welfare of victims during disasters will be handled by the DRR. In relief and temporary shelter management, strict adherence will be ensured to social justice, equitable distribution of relief, neutrality and impartiality in the provision of assistance and respect for the dignity, values and culture of affected persons. Due consideration will be given to activities with respect to Internally Displaced Persons (IDPs) as a result of earthquakes and collateral hazards associated with primary and secondary events. DMB and DRR will coordinate with Ministry of Food & Disaster Management as required.

Currently, there are several ministries and agencies handling different functions related to post disaster recovery, rehabilitation and reconstruction. **During the post disaster period DMB will coordinate** on behalf of the MoFDM with all these

ministries and agencies as relevant, in **planning the long term recovery** and to **review the success of plan operations** for necessary mortifications.

3.1.3 Capacity Assessment

The shortfalls in existing capacities for responding to the needs during the disaster situation will be tied to a scenario based assessment and can be analysed only after **production of hazard, vulnerability maps and loss estimation using HAZUS**. The capacity of respective first responder organizations needed to respond to such scenarios will be determined against the potential earthquake events (of magnitude “xyz”) that impact the cities of Dhaka, Chittagong, and Sylhet. The devastating effects, severity of impacts will be compared against the ability of first responder organizations in terms of their manpower, equipment, material, location of institutions and proximity to the potential zones of high impact, health care needs for mass casualty treatment, and all other needs to respond to earthquake emergencies.

3.2 Standard Operating Procedures (SOP)

National Earthquake Contingency Plan is a plan for management of earthquake emergencies of any magnitude which describes the management arrangements; relationships; strategies and mechanisms for ensuring effective response to the earthquake emergency situations if and when they occur, in different scenarios. The SOPs are needed to:

- Execute the command control structure for plan implementation and highlight the operating procedures of the plan in relation to respective first responder organisations
- Develop a reporting structure between the National Emergency Operations Center and first responder organisations
- Guide the individuals within the first responder organizations who are members of the overall response structure to discharge the assigned roles of the institution effectively

Standing Operating Procedures (SOP’s) should guide the respective first responder organization to effectively discharge the assigned responsibility of each organisation or agency that has a role to play within this National Earthquake Contingency Plan. The SOPs for each responder organization have been developed and provided in the Agency level Contingency Plans.

The individual agencies are supposed to further expand the SOPs to reflect the vertical level functional responsibilities and horizontal level coordination, control & command structure within the organization.

Through the SOPs, the first responder organizations under the National Earthquake Contingency Plan should develop a reporting structure to report to the National Emergency Operations Center.

The National Emergency Operations Center, which is being established separately, will deal with in detail the tasks of Emergency Operations, including all activities ranging from early warning through immediate recovery of essential services and public utilities, covering in detail the emergency response and operations procedure for multi-stakeholder response in disaster or emergency situations in different

scenarios. In case of earthquakes, since there is no time for early warning the response functions will start soon after the occurrence of earthquake but contingency plan has to be activated through an announcement by the Hon. Prime Minister on the advise on the Secretary, Ministry of Food and Disaster management and the Director General of Disaster Management Bureau(DMB).

3.2.1 Stakeholders

There are a number of institutions (ministries, departments, line agencies etc.) who have crucial roles to play during the disaster situation. Such institutions are the key stakeholders of this contingency plan and they must be involved in every step of the plan development process. Each stakeholder has different types and levels of functional responsibility associated with the comprehensive earthquake contingency plan. Table 3.1 shows a range of different stakeholders and the functions they are supposed to carry out during the disaster events as well as in the plan development and implementation process.

Table 3.1 Stakeholders of National Earthquake Contingency Management

AGENCY	BROAD AGENCY LEVEL FUNCTIONS
Ministry of Food and Disaster Management (MoFDM)	<ul style="list-style-type: none"> • Plan administration • M&E
Disaster Management Bureau (DMB)	<ul style="list-style-type: none"> • Plan development, review and revisions • Coordination among stakeholders and facilitate development of Agency level plans • organize training and public awareness activities related to plan implementation • operate an emergency operation center • facilitate preparation of Union, Thana and District level DM plans
Directorate of Relief and Rehabilitation (DRR)	<ul style="list-style-type: none"> • Relief Operations and welfare of victims after disaster events • Maintenance of Camps for displaced • Execution of Rehabilitation schemes • Assistance for Contingency Plan Development • Assistance for DM plan preparation of Union, Thana and District levels
Armed Forces Division (AFD)	<ul style="list-style-type: none"> • Ensure Safety and security of Victims during disaster events • Search and Rescue(S&R) operations • Response actions such as distribution of food, water, medicines and first aid assistance, • Support the actions by Govt. agencies to ensure the welfare of victims • Security for critical facilities • Post disaster immediate Recovery actions • Assistance for Rehabilitation of most essential Infrastructure
Fire Services and Civil Defence Directorate (FSCD)	<ul style="list-style-type: none"> • Fire fighting • Search and Rescue • Logistics assistance • Support the activities undertaken by Govt. agencies and AFD

AGENCY	BROAD AGENCY LEVEL FUNCTIONS
Bangladesh Police (BP)	<ul style="list-style-type: none"> • Maintenance of law & order • Safety of Victims • Traffic control during emergencies
City Corporations/ Office of the Commissioners	<ul style="list-style-type: none"> • Assistance to Govt. agencies and AFD for ensuring the safety and welfare of victims during disaster events • Assist in cleaning and disposal of debris during disaster events • Undertake City development projects to ensure safety of city dwellers • Undertake measures to ensure Conservancy, sanitation within the city • Maintenance of open areas, green areas, parks, recreation etc of city dwellers
Directorate General of Health services (DGHS)	<ul style="list-style-type: none"> • Health and hygiene • Medical care of victims • Triage • Recovery program assistance • Psycho-social activities for victim families
Bangladesh Power Development Board (BPDB)	<ul style="list-style-type: none"> • Emergency power supply to critical facilities • Restoration of power supply
Water and Sewage Authority(WASA)	<ul style="list-style-type: none"> • Emergency water supply • Rehabilitation of Water supply lines, storage, pumping stations
City Development Authorities	<ul style="list-style-type: none"> • Approval of building permits • Mitigation and preparedness measures through physical planning • Land use control • Recovery program assistance
Gas Supply Agencies	<ul style="list-style-type: none"> • Restoration of facilities • Rehabilitation and reconstruction
Bangladesh Telecommunication Regulatory Commission (BTRC)	<ul style="list-style-type: none"> • Emergency tele-communication • Restoration of destroyed facilities • Emergency telephone facilities for Emergency Response personnel
Roads and Highways Agencies	<ul style="list-style-type: none"> • Restoration of damaged roads, bridges • Rehabilitation and reconstruction operations • Emergency arrangements for Road sector (temporary bridges, repairs etc.)
Professional bodies(Bangladesh Institute of Planners, Bangladesh Institute of Architects, Bangladesh Institute of Engineers, Real Estate & Housing Association of Bangladesh (REHAB), other Professional Bodies, individual Consultants	<ul style="list-style-type: none"> • Recovery program design assistance • Rehabilitation and reconstruction assistance • Research, • Planning, Implementation support • Technology transfer • Knowledge management
Academia	<ul style="list-style-type: none"> • Research on Vulnerability & Risk assessment • Capacity building • Technology transfer • Assistance in Recovery program design
Bangladesh Red Crescent Society (BDRCS), International Federation of Red Cross and Red Crescent Society (IFRC), NGOs, International NGOs, Non-Profit Organization, Religious Groups	<ul style="list-style-type: none"> • Assistance for Contingency Plan implementation • Welfare of victims (camp maintenance, health and sanitation etc.) • Relief distribution • Community health and sanitation

AGENCY	BROAD AGENCY LEVEL FUNCTIONS
	<ul style="list-style-type: none"> • Community first aid and Physio social support for victim families • Awareness creation and social marketing • Community and household level preparedness
Community Based Organizations (CBOs)	<ul style="list-style-type: none"> • Community level relief and response activities • Awareness creation and social marketing • Community and household level preparedness
Media	<ul style="list-style-type: none"> • Public awareness • Information dissemination • Situation reports and early warning dissemination
Private Sector	<ul style="list-style-type: none"> • Resources • Training & Education • Plan implementation support
Donor agencies	<ul style="list-style-type: none"> • Provision of Resources
UN agencies	<ul style="list-style-type: none"> • Technical assistance for response and early recovery • Guidance on International conventions • Resources for early recovery

Several formal and informal meetings, consultations were conducted to identify key stakeholders and their mandates and possible roles during disaster events as part of this contingency plan development process. Many agencies participated in the process with clear mandates and roles for disaster response. However, some of them participated in the process with or without clear agency mandates; because of organization missions; concern for safety; community responsibilities. When final considerations are made on institutional mandates, consideration must be given to those who do not have mandates, in order to create appropriate mandates. When such mandates are created, initiative should be made to integrate the same in to the process effectively.

3.2.2 Management

Successful preparation and implementation of the Plan requires a well-designed management framework, including the four phases of good management: leadership, planning, organizing, and monitoring and review. The Earthquake Contingency management plan has paid special attention to create a comprehensive and effective management structure.

3.2.3 Leadership for plan management

The Government of Bangladesh has made a strong commitment to the protection of life and property of the people and the environment of Bangladesh from the consequences of disasters. The Ministry of Food & Disaster Management on behalf of

The MoFDM has been set up to:

- *facilitate implementation of DM projects and programs;*
- *design and implement programs;*
- *coordinate Monitoring and Evaluation of DRM programs; and,*
- *Provide technical assistance and administrative support.*

Box 7

the Government of Bangladesh shall take the lead role in disaster risk management activities as shown in the Box 7.

The **Ministry of Food & Disaster Management** shall undertake the **leadership responsibility for implementation of the *National Earthquake Contingency Plan*** endorsed by the National Council for Disaster Management (NCDM) and the Disaster Management Bureau (DMB) will coordinate the process of contingency plan development with the support of all other stakeholders facilitating all efforts.

3.2.4 Planning process

The tasks shown on the *National Earthquake Contingency Plan* demand careful planning to accomplish the results expected. In compliance with the current mandatory provisions, a number of Cluster s/committees have been established to facilitate plan implementation. The reporting mechanism for reporting the readiness of first responder agencies has been established. The reports should reach the Secretary, Ministry of Food & Disaster Management for onward reporting to National Council for Disaster Management (NCDM) for further advice and guidance. The Disaster Management Bureau (DMB) will be the operational arm of Ministry of Food & Disaster Management in coordinating operations for achieving programme goals and objectives necessary to accomplish the tasks included in the *National Earthquake Contingency Plan*. With the guidance and approval of the Ministry of Food & Disaster Management and National Council for Disaster Management (NCDM), the DMB will undertake various interventions to mainstream *National Earthquake Contingency Plan* tasks as a component of development planning.

A Working Group has been appointed as a follow up to the Round Table Meeting of various key stakeholders which was participated also by the Secretary, Ministry of Food and Disaster Management. The Round Table Meeting was participated by Heads of the institutions which have key roles in earthquake disaster risk management. Members for the Working Group are being nominated by these institutions for continuous update and planning to the contingency plan, and regular monitoring of its implementation. The members of the working Group include specialists, technical experts and members representing different stakeholder agencies handling different aspects of earthquake risk management. This Working Group also provides advice in specific contingency plan activities and functions at the respective levels.

3.2.5 Monitoring and Evaluation

The plan has identified specific elements and tasks to operationalize the plan and develop a work plan for the future. The Monitoring and Evaluation Plan (M&E) should be part of the overall work plan for implementation of the *National Earthquake Contingency Plan*. Monitoring and evaluation of each step identified in the work plan is necessary to ensure that the Contingency Plan goals and objectives are being met. A benchmark study prior to project initiation and review of standards

and guidelines applicable to respective project provides evaluation criteria against which project milestones can be measured. Monitoring against the established evaluation criteria may be carried out in a number of ways: reporting requirements; field visits; progress reports for each activity in the work plan; and development of a reporting system for reporting the readiness of First Responder Organizations. The regular reports submitted to DMB by First Responder Organizations will help in comparison of status against initial evaluation criteria.

Regular monitoring and evaluation enables changes in direction, refinement of approaches and elimination of unproductive activities. It also will help to improve the resource base in terms of man-power, equipment etc. The capacity building programs should address the manpower needs of the First Responder Organizations. Monitoring and evaluation should be done on a regular basis (may be bi-annually) and or following major disaster events. The Plan tasks have to be reviewed against the expected outcome and modifications should be executed in areas where improvements are needed.

3.3 Functional Response Concept

After the occurrence of a damaging earthquake and its impact on a community, there will be a huge task of different emergency response activities starting from damage assessment and need analysis (DANA), control of fires, rescue of trapped persons, treatment of injured to providing shelters and relief supplies to the displaced people. The following is the list of key response activities after any earthquake disaster.

- General Search and Rescue
- Specialist Search and Rescue
- Health and Medical Service
- Request for external assistance for search and rescue
- Law Enforcement & Security
- Emergency Shelter & Mass Care
- Fire-fighting/Rescue
- Communications
- Damage Assessment
- Identification, Care & Disposal of Dead (Coroner)
- Hazardous Material Response
- Relief Coordination
- Relief distribution
- Health & Welfare of Visitors
- Building inspection & demolition
- Inspection of Bridges overpasses, debris, etc
- Inspection of Silos, smoke stacks petroleum tank Farms etc
- Inspection of dams, reservoirs etc
- Public Information announcements & warnings
- Transportation
- Finance and Claims
- Restoration

- Utilities
- Pollution of Waterways & Marine Environments
- Impact Assessment

These emergency tasks can be grouped into a number of functional groups as a planning vehicle through which responsibilities can be assigned to a group of relevant organizations for lead and support functions. When clustering them into functional groups attempts will have to be made to identify institutions responsible for each activity. Assigning functional responsibilities to clusters and identifying lead and support institutions needed for easiness of operations, maintain the command, control structure and undertake training and capacity building operations by fixing the accountability to lead agencies in each cluster.

3.4 Functional Groups/ Clusters

Usually many agencies are involved in accomplishing the above mentioned response activities immediately after occurrence of earthquake. However, experiences have shown that these response activities are extremely complicated and no single agency alone can perform any of the response activities fully; all related organizations have to work together in a coordinated manner for optimum and efficient response. All agencies need to work together in a systematic manner so that their capacities and resources are best utilized to fulfil the need complimenting and supplementing other agencies. Realizing the need of coordinated and comprehensive emergency response, United Nations has been promoting its humanitarian response activities in a cluster approach. This approach is proved to be effective and efficient in responding to recent disasters for example the response during Oct. 8, 2005 earthquake in Pakistan. Hence, it has been decided that this concept of response operations in functional clusters be applied in Bangladesh also in case of possible earthquake disaster.

In this approach, all response activities are grouped into relevant functional clusters based on the similarity of works, normal time and disaster time mandates of different relevant organizations and possible complementarity in the resources and capacities.

With the inputs from several formal and informal consultative meetings with key stakeholders, Round Table and Working Group Meetings, and also from the guidance of Technical Advisory Group of this Contingency Plan development process, the different functional response groups (clusters) decided to be applied in Bangladesh are included in Box 8.

Operational Functional Groups

- *Emergency Operations Cluster 1– Overall Command and Coordination*
- *Emergency Operations Cluster 2 – Search, Rescue and Evacuation*
- *Health Cluster*
- *Relief Services (Food, Nutrition and other Relief) Cluster*
- *Shelter (Including Camp Management) Cluster*
- *Water Supply, Sanitation and Hygiene Cluster*
- *Restoration of Urban Services Cluster*
- *Transport (Road, Rail, Air, Sea) Cluster*
- *Security and Welfare Cluster*

Box 8

Main response activities to be performed and identified lead agency for each of the functional response groups are as list below:

Table 3.2 Functional Response Groups (Clusters), Major Activities and Identified Lead Agencies

Functional Clusters	Activities to be performed	Lead agency	Global Cluster Partners (proposed)
Emergency Operations Cluster 1 – Overall Command and Coordination	<ul style="list-style-type: none"> • Notification of earthquake occurrence to/from concerned authorities • Conduct rapid Damage and Needs Assessment, compile emergency response needs and coordinate for appeals • Operationalization of agency, city etc. level Emergency Operations Centers (EOCs) • Facilitation and coordination for response operations <ul style="list-style-type: none"> ○ Command, control, Coordination among response institutions ○ Maintain proper chain of command ○ Facilitation for logistics and relief transport ○ Lead and operational zing the Incident Command System (ICS) ○ Compile reports regarding response operations • Information dissemination (media) and communication 	MoFDM (National EOC)	UNOCHA, UNRC
Emergency Operations Cluster 2 – Search, Rescue and Evacuation	<ul style="list-style-type: none"> • Light Search and Rescue at the neighbourhood level • Specialized search and rescue • Rubble removal • First Aid & First Medical Response to provide emergency medical treatment • Field level victim triaging • Victim Transportation • Medical care of victims and injured people • Evacuation from hazardous areas • Fire safety & rescue 	FSCD	IFRC
Restoration of Urban Services Cluster	<ul style="list-style-type: none"> • Quick restoration of critical services (electricity, communication, transportation and other critical services) • Detail damage assessment of buildings, infrastructures and other facilities • Restoration and rehabilitation of utilities and services 	City Corporations	UNDP
Health Cluster	<ul style="list-style-type: none"> • Preparedness planning for Hospitals • Arrangements for Medicare for injured • Child care and reproductive health • Medicare for sick people 	DG-Health services	WHO

Functional Clusters	Activities to be performed	Lead agency	Global Cluster Partners (proposed)
	<ul style="list-style-type: none"> • Counseling and Psycho-social trauma support • Mortuary services • Epidemic control • Immunization 		
Relief Services (Food, Nutrition and other Relief) Cluster	<ul style="list-style-type: none"> • Needs analysis survey (to identify needs for victims) • Supply and distribution of food items • Supply and distribution of non-food and other relief items 	DRR	UNICEF, IFRC, WFP
Security and Welfare Cluster	<ul style="list-style-type: none"> • Management of dead & Missing • Security arrangements, Maintenance of law and order • Security (security of people and properties) • Traffic control • Maintenance of Information on dead and missing • Identification and reunification of displaced people 	BP	UNHCR/OHCHR /UNICEF
Shelter (Including Camp Management) Cluster	<ul style="list-style-type: none"> • Establishment of temporary shelters • Collection and distribution of emergency shelter items eg. tents, tarpaulins etc. and assistance to people for erecting such emergency shelters • Identification of people those needing shelters in camps • Identification of Camps for displaced • Shelter management • Maintenance of information related to IDPs 	AFD	IFRC UNHCR IOM
Water Supply, Sanitation and Hygiene Cluster	<ul style="list-style-type: none"> • Rapid Damage assessment • Restoration of Water supply & drainage • Sanitation • Waste disposal 	City Corporations	UNICEF
<i>Transport (Road, Rail, Air, Sea) Cluster</i>	<ul style="list-style-type: none"> • Vulnerability assessment • Damage assessment and planning for restoration of transportation facilities connected with • Road transportation • Rail transportation • Air transportation • Sea transportation • Arrangements for quick restoration of transportation facilities 	BRTA, CAAB, BR, CPA	UNDP, WFP

3.5 Plan Contributors

Current public and private sector institutions, which are actively involved in earthquake risk management activities, are (but not limited to):

- Armed Forces Division (AFD)
- Bangladesh Fire Service & Civil Defense (FSCD)
- Bangladesh Police (BP)
- Bangladesh Ansar & VDP
- City Corporations and Authorities
- Directorate of Relief and Rehabilitation (DRR)
- Disaster Management Bureau (DMB)
- Directorate General of Health Services (DGHS)
- Dhaka Power Distribution Company (DPDC)
- Water Supply and Sewerage Authority (WASA)
- Titas Gas Transmission and Distribution Co. Ltd.
- Bangladesh Power Development Board (BPDB)
- Office of Commissioners in the Dhaka, Chittagong, Sylhet city corporation
- Anjumane Mofidul Islam, Bangladesh (AMI)
- Bangladesh Road and Transport Authority (BRTA)
- Geological Survey of Bangladesh (GSB)
- Institute of Architects Bangladesh (IAB)
- Institution of Engineers Bangladesh (IEB)
- Bangladesh Institute of Planners (BIP)
- Bangladesh Garment Manufacturers and Exporters Association (BGMEA)
- Real Estate & Housing Association of Bangladesh (REHAB)
- Federation of Bangladesh Chambers of Commerce (FBCCI)
- Bangladesh Telecommunications Company Limited (BTCL)
- Electronic and Print Media
- Various Mobile Companies: Grameen Phone, AKTEL, Banglalink, CityCell, TeleTalk)
- NGOs: International Federation of Red Cross and Red Crescent (IFRC), Oxfam GB Bangladesh Program, CARE Bangladesh, Islamic Relief Worldwide (IR), Action Aid Bangladesh (AAB), Bangladesh Disaster Preparedness Centre (BDPC), Bangladesh Red Crescent Society (BDRCS), etc.

Functional Response Groups and their Roles and Responsibilities

4.1 Emergency Response Tasks as per Functional Groups- Preparedness and Mitigation Phase (normal time activities as shown in the following matrices)

CLUSTER 1- EMERGENCY OPERATIONS- OVERALL COMMAND AND COORDINATION				
Objective: To prepare a framework for integrated response efforts by formulating a well coordinated system for reduction of impacts of potential earthquake events				
Cluster Lead: DMB, National EOC				
Responsible Ministry: Ministry of Food and Disaster Management				
Main Tasks assigned to lead and support agencies: 1) Network with National Emergency Operations Centre (NEOC), contributions to NEOC functions and periodic reporting on readiness 2) Contributions to disaster event response reporting system Institutional 3) ICS development at various levels 4) Participate in the Command, Control, Coordination Structure 5) Network with other agencies for information dissemination				
Expected Main Tasks by UN cluster partners				
<ul style="list-style-type: none"> • Technical assistance in Setting up the National EOC 		<ul style="list-style-type: none"> • Contributions for building the capacity of NEOC 		
Expected Main Tasks by other associated agencies				
<ul style="list-style-type: none"> • Participate in Disaster event response reporting • Public information dissemination related to emergency declaration, announcements & warnings on after shocks • Disseminate public awareness & advocacy material to support contingency plan implementation 				
<i>ACTIVITIES</i>		<i>LEAD AGENCY</i>	<i>SUPPORT AGENCIES/INSTITUTIONS</i>	<i>GLOBAL CLUSTER PARTNER (PROPOSED)/OTHER ASSOCIATE AGENCIES</i>
Pre-disaster Phase	Development of Standard Operation Procedure (SOP)	AFD, DRR	Ansar & VDP, RAB, Cost Guard, DMC, DFP, BDR	Global cluster partners - UNOCHA, UNRC Others – BDRCS, NGO, INGO
	Establish National level 24/7 National Emergency Operation Centre (National EOC) and participate in EOC operations and reporting of readiness	FSCD, AFD	Meteorology Department	
	Setting up earthquake Incident Command Systems (ICS) in place (establishment, training and capacity building) where appropriate	FSCD	Ansar & VDP, RAB, Cost Guard, DMC, DFP, BDR, Meteorology Department	
	Organize ICS training and nominate representatives to participate in ICS established at various levels	DMB	Ansar & VDP, RAB, Cost Guard, DMC, DFP, BDR, Meteorology Department	

	Develop a disaster event response reporting system by stakeholder agencies (impacts, resource needs, actions by them for reducing the impact, difficulties, opportunities etc) during earthquake/any other disaster event	DMB	Ansar & VDP, RAB, Cost Guard, DMC, DFP, BDR, Meteorology Department	
	Promotion of informal education on earthquake Contingency Plan operations at all levels and conduct simulations	FSCD, NCB	Dept. of Mass Communication, NGO's	
	Develop guidelines for media agencies on reporting disaster events procedures for public information dissemination related to emergency declaration, announcements & warnings on after shocks and disseminate public awareness & advocacy material to support contingency planning and implementation	DMB	Office of Deputy Commissioners, PID, Bangladesh Television, Bangladesh Betar, Private TV channels, Radio channels, News papers	
Emergency Response Phase	Facilitate mobilization of earthquake incident command system where necessary under the command of AFD and Networking with organizations under ICS	DMB, National EOC	FSCD, AFD, DGHS, DRR, BTRC, BP, RHD, BIWTA, BCAA, BR, Civil Aviation Authorities, Office of Divisional Commissioners, Local Government bodies, Utility agencies and PID	Global cluster partners - UNOCHA, UNRC
	Execute operation surveillance continuously covering all the earthquake affected areas	DMB	FSCD, AFD, DGHS, DRR, BTRC, BP, RHD, BIWTA, BCAA, BR, Civil Aviation Authorities, Office of Divisional Commissioners, Local Government bodies, Utility agencies and PID	
	Expansion of National EOC to address the needs after earthquake disaster event and facilitate EOC operations, Daily or periodic reporting by stakeholders	DMB, National EOC	FSCD, AFD, DGHS, DRR, BTRC, BP, RHD, BIWTA, BCAA, BR, Civil Aviation Authorities, Office of Divisional Commissioners, Local Government bodies, Utility agencies and PID	Others – BDRCS, NGO, INGO
	Mobilize ICS teams at lower level command structure	DMB	FSCD, AFD, DGHS, DRR, BTRC, BP, RHD, BIWTA, BCAA, BR, Civil Aviation Authorities, Office of Divisional Commissioners, Local Government bodies, Utility agencies and PID	

	Facilitate coordination of logistic supply management	DMB/AFD/DRR	FSCD, AFD, DGHS, DRR, BTRC, BP, RHD, BIWTA, BCAA, BR, Civil Aviation Authorities, Office of Divisional Commissioners, Local Government bodies, Utility agencies and PID	
	Assist authorities for communications with media in relation to information dissemination on welfare of victims, Missing and found, Results on Damage assessment surveys, Results on need assessment surveys and facilitate media coverage by media agencies on reporting earthquake disaster event	PID	DMB, Office of Deputy Commissioners, Bangladesh Television, Bangladesh Betar	
	Facilitate public information dissemination related to emergency declaration, announcements & warnings on after shocks and repeat of occurrences of other collateral hazards due to aftershocks	PID	DMB, Office of Deputy Commissioners, Bangladesh Television, Bangladesh Betar, Department of Mass Communication	
Early Recovery Phase	Coordinate Operation Surveillance to reduce impacts due to aftershocks	DMB/ AFD	All first responder organizations (AFD, FSCD, DGHS, DRR), Local Government Bodies, Utility Agencies	Global cluster partners - UNOCHA, UNRC
	Facilitate coordination of logistic supply management and deployment of resources to affected areas, IDP camps etc	DMB/ AFD	All first responder organizations (AFD, FSCD, DGHS, DRR), Local Government Bodies, Utility Agencies	
	Conduct Post disaster Evaluation of performance of <ul style="list-style-type: none"> earthquake incident command system and recommend improvements performance of National EOC and improvement where necessary 	DMB	All first responder organizations (FSCD, DGHS, DRR), Local Government Bodies, Utility Agencies	
	Facilitate continuation of EOC operations and periodic reporting during early recovery period to EOC on involvement of all first responder organizations in earthquake event management and for necessary assistance	DMB	All first responder organizations (FSCD, DGHS, DRR), Local Government Bodies, Utility Agencies	
	Facilitate media coverage by media agencies on reporting of post-earthquake disaster event situation analysis and facilitate public information dissemination related to emergency declaration, Announcements & warnings on after shocks and possible impacts due to collateral hazards	PID, DMB (National Earthquake EOC)	Electronic and Print media	Others – BDRCS, NGO, INGO

	Assist authorities for communications with media in relation to information dissemination on welfare of victims, Missing and found, Results on damage assessment surveys, Results on need assessment surveys	PID, DMB (National Earthquake EOC)	DRR, Electronic and Print media	
	Review the Contingency Plans under the Cluster - Emergency Operations- Overall Command and Coordination and revise the same to include suitable modifications to improve the performance	DMB (National Earthquake EOC)	All first responder organizations (FSCD, DGHS, DRR), Local Government Bodies, Utility Agencies	

Cluster 2 - Emergency Operations- Search, Rescue & Evacuation

Objectives:

- Preparation of effective plan for emergency services (Search ,Rescue & Evacuation, First Aid, Fire Safety etc.) by ensuring inter-agency coordination at national level
- Building the Capacity of concerned agencies and developing national guidelines in the light of international practice

Cluster Lead: FSCD

Responsible Ministry: Ministry of Home Affairs

Main Tasks assigned to lead and Support Agencies:

- 1) Search & Rescue 2) First aid & First Medical Response to provide emergency medical treatment 3) Triage, stabilization of victims before treatment
4) Fire safety & rescue

Expected tasks by UN Cluster partners

- Mobilize the support of relevant International agencies in Search and Rescue operations during earthquake emergencies
- Support for Capacity building of concerned agencies

Expected Main Tasks by other associated agencies

- First Responder training at community level
- Pre-positioning of S&R equipment at community level
- Conduct periodic simulations to enhance the community level preparedness

	<i>Activities</i>	<i>Lead Agencies/ Institutions</i>	<i>Support Agencies/Institutions</i>	<i>Global Cluster Partner (Proposed)/Other associate agencies</i>
Pre-disaster Phase	Develop guidelines for meeting of INSARAG following International USAR Guideline	FSCD	AFD, BP, Local Government bodies	Global cluster partners - IFRC
	Cataloguing/procurement of equipment for special search & rescue & develop procedure for ensuring access	DMB	FSCD, AFD, DGHS, BDRCS, Local Government bodies	
	Capacity building for creating special units for urban search and rescue from collapsed buildings, infrastructure, Medical First Response	FSCD	AFD, DGHS, BDRCS, Local Government bodies	
	Capacity building of community first responder groups in search and rescue operations, medical first response	FSCD	DMB, DGHS, BDRCS, Local Government bodies	
	Develop medico-legal procedure for identification and tagging of dead bodies with health group	DGHS	DMB, BDRCS, AMI, Local Government bodies, NGOs	Others – BDRCS, NGO, INGO
	Ensure fire safety preparations (through pre-positioning of fire hydrants, fire stations, land use planning, developing data base of sources of water, storage of material etc.)	FSCD	Local Government bodies, City Development Authorities, Utility agencies	
	Pre-positioning of tools , equipment and accessories get the civil	DMB	FSCD, AFD, DGHS, LGED, Local	

	authorities to develop inventories of such equipment available for use during earthquakes		Government bodies, Utilities agencies , BDRCS	
	Prepare resource inventory (equipment, tools, accessories and manpower etc.) and Procurement of necessary tools and equipment for urban S&R operations to fill the agency level gaps	DMB/AFD/FSCD	FSCD, AFD, DGHS, DRR, BTRC, BP, Bangladesh Ansar & VDP, RHD, BIWTA, BCAA, BR, City Development Authorities, Local Government bodies, Utility agencies	
	Prepare guidelines for logistic supply management and deployment of resources	DMB	FSCD, AFD, DGHS, DRR, BTRC, BP, Bangladesh Ansar & VDP, RHD, BIWTA, BCAA, BR, City Development Authorities, Local Government bodies, Utility agencies	
	Capability assessment of agencies who could be involved in search & rescue operations	FSCD	AFD, DMB, DGHS, BDRCS, Local Government bodies	
Emergency Response Phase	Carry out the inter-agency coordination to optimize the efforts of Search and Rescue teams by providing necessary guidance and inputs.	FSCD, National EOC	AFD, Local Government Bodies, Office of the District Commissioners, BP, Bangladesh Ansar & VDP, BDRCS	Global cluster partners - IFRC
	Supervision of compliance to INSARAG and International USAR guidelines	FSCD	Local Government bodies, City Development Authorities, AFD, DGHS, DRR, BTRC, BP, RHD, BIWTA, BCAA, BR, Office of Divisional Commissioners, Local Government bodies, DMB, Utility agencies	
	Coordination with national & international teams engaged in USAR and coordination of information supply and feedback	FSCD, National EOC	AFD, DGHS, BDRCS, Local Government bodies, Office of the District Commissioners	Others - BDRCS, NGO, INGO
	Mobilize special teams of US&R for search and rescue from collapsed buildings, infrastructure	FSCD	AFD, DGHS, BDRCS, Local Government bodies, Office of the District Commissioners	
	Mobilizing necessary additional manpower, tools and equipment for urban S&R operation from other stations located outside the affected area	FSCD	AFD, DMB, DGHS, BDRCS, AMI, Local Government bodies	
	Mobilize community based social volunteer networks and trained first responders from areas unaffected to support the S&R parties	Local Government Bodies, Office of the District Commissioners with the support of	FSCD, Bangladesh Ansar & VDP	

		BDRCS, CBOs, and NGOs		
	INSARAG marking should be done by CSSR team	FSCD		
	Make arrangements to obtain resource inventory and data base for S&R operations and provide data based on the spatial data on rapid loss estimation	DMB, National EOC	FSCD, AFD, DGHS, LGED, Local Government bodies, Utilities agencies	
Early Recovery Phase	Networking with organizations and mobilize support for search & rescue operations in areas which are difficult to reach.	FSCD	AFD, DGHS, DRR, NGOs	Global cluster partners - IFRC
	Mobilize community based social volunteer networks and trained community first responder groups to assist special units mobilized for search and rescue from collapsed buildings, infrastructure	BDRCS, City Corporations	FCSD, BP, DGHS, Bangladesh Ansar & VDP, AMI	
	Make arrangements to Access Resource inventory items for S&R operations and mobilize support of external groups for search and rescue operations	FCSD	AFD, DGHS, DRR, NGOs	Others – BDRCS, NGO, INGO
	<ul style="list-style-type: none"> • M&E and post disaster performance evaluation of special units mobilized for search and rescue from collapsed buildings, infrastructure • inter-agency coordination functions • All relevant emergency services in operation in earthquake affected areas aiming at reducing the human casualties 	DMB	AFD, FCSD, DGHS, DRR, BP, DGHS, RHD, DCC, LGED, Bangladesh Ansar & VDP	
	Review the Contingency Plans under the Cluster - Emergency Operations- Search Rescue and Evacuation and revise the same to include suitable modifications to improve the performance	FSCD/DMB	AFD, FCSD, DGHS, DRR, BP, DGHS, RHD, LGED Bangladesh Ansar & VDP,	

Cluster 3 - Health

Objectives:

- To minimize human casualties by establishing an efficient medical first response system in areas with high seismic hazard
- To enhance the hospital emergency medical care through development of Hospital Preparedness plans
- Capacity building for setting up a well-organized mass casualty treatment system.
- Develop epidemic surveillance system to prevent outbreak of epidemics during post earthquake period

Cluster Lead: Directorate General of Health Services (DGHS)

Responsible Ministry: Ministry of Health & Family Welfare

Main Tasks assigned to lead and support agencies:

- 1) Arrangements for Medicare for injured 2) Preparedness planning for Hospitals 3) Handling dead & Missing 4) Medicare for sick & injured people
5) Counseling and Physio-social support

Expected Main Tasks by UN cluster partners

- Sharing of best practices from other countries
- Technical Assistance in Capacity building in Hospital Preparedness Planning

Expected Main Tasks by other associated agencies

- Counseling and Physio-social support at community level
- Community medical first responder training
- Assistance in funeral arrangements at community level

	<i>Activities</i>	<i>Lead Agencies/ Institutions</i>	<i>Support Agencies/Institutions</i>	<i>Global Cluster Partner (Proposed)/Other associate agencies</i>
Pre-disaster Phase	Hospital Preparedness planning and training on Hospital Preparedness for Emergency operations	DGHS	Office of Civil Surgeon, AFD, Centre for Medical Education (CME), CDC, NIPSOM	Global cluster partners - WHO, IRC, UNICEF, ICDDRB
	Methodology development for handling of dead and missing during earthquakes and emergencies	DGHS	Office of Civil Surgeon, AFD, CPP, DMB, AMI, DoE, LG	
	Develop networks with private & government hospitals within the area and in the neighborhood for support during emergencies like earthquakes	DGHS	AFD, Office of Civil Surgeon, AFD, DH	
	Develop alert system for hospital staff including doctors to report for work during emergencies such as earthquakes	DGHS	CPP, Office of Civil Surgeon, AFD, DH	
	Setting up of 24/7 State of the art ambulance services	DGHS	Centre for Medical Education (CME), Office of Civil Surgeon, AFD, DMB, AMI, FSCD, DH	

	Identify needs for pre-positioning of medicine, temporary hospitals etc and obtain the necessary resources	DGHS	NGOs, AFD, NGOs, FSCD, Office of Civil Surgeon, AFD	Others – NGO, INGO, BDRCS
	Methodology development for epidemic surveillance and control Conduct operation surveillance training for all First Responder Organization for quick mobilization in earthquake events	DGHS	Office of Civil Surgeon, AFD, IEDCR, BDRCS	
	Train community medical first responders within the city and develop a database	DGHS,	AFD, NGOs, FSCD, Centre for Medical Education (CME), Office of Civil Surgeon, AFD, NGOs	
	Methodology development for estimation of casualty and human injury	DGHS	Office of Civil Surgeon, AFD, CPP, DMB, LG, Agencies under Home Ministry	
	Methodology development for estimation of livestock casualty	DLS	CPP, DMB, BLRI, AFD	
Emergency Response Phase	Mobilize health teams for providing emergency medical care to displaced persons.	DGHS	AFD, FSCD, Office of Civil Surgeon, CPP, DRR, BLRI, NGO	WHO, IRC, UNICEF
	Activate the alert system for hospital staff and voluntary groups to report to hospitals and medical centers as planned	DGHS	Hospital and Clinic authorities, Medical Colleges	
	Mobilize health teams to provide first aid to displaced and injured when and where necessary	DGHS	FSCD, Office of Civil Surgeon , NGO, BDRCS	
	Mobilize health teams for setting up of temporary hospitals in suitable locations, when and where necessary to treat injured and sick after the earthquake	DGHS	AFD, Office of Civil Surgeon, BRCS, CPP, DMB, DH	
	Mobilize pre-positioned medical facilities , Mobile Hospitals etc to treat injured and sick	DGHS	Hospital and Clinic authorities, Local Government Bodies, AFD,FSCD, Office of Civil Surgeon	
	Mobilize support from other hospitals(Private hospitals (I think no need), hospitals located elsewhere etc) when and as needed and coordinate with private and International Medical Teams to optimize their contributions to national efforts in saving lives and treatment of critically injured.	DGHS	Hospital and Clinic authorities, Local Government Bodies, AFD,FSCD, Office of Civil Surgeon, NGOs	
	Mobilize medical first responders within the city to assist field medical teams, Hospitals and Medical Clinic authorities	DGHS	DGHS, Hospital and Clinic authorities, Local Government Bodies, AFD,FSCD, BRCS, Office of Civil Surgeon, AMI	
	Mobilize trained Triage teams to affected city wards and control points, transportation of injured to hospitals	DGHS	Hospital and Clinic Authorities, Local Government Bodies, Office of Civil Surgeon	

	Mobilize ambulance services to transport sick and injured	DGHS	Hospital and Clinic authorities, AFD, Local Government Bodies FSCD, BRCS, Office of Civil Surgeon. AMI	Others – NGO, INGO, BDRCS
	Mobilize health teams for tagging of dead bodies and locating missing during the earthquake	DGHS	Office of Civil Surgeon, AFD, AMI, LG, MoHA Agency	
	Get assistance from qualified professionals to conduct rapid damage assessment of all health infrastructure within the city and identify suitability for usage for treatment of injured and sick	DGHS	Local Government Bodies, Professional bodies, Acedemia, LGED, PWDB, CMMU, DPHE	
	Establishing counseling centers	DGHS	DMB, NGOs	
Early Recovery Phase	Continue in providing emergency medical care to displaced persons.	DGHS	AFD, DMB, DRR, Local Government Bodies, Civil Society, DH	WHO, IRC, UNICEF Others – NGO, INGO, BDRCS
	Conduct the M&E and performance evaluation of Health cluster activities and introduce necessary modifications to improve the performance	DGHS	AFD, FSCD, DMB, DRR, Local Government Bodies, BDRCS, NGO	
	Conduct evaluation of performance of medical first responder groups and improve the methodology for training and simulations	Local Government Bodies	DGHS, NGOs, Media	
	Conduct the evaluation of ambulance services to transport sick and injured during emergencies and introduce modifications to improve the services	Local Government Bodies	DGHS, NGOs, Hospital and clinic authorities, Life line service providers	
	Continue Assistance to authorities in mortuary services(such as identifying dead & missing, issue of death certificates for disposed and inventorying and maintenance of records etc)	DGHS	AFD, FSCD, DMB, DRR, NGOs, Local Government Bodies, BDRCS,	
	Follow medico-legal procedure for identification and tagging of bodies, disposal of dead bodies	DMB, AFD,	BRCS, NGOs, Local Government Bodies, MoHA Agencies, AMI	
	Conduct Evaluations of the level of preparedness & performance during emergency by all Hospital and Medical institutions	DGHS	AFD, Local Government Bodies, Medias, Civil Society	
	Conduct review of the Contingency Plan for the Health Cluster agencies and revise to integrate the improvements	DGHS	AFD, FSCD, DMB, DRR, Local Government Bodies,	

Cluster 4 - Relief Services (Food, Nutrition and other Relief)

Objectives:

- Damage Analysis and Need Assessment surveys to identify external needs,
- Ensure provision of necessary essential facilities for displaced after emergencies
- Provision of food and nutrition ,logistic supply to displaced based on need assessment
- Efficient coordination with UN Agencies, international and local NGOs, Donor agencies to supplement the government welfare assistance to IDPs
- Intersection/ Coordination

Cluster Lead: Directorate of Relief and Rehabilitation (DRR)

Responsible Ministry: Ministry of Food and Disaster Management

Main Tasks assigned to lead and support agencies:

1) Damage Analysis and Need Assessment survey, 2. Arrangements for Food & nutrition and non-food supplies for displaced 3) Maintenance of Camps for IDPs after emergencies, 4) Prevention of outbreak of epidemics within the camps set up for IDPs

Expected Main Tasks by UN cluster partners

- Mobilize the support of UN agencies to provide technical assistance
- Facilitate government efforts to obtain the support of International donor community through Flash appeals

Expected Main Tasks by other associated agencies

- Mobilize the support of International donor community to supplement government efforts to provide Food and non-food items
- Assistance in distribution of Food and non-food items

	<i>Activities</i>	<i>Lead Agencies/ Institutions</i>	<i>Support Agencies/ Institutions from the Government</i>	<i>Global Cluster Partner (Proposed)/Other associate agencies</i>
Pre-disaster Phase	Networking with various stakeholders and development of system for reporting the stocks of supplies and resources (funding agencies, NGOs & INGOs for identification of resources, improved coordination relief material distribution) and maintain a database	DRR, DC	,DMB, Dhaka, Chittagong and Sylhet City corporations, DoF, BDRCS	UNICEF, IFRC, WFP, FAO, ADB Others – NGO,
	Develop guidelines, data formats and carry out capacity building for Damage analysis and Need Assessment	DRR	DC, Dhaka, Chittagong and Sylhet City corporations, DMB	
	Develop guidelines and disseminate information on <ul style="list-style-type: none"> • Logistic supply management and deployment of resources, • Maintaining of temporary of permanent earthquake shelters, • Distribution of welfare items and food, • Quality assurance for food and nutrition, 	DRR	Dhaka, Chittagong and Sylhet City corporations, DMB, BDRCS	

	<ul style="list-style-type: none"> Setting up welfare camps by all agencies 			INGO, BDRCS
	Develop Guidelines for community mobilization to increase the community participation in evacuation and camp management	DMB	DRR, Dhaka, Chittagong and Sylhet City corporations, FSCD, AFD, BDRCS	
	Establish regional warehouses for store of government supplies of welfare items food and supplementary items	DRR	DC, DMB, City Corporations	
	Ensure government resources for buying additional welfare items food and supplementary items	DC,DRR	DMB, RC(Food)	
	Developing guidelines for rehabilitation of physically handicapped disabled & vulnerable groups	DRR	DMB, Social Welfare, Child Welfare	
	Develop inventory of agencies within the city who possess stocks of welfare items, food and nutrition, temporary shelter and camps, water purification plants, Generators, Cooking facilities etc to be used in case of emergencies	DRR,DC	DC,DMB, , Urban Local authorities, AFD, BDRCS	
Emergency Response Phase	Preparation of necessary documentation for preparation of Flash appeals in collaboration with UN agencies	DRR	AFD, DMB, Foreign Affairs Dept.	UNICEF, IFRC, WFP, FAO, ADB Others – NGO, INGO, BDRCS
	Conduct of Damage Analysis and Need Assessment survey in affected areas and preparation of estimates of items and other urgent needs for obtaining donor support for external contributions. Networking with various stakeholders (funding agencies, NGOs & INGOs for mobilization of contributions, improved coordination of relief material distribution)	DMB	DCs, DRR, NGOs, AFD, FSCD	
	Set up temporary camps to house IDPs and provide other essential items (such as Food, Nutrition and other Relief), Mobilize support from NGOs, INGOs for providing assistance to IDPs	DRR, DCs,	Local Government bodies, City Corporations, NGO, BDRCS, AFD	
	Mobilization of community social volunteer groups through Local Governments, CBOs and NGOs to assist setting up of camps for IDPs, maintenance of camps etc	AFD	DRR,DMB, Bangladesh Ansar & VDP, BDRCS	
	Network with ministries, departments, district authorities, UN agencies, NGOs & INGOs for mobilization of support for supply & distribution of relief material & welfare items. Supply of food and supplementary items through DCs, government departments, other district authorities for distribution to victims, Conduct surveys for quality assurance for food and distribution	DRR	DCs, AFD,DMB, Local Government Bodies Bangladesh Ansar & VDP, BDR	
	Identification of physically handicapped disabled for special treatment	DGHS	DRR, City Corporations, Private Hospitals, BDRCS, Social Welfare	

	Liaise with relevant govt. Agencies, line departments, district authorities, civil society agencies to ensure welfare of other victims(those who are living in their own, those who are with friends and relatives etc) and food supply	DRR	DCs,AFD,DMB, Local Government Bodies, Bangladesh Ansar & VDP	
	Assist other stakeholder agencies such as NGOs and INGOs for supply of food and supplementary items to displaced when and where necessary thro' assistance in national level procurement, import of items, custom clarence, transportation to affected areas etc	DRR	AFD, DCs,, Local Government Bodies	
Early Recovery Phase	Evaluation of overall performance of Cluster on Relief Services (Food, Nutrition and other Relief)	DMB, DCs	Police, Local Government Bodies, DRR, AFD	UNICEF, IFRC, WFP, FAO Others – NGO, INGO, BDRCS
	Network with ministries, departments, district authorities, UN agencies ,NGOs & INGOs and assistance for efficient coordination for distribution of relief material welfare items	DRR, DCs ,	DMB, DRROs, Local Government Bodies, DCs	
	Conducting routine surveys for quality assurance for food and nutrition distributions carried out by government and non-government agencies	DRR	Local Govt. Bodies, AFD	
	Periodic Stock taking of central Godawns to carry out qualitative and quantitative assessment of food items and facilitate efficient distribution	DG Food	NGOs, Local Government Bodies, DCs, INGOs, NGOs, DRR	
	Periodic visits to welfare camps and M&E of compliance of guidelines for maintenance of welfare camps by all agencies	DRR	DMB, DCs, AFD	
	Provide necessary Assistance in documentation, tax payment if applicable and custom clarence etc to other stakeholder agencies such as NGOs and INGOs for continues Supply of food and supplementary items to displaced located in camps for IDPs	DRR, DCs	AFD, Local Government Bodies , NBR	
	Assist all agencies providing welfare , food and nutrition support for transportation and distribution of supplies to victims when and where necessary	DRR,DCs	DRR, DMB, INGOs, Local Government Bodies, City Corporations, AFD	
	Review the Contingency Plan for the Cluster on Relief Services (Food, Nutrition and other Relief) and revise if necessary to introduce measures to improve performance	DRR	DRR, DMB, Local Government Bodies, NGOs, INGO, BDRCS, AFD	

Cluster 5 - Shelter (Including setting up temporary shelter) and Utility Planning

Objectives:

- To ensure efficient restoration of utilities and services after earthquakes such as supply of telecommunication facilities, power, gas and, waste disposal etc
- To ensure temporary shelter for displaced after disaster events such as Earthquakes and provision of basic facilities to the same
- To prevent outbreak of fire due to malfunctioning of utilities such as gas, electricity supply etc
- To ensure prevention of environmental disorder due to release of hazardous waste and material

Cluster Lead: Disaster Management Bureau (DMB)

Responsible Ministry: Ministry of Food and Disaster Management

Main Tasks assigned to lead and support agencies:

- 1) Vulnerability assessment of Utilities 2) Rapid Damage assessment 3) Restoration of utilities 4) Rehabilitation and recovery planning for utilities
5) Provision of temporary Shelter and basic essential facilities for displaced 6.Actions to control fire outbreaks, environmental hazards etc

Expected Main Tasks by UN cluster partners

- Mobilize the support of UN agencies to provide technical assistance
- Facilitate government efforts to obtain International Assistance for restoration of utility services and provision of stand-by facilities

Expected Main Tasks by other associated agencies

- Create awareness at community level on household/community level actions to control fire outbreaks, environmental hazards etc
- Assistance in setting up temporary shelter facilities, standby facilities such as generators

	<i>Activities</i>	<i>Lead Agencies/ Institutions</i>	<i>Support Agencies/Institutions</i>	<i>Global Cluster Partner (Proposed)</i>
Pre-disaster Phase	Conduct meetings with Utilities sub-committee for enhanced preparedness measures to be undertaken by Utility agencies to minimize impacts and to prevent malfunctioning of services during emergencies	DMB	TGTDCL, JGTDSL, BGSL, PGCL, DESA, DESCO, WASA, BPDB	Global cluster partners - IFRC, UNHCR, IOM
	Maintenance of stocks of most essential spare parts and service personal for attending to large scale emergencies such as earthquakes	Utility agencies		
	Develop guidelines for vulnerability assessment of utilities and conduct training for Utility sector staff for undertaking vulnerability assessments	DMB	TGTDCL, JGTDSL, BGSL, PGCL, DESA, DESCO, WASA, BPDB	
	Capacity building of utility sector for contingency planning and planning for restoration of facilities and Implement Response Capacity Assessment programs for reduction of impacts for Utility sector and develop efficient response	DMB	TGTDCL, JGTDSL, BGSL, PGCL, DESA, DESCO, WASA, BPDB, City Corporations and Urban Local bodies	

	capacity			Others – NGO, INGO, BDRCS
	Design and implement projects for pre-positioning of emergency power supply services for critical areas	Local Govt. Bodies	TGTDCL, JGTDSL, BGSL, PGCL, DESA, DESCO, WASA, BPDB	
	Develop procedure for post earthquake damage assessment of all essential utilities within the city by utility managers	TGTDCL, JGTDSL, BGSL, PGCL, DESA, DESCO, WASA, BPDB	City Corporations and Urban Local bodies	
	Identification of all buildings(such as schools) which can be used as Temporary shelter and conduct capacity assessment survey for identification of needs	City Corporations and Urban Local bodies	Utility agencies	
	Provision of utility services for buildings identified as temporary Shelters, and maintain stocks of standby emergency shelter items/equipment for quick mobilization during establishment of temporary shelter(stand-by generators, Temporary camps etc)	City Corporations and Urban Local bodies	Utility agencies	
	Identification of all possible sources of Hazardous waste/hazardous material release during emergencies and conduct awareness programs to prevent environmental and societal impacts due to release of hazardous substance during emergencies such as earthquakes	City Corporations and Urban Local bodies	Relevant Industries, Business enterprises	
Emergency Response Phase Role	Immediately activate the Plan for shut off of all supplies of Gas, electricity, Waste disposal etc at all shut off points.	Utility agencies/Local Government Bodies		Global cluster partners - IFRC, UNHCR IOM Others – NGO, INGO, BDRCS
	Utility agencies undertake restoration work and actions to rehabilitate supply of power, gas, etc to critical agencies(hospitals, AFD, Police, evacuation camps so on)	Utility agencies(TGTDCL, JGTDSL, BGSL, PGCL, DESA, DESCO, WASA, BPDB)/Local Government Bodies	AFD,FSCD, School, College, Universities, DMB, DRR,	
	Conduct rapid damage assessment survey of power supply systems(generation, distribution, supply) and restoration of supply to critical facilities(such as hospitals, police, AFD, Fire Service etc) Organize project teams to conduct Rapid damage assessment of all essential utilities within the city by utility	Utility agencies (TGTDCL, JGTDSL, BGSL, PGCL, DESA, DESCO, WASA, BPDB)/ Local Government Bodies,	AFD, FSCD, Universities,	

	managers			
	Mobilize pre-positioned emergency power supply services for critical areas	BPDB	DESA, DESCO, AFD, FSCD, Local Govt. Bodies, Universities, NGOs	
	Obtain periodic situation reports and review the progress on activation of Contingency Plans and restoration of services by utility agencies	DMB	TGTDCL, JGTDSL, BGSL, PGCL, DESA, DESCO, WASA, BPDB	
Early Recovery Phase	Conduct survey of Temporary shelter set up for IDPs for qualitative improvement of shelter for IDPs	DMB	DRR, AFD, Local Government Bodies, Academia, Professional bodies,	Global cluster partners - IFRC, UNHCR IOM
	Develop early recovery Plans for setting up new Settlement programs and rehabilitation of partially damage settlement and housing for supply of permanent shelter for affected.	DMB	Local Government Bodies, Academia, Professional bodies,	
	Conducting damage assessment survey of all utilities and prepare Plans for restore and rehabilitate supply of power, water, gas, to affected areas and in waste disposal	All Utility agencies	DMB,AFD, Local Government Bodies, Universities, PDB, Private Telecom Companies, TITAS, Utility agencies	
	Conduct damage assessment survey of power supply systems(generation, distribution, supply) and prepare estimates for restoration of supply to other areas , Preparation of Plans for rehabilitation	BPDB	Local Government Bodies, Universities, DESA, DESCO	
	Integrate mitigation and preparedness programs in Recovery Planning by utilities for reduction of future earthquake impacts during restoration of facilities	All Utility agencies	Local Government Bodies, Universities, PDB, Telecom, TITAS, Utility agencies	Others - NGO, INGO, BDRCS
	Assist in restoration of all essential utilities and services within the city by utility managers	Local Government Bodies	PDB, TITAS, WASA, DESA, Universities	
	Provide periodic situation reports on the status of restoration of services and review the progress	DMB, National EOC	PDB, TITAS, WASA, DESA, Universities	
	Review the Performance of Cluster 5 - Shelter (Including setting up temporary Camps) and Utility Planning Cluster and introduce modifications to the Contingency Plan for better performance in future.	DMB, National EOC	Utility agencies, Local Government Bodies	

Cluster 6 - Water Supply, Sanitation and Hygiene					
Objectives: Quick restoration of water supply for provision of safe drinking water and sanitation management during earthquake disaster.					
Cluster Lead: Local Government Bodies (City Corporations, Pourashavas)					
Responsible Ministry: Ministry of Local Government and Rural Development (Local Government Division)					
Main Tasks assigned to lead and support agencies: 1) Damage assessment of Water supply & drainage, waste management systems 2) Restoration of Water supply & drainage 3)Observe Sanitation norms during emergencies 4) Restoration of Waste disposal 5) Epidemic control and Immunization					
Expected Main Tasks by UN cluster partners					
<ul style="list-style-type: none"> Mobilize the support of UN agencies to provide technical assistance Facilitate government efforts to obtain International Assistance for restoration of Water Supply & services and provision of stand-by facilities 					
Expected Main Tasks by other associated agencies					
<ul style="list-style-type: none"> Setting up alternate measures for drinking water supply at community level Building community capacity to avoid outbreak of epidemics Public awareness creation on community level Health, Hygiene and sanitation issues. 					
		<i>Activities</i>	<i>Lead Agency/ Institution</i>	<i>Support Agencies/Institutions</i>	<i>Global Cluster Partner (Proposed)/Other associate agencies</i>
Pre-disaster Phase		Develop procedure for vulnerability assessment of water supply system, infrastructure facilities & buildings, sewerage & drainage systems by respective managers	Local Government Bodies	DWASA, CWASA, , DPHE	Global cluster partners -UNICEF, World Bank ADP GOJ
		Develop Contingency Plans for water and sanitation sector, waste management systems at all levels covering earthquake prone local government agencies by respective managers	Local Government Bodies	DWASA, CWASA, DPHE	
		Pre-positioning of water supply deep wells to be used during emergencies	WASA/DPHE	Local Government Bodies, DPHE	
		Develop minimum standards for drinking water supply and issue guidelines to public, NGOs, INGOs and other civil society agencies	Local Government Bodies	DWASA, CWASA, DPHE	
		Develop guidelines for close surveillance in epidemic outbreak and conduct of preparedness measures such as Immunization programs , awareness programs to prevent epidemic outbreaks	DGHS	Office of Civil Surgeon, AFD, Centre for Medical Education (CME), Local Government Bodies	Others – NGO, INGO, BDRCS
		Develop guidelines with water and sanitation group for minimum sanitation levels to be maintained in temporary shelter set up for IDPs	Local Government Bodies	DWASA, CWASA, DPHE, DGHS	

	Facilitate alternate systems for emergency water supplies such as transportation by container trucks, bowsers etc.	Local Government Bodies	DWASA, CWASA, DPHE, DGHS, FSCD	
	Promote household level long term water conservation methods such as rain water harvesting, water softening & SODIS techniques for water purification	Local Government Bodies	DWASA, CWASA, DPHE	
Emergency Response Phase	Activate the Contingency Plans for water and sanitation sector at all levels covering earthquake affected areas	Local government Bodies/WASA	DMB, AFD, DPHE	Global cluster partners -UNICEF, World Bank, ADP, GOJ
	Observe the emergency water supply needs and communicate to relevant stakeholders	Local government Bodies/WASA	DMB, AFD, DPHE,	
	Close surveillance in epidemic outbreak in affected areas due to problems connected with water and sanitation and make remedial actions	DGHS, , Office of Civil Surgeon	AFD, Local govt. Bodies, DRR	
	Rapid damage assessment of water supply, sewerage & drainage system and initiate actions for restoration Assist authorities to maintain water supply & sanitation facilities within welfare camps set up for victims	Local government Bodies	AFD, WASA, DPHE, DRR,	Others – NGO, INGO, BDRCS
	Implement temporary shelter sanitation management system in the temporary shelter for the benefit of victims in affected areas	Local Govt. Bodies	AFD, DMB, DRR, DPHE	
	Arrangements for quality check of water sources, bottled water and disposable water containers	Local government Bodies	DGHS, DMB, AFD, DPHE	
Early Recovery Phase	Carry out performance evaluation of response actions under cluster Water Supply, Sanitation and Hygiene and introduce suitable modifications to Contingency Plan to improve the performance	Local Government Bodies, WASA	DGHS, DMB, DRR, DPHE	Global cluster partners -UNICEF, World Bank ADP, GOJ
	Observe and facilitate the emergency water supply needs and communicate to relevant stakeholders	Local Government Bodies	DMB,WASA, DPHE, District Administrations	
	Close surveillance in epidemic outbreak in affected areas due to problems connected with water and sanitation and make remedial actions	Local Government Bodies	DGHS,DMB, WASA, DPHE	
	Conduct Damage Assessment survey for Water supply facilities and develop Plans to restore and rehabilitate water and sanitation sector facilities at all levels covering earthquake affected areas	Local Government Bodies, WASA	DMB, DPHE	Others – NGO, INGO, BDRCS
	Conduct periodic quality check of water sources, portable water containers and disposal of waste	WASA, Local Govt. Bodies	DMB, DOE, DPHE	

Cluster 7 - Restoration of Urban Services

Objectives:

- Identification of critical public facilities vulnerable to Earthquakes and strengthening the same to a higher safety level
- Spatial Planning & land use control for earthquake vulnerability reduction
- Building control & ensure compliance to Building Code practices

Cluster Lead: Dhaka, Chittagong and Sylhet City Corporations/ Concerned Local Government Bodies

Responsible Ministry: Ministry of Local Government & Rural Development

Main Tasks assigned to lead and support agencies:

1) Vulnerability assessment of building & facilities and ensure higher standards of building safety in earthquake prone areas, 2) Spatial Planning & land use control (for emergency evacuation and provision of temporary shelters both in developed & undeveloped areas) 3. Regular reviewing and updating of building codes(BC) and compliance with BC 4) Certification of suitability for occupancy after occurrence of earthquakes,

Expected Main Tasks by UN cluster partners

- Sharing of better International practices related to Urban Planning and Building control, to reduce Earthquake impacts
- Assistance in Capacity building

Expected Main Tasks by other associated agencies

- Validation of Contingency plan arrangements for evacuation at community level
- Public awareness creation on building safety and community & Household level preparedness

	<i>Activities</i>	<i>Lead Agency/ Institution</i>	<i>Support Agencies/Institutions</i>	<i>Global Cluster Partner (Proposed)/Other associate agencies</i>
Pre-disaster Phase	Conduct scenario based need assessment survey for emergency services for earthquake prone urban areas and report to authorities	Utility Agencies, FSCD, DG_HS, DRR	Urban Local authorities	Global cluster partners -UNDP, UNHABITAT, JICA
	Develop methodology for vulnerability assessment of buildings & infrastructures and loss estimation to identify high risk areas	Professional bodies (IEB, IAB, BIP), REHAB, Universities	City Development Authorities, Housing and Building Research Institute, National Housing Authority, Concerned Local Government Bodies	
	Develop procedure for restricting or preventing entry in to damaged buildings	BP	FSCD, Bangladesh Ansar & VDP, AFD , Urban Local authorities	
	Conduct Vulnerability assessment of important government buildings , critical facilities, infrastructures (Govt. Hospitals, school buildings,	Urban Local Authorities	Professional bodies (IEB, IAB, BIP), REHAB, Academia, City	

theatres, & other important govt buildings, bridges)		Development Authorities, Housing and Building Research Institute, National Housing Authority, Concerned Local Government Bodies	Others – NGO, INGO
Prepare location maps and collect other information related to pre-positioned essential facilities (bore holes, tools, equipments, fire hydrants, temporary hospitals etc) to be used during earthquakes	Concerned Local Govt. Bodies, FSCD, DGHS, DRR, Utility agencies	DMB, GSB, SoB, City Development Authorities,	
Develop guidelines for spatial planning & land use control (for emergency evacuation and provision of temporary shelters both in developed & undeveloped areas) and revise land use Plans to create/preserve open areas within urban areas, create more parks, recreational areas, green areas suitable for emergency evacuations, create essential facilities such as water, electricity	LGED/ UDD/ City Development Authorities	DMB, Concerned Local Government bodies	
Develop guidelines for Recovery Planning at various levels based on sector needs and special vulnerable groups (gender, elder persons, children etc) through integration of earthquake risk management principles to ensure higher seismic safety.	DMB	Local Government bodies, City Development Authorities, FSCD, AFD, DRR, BP, Office of Divisional Commissioners, Local Government bodies, Utility agencies, NGOs	
Regular reviewing and updating of building codes to integrate earthquake vulnerability reduction needs in buildings and methods and Efficient implementation of building codes to integrate earthquake vulnerability reduction within the city	Concerned Local Govt. Bodies,	Professional bodies (IEB, IAB, BIP), REHAB, Academia National Housing Authority, Housing and Building Research Institute, City Development Authorities, FSCD, Utility agencies,	
Identification of evacuation routes in high risk areas and take actions to improve access to inaccessible areas for S&R actions	LGED/ UDD/ City Development Authorities	DMB, FSCD, AFD, RHD, Concerned Local Government bodies, BP	
Discuss with Private institutions (Business sector, Garment factories, Industries etc) to create awareness on contingency planning to reduce losses and casualties in work places and provide necessary technical assistance and conducting mock drill etc. for contingency planning	DMB	Private institutions (Business sector, Garment factories, Industries etc), City Development Authorities,	

Emergency Response Phase	Emergency Shut down of control switches & values of electrical substation, gas control centers etc.	Gas, Electricity & Utility Agencies	MEMR & Local Govt.	Global cluster partner - UNDP, UN-HABITAT, ADB
	Mobilize Pre positioned/stand by essential emergency support units and facilities(boreholes for emergency water supply, Search and Rescue stores at community level, Stand-by generators, mobile kitchens, water supply and purification units , mobile hospitals etc)	Utility Agencies, DGHS,	Local Govt. Bodies, Bangladesh Ansar & VDP, AFD, BP	
	Facilitate safe evacuation of victims and the process of setting up evacuation centers in pre-identified areas for evacuation	AFD	BP, Bangladesh Ansar & VDP, DMB, Local Government Bodies	
	Carry out rapid damage assessment of critical facilities (school buildings, theatres, etc) & city buildings and suitability check for using as Temporary offices, IDP occupation etc	Local Government Bodies/ City Development Authorities	DMB, AFD, PWD, LGED,	Others – NGO, INGO
	Facilitate provision of basic facilities to temporary camps set up for IDPs,	AFD	DMB, FSCD, Local Government Bodies, BP, Bangladesh Ansar & VDP	
	Mobilize teams for rapid damage assessment of housing units and dwellings and issue certificate for occupation after earthquake event	Local Government Bodies/ City Development Authorities	DMB,AFD, RHD, LGED, Utility Agencies	
	Assistance for Rapid damage assessment of buildings belong to First Responder agencies such as Armed Forces Division, Fire service, Hospitals , Critical Government Buildings, for prevention of occupation of unsafe buildings and further damage after shocks	Academic Institutions/Professional bodies	Local Government Bodies, City Development Authorities, DMB, LGED,	
	Liaise with private institutions(Business sector, Garment factories, Industries etc) for activating the Contingency Plans to conduct rapid damage assessments to work places and provide necessary technical assistance	DMB	Private institutions(Business sector, Garment factories, Industries etc), City Development Authorities, Local Government bodies	
	Making suitable arrangements and provide assistance to buildings allocated for VIPs, and Important Ministries, departments for conducting rapid damage assessment survey and issue of certificates for ensuring suitability for occupation after the earthquake	Local Government Bodies	AFD, Fire Service, DGHS, BP, BRTA, BRTC	

Early Recovery Phase	Carry out rescue operation for livelihood recovery in earthquake prone areas	DMB, Professional bodies, Academia	City Development Authorities, Utility Agencies, Local Government Bodies, relevant ministries, private sector agencies	UNDP, UN-HABITAT, ADB
	Phase by phase restoration of disrupted power, gas and water supply through assessment of degree of damage	Utilities, Local Govt. Bodies, BP, Ansar & VDP	MEMR, Local Govt. Bodies	
	Provide assistance to AFD, Fire Service, Police, Ministries, departments for conducting rapid damage assistance and developing estimates for rehabilitation of services	Local Government Bodies, Professional bodies, Academia	DMB, AFD, Police, Para-military, City Development Authorities, Utility Agencies	
	Rapid damage assessment survey and issue of certificates to house owners and owners of other buildings (business enterprises, shops, commercial centers, inductees, garment factories, hotels etc)for ensuring suitability for occupation after the earthquake	PWD and Local Government Bodies	DMB, Rajdhani Unnyan Kortipakha (RAJUK) and Chittagong Development Authority (CDA), Universities, Professional bodies	
	Carry out Planning operations for systematic cleaning of debris , removal, transportation of debris, identify dump sites	City Development Authorities, Local Government Bodies,	PWD, relevant ministries, private sector agencies	
	Carry out city Planning operations for rehabilitation and reconstruction of earthquake affected areas through integration of earthquake risk management principles	City Development Authorities, Local Government Bodies, UDD	Utility Agencies, relevant ministries, private sector agencies, Academia,	
	Carry out sector based early recovery Planning at various levels through integration of earthquake risk management principles to ensure higher seismic safety.	DMB, Professional bodies, Academia	City Development Authorities, Utility Agencies, Local Government Bodies, relevant ministries	
	Conduct a review of performance of the Cluster - Restoration of Urban Service and revise the Contingency Plan accordingly	DMB	Local Government Bodies,, Rajdhani Unnyan Kortipakha (RAJUK) and Chittagong Development Authority (CDA), Universities, Professional bodies	

Cluster 8 - Transportation (Road, rail, air, water way, sea)

Objectives:

- Identification of vulnerabilities of transportation infrastructures to earthquakes and strengthening the same to a higher safety level
- To restore the transport system after earthquake events for mobilization of resources to the affected areas

Cluster Lead: Roads & Highway Department (RHD)

Responsible Ministry: Ministry of Communication/ Ministry of LGRDC

Main Tasks assigned to lead and support agencies:

1) Vulnerability assessment of transportation infrastructures, 2) Planning for quick restoration of transportation facilities (Road transportation, Rail transportation, Air transportation, Sea transportation), 3.) Arrangements for quick restoration of transportation facilities

Expected Main Tasks by UN cluster partners

- Mobilize support of International community for air and sea transportation of food and non-food items, displaced persons etc
- Share International Good practices to improve the knowledge of local level stakeholders

Expected Main Tasks by other associated agencies

- Public awareness creation

		<i>Activities</i>	<i>Lead Agencies/ Institutions</i>	<i>Support Agencies/Institutions</i>	<i>Global Cluster Partner (Proposed)/Other associate agencies</i>
Pre-disaster Phase		Develop guidelines for vulnerability assessment of transport systems (road, railway, air, water ways) and Conduct vulnerability assessment and strengthen the buildings and transport infrastructure	RHD, LGED, CAAB, Bangladesh Sthala Bandar Kartipaksha, National Bridge Authority, Bangladesh Railway	Dhaka, Chittagong and Sylhet City corporations, Chittagong Port Authority, Shah Amanat International Airport, Zia International Airport, Osmani International Airport, BRTC, BIWTC	Global cluster partners - UNDP, WFP
		Develop Emergency teams for restoration of facilities	BIWTA, CAAB, Bangladesh Sthala Bandar Kartipaksha, National Bridge Authority, Bangladesh Railway, RHD, LGED	Dhaka, Chittagong and Sylhet City corporations, Roads and Highways Department, LGED, Chittagong Port Authority, Shah Amanat International Airport, Zia International Airport, Osmani International Airport, BRTC, BIWTC	
		Study alternate transport arrangements in case of	BIWTA, CAAB, Bangladesh Sthala	Dhaka, Chittagong and Sylhet City	

	earthquakes and develop route map	Bandar Kartipaksha, National Bridge Authority, Bangladesh Railway, RHD, LGED	corporations, Chittagong Port Authority, Shah Amanat International Airport, Zia International Airport, Osmani International Airport, BRTC, BIWTC	
	Develop coordination arrangements between different transport authorities (road, air, sea) to function during emergencies	BRTA, BIWTA, CAAB, Bangladesh Sthala Bandar Kartipaksha, National Bridge Authority, Bangladesh Railway, RHD, LGED, BA	Dhaka, Chittagong and Sylhet City corporations, Chittagong Port Authority, Shah Amanat International Airport, Zia International Airport, Osmani International Airport, BRTC, BIWTC	
	Develop Contingency plans for city level transportation systems to avoid high risk areas	Concerned City Corporations	City Development Authorities, BP (traffic division), LGED	
	Make arrangements for storage of essential spare parts	BIWTA, CAAB, Bangladesh Sthala Bandar Kartipaksha, National Bridge Authority, Bangladesh Railway, RHD, LGED	Dhaka, Chittagong and Sylhet City corporations, Chittagong Port Authority, Shah Amanat International Airport, Zia International Airport, Osmani International Airport, BRTC, BIWTC	
	Make arrangements to fabricate temporary bridges,	Roads and Highways Department, LGED	AFD	
Emergency Response Phase	Action by transport authorities to restore the transportation systems to reach critical areas for S&R teams and supply of relief	, BRTA, BR, BIWTA, CAAB, Bangladesh Sthala Bandar Kartipaksha, National Bridge Authority, Bangladesh Railway, RHD, LGED	AFD, Chittagong port Authority, Mongla Port Authority, Civil Aviation Authority, Local Government Bodies, DMB, DRR, AFD, FSCD, DGHS, BIWTC, BP	UNDP/ WFP
	Conduct rapid damage assessment survey and reporting by transport authorities for obtaining cooperation of other agencies for restoration of transportation systems.	, BRTA, BR, BIWTA, CAAB, Bangladesh Sthala Bandar Kartipaksha, National Bridge Authority, Bangladesh Railway, RHD, LGED	BP, AFD, Chittagong port Authority, Mongla Port Authority, Civil Aviation Authority, Local Government Bodies,	
	Mobilization of resources for activation of	Local Government Bodies, BRTA,	AFD, Chittagong port Authority,	

	alternate transport arrangements	BR, BIWTA, CAAB, Bangladesh Sthala Bandar Kartipaksha, National Bridge Authority, Bangladesh Railway, RHD, LGED	Mongla Port Authority, Civil Aviation Authority, BIWTC	
	Notification of accessible routes after the earthquake event based on the rapid assessment and issue of updates regularly after restoration of additional routes	BRTA, BR, BIWTA, CAAB, Bangladesh Sthala Bandar Kartipaksha, National Bridge Authority, Bangladesh Railway, RHD, LGED	BP, AFD, Chittagong port Authority, Mongla Port Authority, Civil Aviation Authority, Local Government Bodies, Media institutions, DMB,	
Early Recovery Phase	Conduct damage assessment survey of transport systems due to impact of occurrence of Earthquake and collateral hazards and develop Plans for restoration of transport systems to higher seismic safety.	Bangladesh Road and Transport Authority (BRTA), Bangladesh Inland Water Transport Authority (BIWTA), Civil Aviation Authority of Bangladesh (CAAB), Bangladesh Sthala Bandar Kartipaksha, National Bridge Authority, Bangladesh Railway, RHD, LGED	AFD, DMB, Local Government Bodies, Chittagong Port Authority, Shah Amanat International Airport, Zia International Airport, Osmani International Airport, Bangladesh Road Transport Corporation (BRTC), BIWTC	UNDP, WFP
	Assist actions by transport authorities to identify alternate routes for transportation of essential relief supplies, food stocks, welfare items etc	Bangladesh Road and Transport Authority (BRTA), Bangladesh Inland Water Transport Authority (BIWTA), Civil Aviation Authority of Bangladesh (CAAB), Bangladesh Sthala Bandar Kartipaksha, National Bridge Authority, Bangladesh Railway, RHD, LGED	AFD, Local Government Bodies, Chittagong Port Authority, Shah Amanat International Airport, Zia International Airport, Osmani International Airport, Bangladesh Road Transport Corporation (BRTC), BIWTC	
	Commence rehabilitation of damaged transport infrastructure and facilities, rail roads, main roads, ports, airports etc	Bangladesh Road and Transport Authority (BRTA), Bangladesh Inland Water Transport Authority (BIWTA), Civil Aviation Authority of Bangladesh (CAAB), Bangladesh Sthala Bandar Kartipaksha, National Bridge Authority, Bangladesh Railway, RHD, LGED	AFD, Local Government Bodies, Roads and Highways Department, LGED, Chittagong Port Authority, Shah Amanat International Airport, Zia International Airport, Osmani International Airport, Bangladesh Road Transport Corporation (BRTC), BIWTC	
	Review the performance of Cluster 8 - Transportation (Road, rail, air, sea) during the	Bangladesh Road and Transport Authority (BRTA), Bangladesh	AFD, Local Government Bodies, Chittagong Port Authority, Shah	

	emergency response period and revise the contingency Plan to improve the performance	Inland Water Transport Authority (BIWTA), Civil Aviation Authority of Bangladesh (CAAB), Bangladesh Sthala Bandar Kartipaksha, National Bridge Authority, Bangladesh Railway, RHD, LGED	Amanat International Airport, Zia International Airport, Osmani International Airport, Bangladesh Road Transport Corporation (BRTC), BIWTC	
Cluster 9 - Security, and Welfare				
Objectives: To maintain the law and order situation during emergencies such as earthquakes				
Cluster Lead: Bangladesh Police (BP)				
Responsible Ministry: Ministry of Food and Disaster Management				
Main Tasks: 1) Security arrangements during emergencies to ensure safety of citizens and protection of government & private property, 2) Restrict entry into affected areas by unauthorized persons 3) Traffic control during emergencies				
Expected Main Tasks by UN cluster partners				
<ul style="list-style-type: none"> • Sharing of Good practices from the region • Assistance in capacity building efforts 				
Expected Main Tasks by other associated agencies				
<ul style="list-style-type: none"> • Building the capacity of civil society for assisting the police and paramilitary forces in maintaining law and order situation during emergencies 				
Activities		Lead Agency/ Institution	Support Agencies/Institutions	Global Cluster Partner (Proposed)/Other associate agencies
Pre-disaster Phase	Develop a Comprehensive Plan for security arrangements for Citizens and protection of government & private property, business and industries as well as for maintenance of law and order to be adopted during emergencies such as earthquakes	BP	AFD, BDR, BCG, Bangladesh Ansar & VDP, RAB	Global cluster partners – UNDP, UNHABITAT
	Develop a comprehensive plan for traffic control during emergencies	BP		
	Develop guidelines for control of entrance in to damaged buildings, and restrict access to affected areas by unauthorized persons	BP	AFD, BDR, Bangladesh Ansar & VDP, RAB, FSCD, BCG	Others – BDRCS, NGO, INGO
	Develop guidelines for evaluation of Security Planning and operations for maintenance of law and order during emergencies	Bangladesh Police	FSCD, BDR, Bangladesh Ansar & VDP, RAB, FSCD, BCG, AFD, Office of Deputy Commissioners,	
	Assist development of procedures for handling of destitute and orphans	DRR	NGOs	
	Assist in promotion of social security systems (insurance	DMB	Life Insurance companies,	

	schemes, micro credit, etc.)			
	Develop guidelines for integrating fire hazard management as a component of Earthquake response and early recovery actions especially concerning temporary shelter, government buildings, private buildings, business enterprises,, utilities & Services	FSCD	AFD,DRR,DMB, INGOs, NGOs	
	Develop procedures for management and maintenance of information on dead and missing	BP	AFD, City Corporations, FSCD, DGHS	
	Develop procedures for burial of dead, funeral rights, mortuary services etc	BP	AFD, BDR, Bangladesh Ansar & VDP, , FSCD, AMI	
Emergency Response Phase	Activate the Security Plan for citizens and protection of government & private property, business and industries as well as for maintenance of law and order	BP	AFD, BDR, BCG, Bangladesh Ansar & VDP, RAB	Global cluster partners – UNDP, UNHABITAT
	Activate the Plan for traffic control during emergencies	BP		
	Exercise control of entrance in to damaged buildings, and restrict access to affected areas by unauthorized persons	BP	AFD, BDR, Bangladesh Ansar & VDP, RAB, FSCD, BCG	Others – BDRCS, NGO, INGO
	Conduct periodic M&E of security operations for maintenance of law and order during emergencies	Bangladesh Police	FSCD, BDR, Bangladesh Ansar & VDP, RAB, FSCD, BCG, AFD, Office of Deputy Commissioners,	
	Activate the Plan for handling of destitute and orphans	DRR	NGOs	
	Assist in documentation and fulfillment of other needs to benefit the beneficiaries of social security systems such as insurance Schemes, micro credit, etc.	DMB	Life Insurance companies,	
	Carry out the Plans for prevention and control of fire hazard due to main shock and aftershocks in temporary shelter, government buildings, private buildings, business enterprises,, utilities & Services	FSCD	AFD,DRR,DMB, INGOs, NGOs	
	Carry out the Plan for management and maintenance of information on dead and missing	BP	AFD, City Corporations, FSCD, DGHS,	
	Carry out the procedures for burial of dead, funeral rights, mortuary services etc	BP	AFD, BDR, Bangladesh Ansar & VDP, AMI	
Recovery	Review the performance of implementation of Security Plan and arrangements during earthquake emergency for safety of Citizens and protection of Government & Private Property,	BP	AFD, BDR, BCG, Bangladesh Ansar & VDP, RAB	Global cluster partners – UNDP, UNHABITAT

	Business and Industries as well as for Maintenance of law and order to be adopted during emergencies such as earthquakes			Others – BDRCS, NGO, INGO
	Review the performance of implementation of Plan for traffic control during emergencies	BP	FSCD, BDR, Bangladesh Ansar & VDP, RAB, FSCD, BCG, AFD, Office of Deputy Commissioners,	
	Exercise control of entrance in to damaged buildings, and restrict access to affected areas by unauthorized persons	BP	AFD, BDR, Bangladesh Ansar & VDP, RAB, FSCD, BCG	
	Carry out evaluation of Security Planning and operations for maintenance of law and order during Earthquake emergency	Bangladesh Police	FSCD, BDR, Bangladesh Ansar & VDP, RAB, FSCD, BCG, AFD, Office of Deputy Commissioners,	
	Conduct review of the Contingency Plan under Cluster 9 – Security and Welfare and introduce suitable modifications in revising the Plan to improve the performance	Bangladesh Police	FSCD, BDR, Bangladesh Ansar & VDP, RAB, FSCD, BCG, AFD, Office of Deputy Commissioners,	

Capacity Building, Awareness Creation and Advocacy to Support Plan Implementation

Capacity building of different public and private agencies/institutions, awareness creation among different cross section of people and continuous advocacy to the policy and decision makers are required to support proper and successful implementation of Contingency Plans. Capacity Building, Awareness Creation and Advocacy program will have several components, as shown in the Box 9.

5.1 Capacity Building

A comprehensive understanding of capacity building as defined by the United Nation's Agenda 21 states, "Specifically, capacity building encompasses the country's human, scientific, technological, organizational, institutional, and resource capabilities." (Chapter 37, UNCED, 1992).

This would mean assessing the needs in relation to current or existing capacities and enhancing it to a level, which can satisfy the needs. It is important that our understanding of capacity building emanates from the platform of human resource needs, which would need skills, (crafts, and labour), knowledge- (technical and indigenous) and character (attitudes and motivation). Following three important issues are needed to be addressed for national capacity building to face earthquake emergencies of the country:

Capacity Building, Awareness Creation and Advocacy Activities

- *Training and Education*
- *Pre-Positioning of Emergency Facilities at important Urban Centers and critical locations*
- *Resource mobilization for addressing the gaps*
- *Community Level Awareness Programme*
- *Awareness campaigns for Different Government Officials at City level*
- *Creating awareness among Private sector institutions*
- *Public Awareness Campaigns*
- *School Awareness programmes*
- *Supportive Role of Media*
- *Advocacy Campaigns for mobilizing support of political leaders for Contingency Plan implementation*

Box 9

5.1.1 Training and Education

Training and Education include trainings for different strata of administration and technical personnel, field officers, NGOs, business community, CBOs, selected community leaders and volunteers. In developing plans for Training and Education under Contingency Planning for Earthquakes need to consider appropriateness of such activities already being conducted by various agencies for different Target Groups. Based on the Training Needs Analysis conducted by the Contingency Planning Project Team, the categories of trainees and types of training to be conducted are listed in table 5.1.

Type of training	Target group	Delivery method	By whom?
Contingency Plan development	First Responder Agencies	Training Workshops.	DMB
	Utility services agencies and lifeline agencies	Training workshop/Guideline for contingency planning	DMB
	Other agencies	Issue Guideline for contingency planning	DMB
	Ward/Community level	Issue Guideline for contingency planning and training for NGOs to undertake planning at ward level	DMB
	Private sector institutions, banks, industries, factories	Issue Guideline for contingency planning	DMB
Training in EOC functions	DMB, Other government agencies	Issue SOPs	DMB
Training on Incident Command System (ICS)	AFD, Stakeholders within city corporations of Dhaka, Chittagong, Sylhet	City level Training workshops	DMB
Training on Damage assessment and need analysis(DANA)	DMB, DRR, other national level relevant stakeholders	National level Training workshops	DMB
Earthquake Response simulations/table top exercises	Health Service, FSCD, AFD, DMB, DRR, city corporations	City level Training workshops	DMB
Professional First responder courses (Collapse Building Search & Rescue, Medical First Responder training)	AFD, FSCD, Auxiliary forces,	PEER training delivery method	By Instructors trained by PEER training program as per government commitment
Hospital Preparedness for emergencies(HOPE)	Health services, National and city level hospitals	PEER training delivery method	By Instructors trained by PEER training program as per government commitment
Community level first responders	Community Volunteer groups in three cities	FSCD training course on community first responders	FSCD as per arrangement with CDMP
	Red Cross and Red Crescent volunteers	PEER community first responder training program	By Instructors trained by PEER training program and PEER training schedule
Restoration of Utility services	Field teams attached to utility agencies	Training programs designed by utility agencies	By utility agencies
Restoration of life line facilities	Field teams attached to lifeline agencies	Training Workshops.	By lifeline agencies

Table 5.1 Categories and Types of Training

5.1.2 Pre-Positioning of Emergency Facilities at important Urban Centers and critical locations

An efficient emergency response system can be in place as planned in areas where damage is minimum but in areas where the damages are high due to occurrence of earthquake event there will be a high demand for search and rescue operations and other response actions but working in such areas will be extremely difficult due to non-functioning of most of the essential facilities. In areas where high risk is found and heavy losses are anticipated prior arrangements have to be made to replace potential non-functional facilities or enhance the existing capacity. In some cases the demand may be higher than what is available due to additional demand created by the event, in such areas the additional facilities will help to respond to increased demand. Also in some cases due to damages and destructions expected services can not be made available to certain other areas and First Responder Organizations may have difficulties to engage efficiently in their expected roles.

In order to ease the situation certain facilities or materials are suggested to be pre-positioned in such a way that such facilities can be utilized immediately after the disaster event as an alternative source.

Some of such suggested facilities are given below;

Table 5.2 Suggested facilities for pre-positioning of Emergency

Facility	Purpose	location	Number
Water supply wells(deep tube wells)	<ul style="list-style-type: none"> Emergency water supply for drinking Emergency water supply for fire fighting 	Will be decided after assessment of Risk	Will be decided after assessment of Risk
Temporary Hospitals	To provide emergency medical care during mass casualty situations		
Temporary shelter	<ul style="list-style-type: none"> To be used as temporary shelter for displaced To be used as temporary office facilities, warehouses, etc 		
Emergency Rescue containers	Emergency rescue items, equipments to be used by community first responders		
Generators	Provide electricity for essential locations such as hospitals, medical storage, food storage etc		
Water purification plants, mobile kitchens, etc	To be used for evacuation camps for displaced		
Heavy equipments and tools	For Urban search and rescue		

5.1.3 Resource mobilization

i) CDMP Phase II

Comprehensive Disaster Management Program (CDMP) of the Government of Bangladesh (GoB) currently being implemented by the Ministry of Food and Disaster Management (MoFDM) may get extended to its second phase after

completion of Phase I in 2009 August. CDMP is currently funded by the United Nations Development Programme(UNDP), UK Department for International Development-Bangladesh (DFID-B) and the European Commission (EC) and such funding support will be extended to its second phase and if such resource needs can be identified under phase I such needs can be included in the Phase II as CDMP is designed to strengthen the Bangladesh Disaster Management system and more specifically to achieve the paradigm shift from reactive response to a proactive risk reduction culture.

ii) UN system support

The United Nations Disaster Management Team (UNDMT) is expected to exist in each disaster prone country and it can assist in capacity building of most essential areas of deficiency. The UNDMT comprising a core group represented by the country level representatives of FAO, UNDP, UNICEF, WFP, WHO and UNHCR when present in the country, is convened as necessary and chaired by the UN Resident Coordinator/ Humanitarian Coordinator (RC/HC), who is normally assisted by the mandated agencies.

The United Nations Disaster Assessment and Coordination (UNDAC) system is designed to assist the United Nation system in meeting international needs for early and accurate information supply during the initial phase of a sudden-onset of an emergency. It also helps in the coordination of incoming international relief at national level and/or at the site of emergency. Other UN-Agencies such as UNOCHA, WFP, UN-BCPR, WHO provide different kind of assistance during disasters. Contingency Plan should have links to obtain such agency support and it is better if the assistance needed in implementation of Contingency Plan can be defined during capacity assessment.

iii) Support from INGOs, Donor community

The Red Cross system and International NGOs such as CARE, Oxfam, Islamic relief, ActionAid etc have their own assessments and Contingency Plans for assisting countries. DMB and DRR can have a coordination mechanism with all such INGOs and Donor agencies such as USAID, DFID for assistance for emergency response. It is better some agreements can be worked out for not only for emergency response needs but also capacity building of community responder teams and other assistance such as material, equipment etc. Involvement of NGOs and INGOs in Earthquake Preparedness Planning in the respective geographical areas where they are active will be very effective. Such efforts by NGOs are underway in order to train First Responder teams in selected districts of Bangladesh. Discussions are on the way with other NGOs for similar initiatives such as developing disaster mitigation plans & preparedness plans at different levels; CBDM activities etc. The government will take steps to stipulate a policy framework within which NGOs and INGOs will be able to operate within Bangladesh and complement the actions taken by some of the government first responder organizations. Such activities may include:

- Response activities related to medical first response, counselling, psycho-social support etc.
- Community first response
- Preparedness planning at community and house hold level

- Awareness creation, advocacy and training

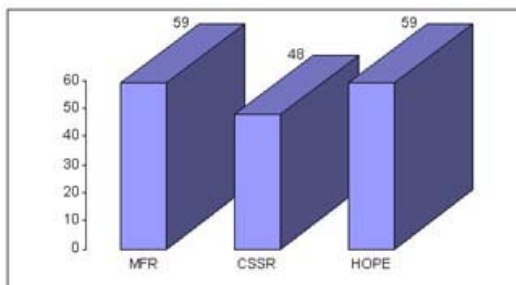
iv) Other Opportunities for Capacity building of Enhancement of Emergency Response

The Program for Enhancement of Emergency Response (PEER) is a regional training program initiated in 1998 by the U.S. Agency for International Development's, Office of U.S. Foreign Disaster Assistance (USAID/OFDA) to strengthen disaster response capacities in Asia.

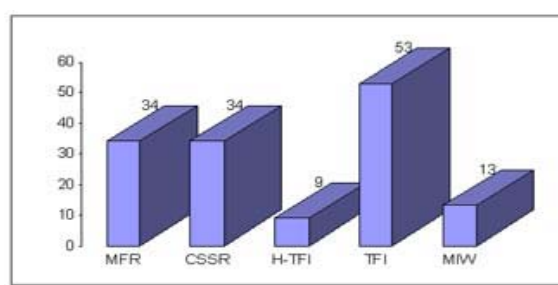
In March 2003, Bangladesh was included as the fifth partner country in the Program for Enhancement of Emergency Response (PEER), joining India, Indonesia, Nepal and the Philippines – the four PEER countries in Phase I of the program (1998-2003). These countries were selected to participate in the program based on their high seismic vulnerability, their need to improve their disaster response capacity, and the interest on the part of their national governments to participate in the program. PEER countries were selected based on seismic vulnerability and PEER is now in the fifth year of phase II (2003-2008).

PEER implements activities in Bangladesh under the coordinating authority of the Ministry of Food and Disaster Management (MoFDM), with which the program has a Memorandum of Understanding. The designated training institution for Medical First Responder (MFR) and Collapsed Structure Search and Rescue (CSSR) training is the Bangladesh Fire Service & Civil Defence (FSCD). The designated training institution for Hospital Preparedness for Emergencies (HOPE) is the National Institute for Preventive Medicine (NIPSOM), which falls under the authority of the Ministry of Health and Family Welfare.

The National Society for Earthquake Technology (NSET), Nepal, in collaboration with three U.S. partners, manages PEER, International Resources Group (IRG), Johns Hopkins University/Center for International Emergencies, Disasters and Refugee Studies (CIEDRS), and Safety Solutions, Inc.



PEER Graduates



PEER Instructor W/s Graduates

PEER conducted Seventeen different programs in Bangladesh from March 2003 – December 2007. PEER was able to produce 59 graduates and 34 IW graduates for MFR, 48 graduates and 34 IW graduates for CSSR, 53 TFI graduates, 59 graduates and 9 IW graduates for HOPE and 13 Master Instructors Workshop graduates. These IW graduates can be utilized as assistant instructors and instructors for the PEER courses. In the process of institutionalizing and nationalizing PEER courses in the country, NSET-PEER is assisting the Fire Service and Civil Defense (FSCD) and National Institute of Preventive and Social Medicine in developing their pool of instructors.

The PEER stage 3 will be started from 2009 and has three components included in its next phase;

- PEER training in order to increase the Instructors and master instructors for CSSR, HOPE, MFR etc.;
- Conduct of HOPE course and prepare Hospital emergency plans;
- Develop curriculum for community first responder training;

5.2 Awareness Creation

Low understanding of risk can be the result of inadequate capacity of local-level community to understand the risk environment, inadequacy of knowledge on infrastructure, which can protect vulnerable communities, lack of knowledge or lack of confidence on early warning or other inadequacies for behavioral change for improvement of living conditions. Risk communication as an effective tool or measure for creating appropriate understanding on the unacceptability of prevailing conditions of risk can cross more boundaries (a skill once learned can be taught more easily than a safe building can be built). An informed public can take action before, during the following disaster onset to reduce the risk of injury and loss. An effective public awareness education campaign requires the coordinated efforts of all the stakeholders such as the government officials and community members, media, scientific and technical experts, business leaders and development workers, civil society groups etc.

5.2.1 Community Level Awareness Programme

Following aspects should be covered in awareness programmes

In a situation of an impending earthquake disaster,

- Encourage people to keep fuel in their cars as petrol pumps may be closed during emergencies.
- Ask people to keep gas supply line closed always after utilization
- Ask people to shut off the electricity main switches, gas and water valves, soon after the earthquake if they do not have a fixed automatic disconnecting mechanisms
- Close and lock doors and windows and secure their homes before leaving.
- Ask people to listen to a battery-powered radio and follow local instructions.
- If the danger is a chemical release, then people should be instructed to evacuate immediately.
- Leave early enough to avoid being trapped.
- Follow recommended evacuation routes.
- Not to move or drive into areas heavy destructions or areas with fire break out.
- Stay away from fallen power lines.
- Release pets and domestic animals
- Community should set the livestock free

Earthquake survival kit: The earthquakes normally generate a high number of displaced people and also many people will be trapped inside buildings. The immediate life support and survival will depend on how fast they can get external assistance. Until such time they need to survive through their own supplies and it is highly recommended that at community level they have prepared an Earthquake survival kit. Families should be encouraged to take along with them during earthquake emergencies adequate supplies such as shown in the Box 10.

Earthquake Survival Kit

- Adequate supply of water in closed unbreakable containers
- Adequate supply of non-perishable packaged food and dry rations
- Medicine
- A change of clothing and rain gear
- Blankets and bed sheets, towels
- Buckets, plates, glasses, mugs made of plastic
- Soap, toothbrushes, toothpaste
- A battery-powered radio, torch, lantern, matches
- Cash and jewelry
- Personal medicines
- Important documents including passport, national identity card, bank passbook, address/telephone book (of relatives), certificates, driving license, property documents, insurance documents etc.
- Special items including food for infants, elderly or disabled family members.

Box 10

Such supplies should be collected and kept in a **Go-Bag** so that they will be able to evacuate quickly with such urgent supplies.

5.2.2 Awareness Campaigns for Government Officials

Awareness programmes related to following important issues need to be conducted in all cities (Dhaka, Chittagong, Sylhet etc) with high seismic risk:

- Awareness on seismic hazards and vulnerability to earthquakes
- Awareness about the functional response clusters and contingency planning functions
- Roles and responsibilities of agencies according to city level earthquake Contingency Plans
- SOPs and responsibilities assigned to various agencies/institutions
- EOC functions, and duties and responsibilities assigned to various agencies/ institutions
- Site Operation Centre (SOC) functions, and duties and responsibilities assigned to various personnel
- Validation of plans especially evacuation routes at community level with assistance from local governments (by ward commissioners/ward level DM committee) and NGOs, CBOs working in certain areas.

5.2.3 Creating Awareness among Private Sector

Private sector establishments can get affected by earthquakes depending on the vulnerability of buildings. This can bring very high economic losses as well as human and material losses. In most cases institutions such as Garment factories do have a large work force and vulnerable to building collapse in an event of an earthquake. The private sector should be encouraged for having their own Contingency Plans

and also they should conduct periodic simulations to enhance the preparedness level. The fire safety is another important factor and they should be encouraged to equip with equipment and trained staff to handle cases of fire until the staff from FSCD take charge of such events. It is also better to encourage private sector security firms to have trained and skill medical first responders, search and rescue teams to help the professional first responder agencies.

5.2.4 Public Awareness Campaigns

Public awareness programmes on the City level Contingency Plans should be organized with the involvement of City Corporations, various Government Stakeholder Agencies, NGOs and Media. These can take the form of public awareness campaigns using both electronic and print media, posters, competitions, street dramas, workshops and others.

Public awareness campaigns generate community support for the implementation of Earthquake Contingency Plans at city level and encourage those engaged in response activities at community level and to mobilize community support. Informing the general population about the potential seismic hazard and risks increases public knowledge and understanding of the situation. Risk communication can encourage greater public participation in community/household/family level preparedness activities, enhancing the effectiveness of preparedness planning. Campaigns need to be targeted to specific audiences with directed messages.

Public Awareness programmes should be for the following target groups:

- *Community leaders and members including farmers, fishermen, traders, skilled workmen in building trades etc. and house wives*
- *School children*
- *Religious leaders*
- *Officials of various private sector organizations*
- *Professionals of different sectors*
- *Political heads of local Authorities, other selected members, office bearers*
- *Media personnel*

Box 11

A wide array of channels of communication is available for Public Awareness campaigns with different target groups:

- Face-to-face: meeting, seminar, workshop, conference, march, exhibition, demonstration, training, exchange visit, planning
- Mass media: television, melodramas, radio, newspaper, cinema
- Distributed print material: leaflet, pamphlet, brochure, booklet, guideline, case study, newsletter, journal, research paper, report
- Folk media: story, drama, dance, song, puppet, music, street entertainment
- Audio-visual: video, audio, multi-media, artwork, photograph, slide show, model, map
- Stand-alone print: billboard, poster, banner, warning sign, flood water level marker
- Postal: direct mailing

- People: community leader, volunteer, project worker, head of women's group
- Electronic media: website, e-mail, e-mail discussion lists, electronic conferencing, distance learning platform, SMS etc.
- Earthquake simulations

5.2.5 School Awareness programmes

i. Training for Scouts as First Responders

If the Earthquake response activities can be brought to the Scouts movement, they can be trained easily in

- Community First Responder activities to assist professional Search and Rescue teams
- First Aid and medical First Response activities.

It will be necessary for the Ministry of Food and Disaster management to have discussions with Ministry of Education and school authorities as well as with the Scout movement to impart training on above activities. Qualified trainers/Instructors from FSCD can provide ToT and train school teachers for providing necessary trainings to scouts and girl guides in selected schools.

ii. School awareness programmes

School awareness programmes should consist of the activities as shown in the Box 12:

DMB will collaborate with Ministry of Education and school authorities' through CDMP in conducting school awareness programmes and in sharing awareness material (videos, printed material posters etc.) as well as in conducting joint simulation activities under some School Safety Projects.

School Awareness Programmes

- *Seminars for school children, teachers and parents*
- *Distribution of specific awareness leaflets – Materials on Contingency Plans, evacuation areas , routs, should be developed by DMB*
- *Awareness on First Aid and medical first responder functions(for those involved in Scout movement)*
- *Awareness programs conducted through media (TV, Radio and Newspaper) targeting at school children, parents and teachers*

Box 12

Extra curricular activities like art/quiz competitions, school safety clubs, news letters etc will be promoted as a part of awareness campaign on contingency planning and earthquake preparedness. The extra curriculum activities comprised of establishing of School earthquake preparedness/safety clubs in the selected schools. Activities of such clubs will focus on the following:

- Identifying the earthquake vulnerability in the neighbourhood of the school
- Components of structural non-structural vulnerability of schools
- Earthquake Preparedness planning for class/school and evacuation simulations
- Lectures by guest lecturers and publication of wall paper

- Studying wind effects and measuring wind speeds
- Gathering and recording DM related data and information
- Disaster mitigation and environmental management related activities that can be done at school level

5.2.6 Role of Media

The Media act to provide the public with technical information about hazards, the risks posed by the hazards and steps people can take to protect themselves and their families from disaster. Media transmit vital information quickly and in language that the community can relate to, both in normal times and in emergency. Media Personnel are important allies for the government and technical experts in that they have access to telecommunications and information management systems that government may not have. Government should actively seek out media participation in disaster management activities before, during, and after disaster;

- For providing information on earthquake disaster, what to do before, during and after an earthquakes
- For providing information on preparedness measures(keeping a Go-bag with essential supplies
- For building awareness to develop house-hold level preparedness plan by every household
- For creating awareness about and continuous persuasion to local government bodies for making Contingency Plans at local government level
- to aware citizens about evacuation places and evaquation routs in the communities/towns/ cities during any earthquake situation
- Dos and Don'ts during earthquakes

i. The Emergency Public Information Function

During the emergencies, provision should be made for frequent briefings with accurate and timely information to the media. It is advisable to provide as much information as possible from one location or source, i.e. The EOC where the information has been compiled and verified. Accurate, timely and useful information and instructions to the public are necessary throughout a disaster period. Information must be disseminated to the people at risk and also to the public at large, who may be indirectly affected by the disaster event, e.g. those with family or friends at risk, or persons who may want to assist in providing relief. Responsibility for emergency public information should be convened to the appropriate organization. Available means of dissemination should be surveyed and access to them ensured. In case of earthquake, normal lines of communication may be disrupted, and alternate means may need to identified and provided.

ii. Media Mobilization Guidelines

In any case of disaster event it is also necessary to mobilize the support of Media for information dissemination. Since this has to be done in a systematic manner it is advisable to provide guidelines for media so that they will be familiar with the Standard Operational Procedure during such emergencies.

The following media mobilization guidelines are suggested for covering Earthquake disaster event, immediate response, social mobilisation at national and local level etc.

Table 5.3 Media Mobilization Guidelines

Methods	Activity / Technique	Materials to be used
Establish Standard Operational Procedure for use	Media briefing formats: press conferences, warning bulletins for after shocks, disaster event bulletins (e.g., public safety etc.)	Disaster event bulletins, After shock warning bulletins public statements and standard data forms drafted for media / general release: casualties, public safety measures, evacuation instructions etc.
Information control: to prevent public confusion and ensure appropriate behaviour e.g., correct safety / prevention measures	Sequencing of information releases with content according to each stage of evolving situation; accurate targeting intended audience according to message	Data / announcements pre-drafted in readiness for each stage; content as relevant to each stage, accurately drafted for intended audience / purpose
Media education: informing media professionals of nature of possible / anticipated disasters, and contingencies arising thereof; ensuring selected media people (concerned reporters / video-graphers, news decision makers – e.g., editors, news directors)	Specific disaster-related training and briefing of media people; provision of informational material on contingencies	Training materials, disaster news coverage guide manuals, instructional audio / video cassettes, photographic briefs, briefing dockets, posters
Public awareness via media	Prior arrangements with media organisations for airtime slots, newspaper space for prepared material	Video warning / instruction messages, prepared print material for public instructions on disaster response measures

5.3 Advocacy

It is necessary to conduct advocacy campaigns to obtain support of political leaders, elected representatives etc, city authorities and for mobilization community support for implementation of the Earthquake Contingency Plans. Such campaigns can be conducted through focus group discussions, presentations and distribution of public awareness material. The political authorities should be invited as guests in such events and also it is necessary to explain the importance of preparedness at community level. City authorities should be invited to take part actively in plan development and plan execution.

Actions to Support Implementation of the Contingency Plan

6.1 Establishment of a National Emergency Operation Center (NEOC)

6.1.1 Introduction

The proposed National EOC is the physical location where the tasks of all responder organizations are monitored and coordinated before during and after Earthquakes. However, since Bangladesh is facing many events per year it is useful to have a permanent Multi-hazard EOC. In addition to this Earthquake will demand very quick actions after an event and no time will be available to organize it. Earthquakes will occur without any warning and many activities to increase preparedness for responding to earthquakes have to be coordinated by a permanent EOC. This mechanism will enable Bangladesh to issue warnings against slow on set disasters and Tsunami and also to retain the resources (equipment, trained man-power and data bases on resources) needed for large scale mass casualty events. The NEOC will work with limited capacity to fulfil the routine tasks during normal time and during on-set of disasters it will expand the role to accommodate during disaster functions to coordinate response and recovery actions and resources. This centre may alternatively be called national command centre.

The proposed NEOC will have to have a redundant system, located in other major city (May be Chittagong) with similar facility and infrastructure. The purpose of redundant system is to provide uninterrupted, seamless command and control during any emergency situation. The objectives of the NEOC will be as show below:

During Disaster:

- Emergency coordination, command and control with various involved agencies
- Implementation of disaster response activities and its coordination
- Review and monitoring of progress of disaster response activities

Pre Disaster period:

- creating and ensuring readiness among various agencies for anticipated disasters ,
- Provide technical assistance to institutions for plan development review and revisions
- Monitoring of reporting of the readiness by various first responder institutions

Post Disaster period:

- Monitoring of impacts of after shocks,
- Monitoring and coordination of emergency response functions for incidents related to after shocks
- Review the plan functions taking in to consideration of the failures/shortcomings of Contingency plan implementation by agencies
- Assistance in coordination for recovery activities

6.1.2 Organization Structure

The NEOC suggests inclusion of inter and intra organizational coordination. The proposed organizational structure of the NEOC is enclosed at Figure 1. The NEOC is headed by commander / chief. The chief is assisted by liaison officer, panel of technical experts, EOC administrative system and Telecommunication and system analysts. Four major desks are suggested in NEOC. These desks are defined as shown in the Box.

Major Desks
Desk 1: Planning desk
Desk 2: Operation Desk
Desk 3: Logistics desk
Desk 4: Administration and logistics

EOC administrative system and telecommunication and system analyst wing of NEOC is dedicated for ensuring sufficient provision of resources to run the system round the clock. This wing will work on routine basis. The government through the MoFDM will ensure recurring and non-recurring expenditure towards operationalizing the NEOC. Other officers and desks will be activated as and when required. The NEOC will also be closely linked with EOC operations desks of Armed Forces Division, FSCD, Auxiliary forces (Police, Ansar & VDP, Para-military forces etc), DGHS, DRR, City corporations of Dhaka, Chittagong, Sylhet, Lifeline and Utilities agencies (Water, electricity, Gas, telecom, public works, road and transportation authorities), and other nodal response agencies (Red Cross & Red Crescent societies, INGOs, NGOs).

These operation desks of agency level EOC will exchange information on regular basis for facilitating the NEOC for effective functioning. NEOC will also be linked to EOCs of international, national and local Non government agencies. Disaster Management Bureau will provide all possible support for operating NEOC. The command and control of NEOC will be transferred to Armed Forces Division (AFD) during earthquake events. The EOC at district and city level should also be equipped with similar resources and equipments to assist NEOC functions.

Planning Desk is primarily involved in evaluating the situation, determining objectives, selecting a proper strategy, and deciding which resources should be used to achieve disaster response in the most efficient and cost-effective manner.

Operation Desk is responsible for conducting tactical field operations to carry out the plan. They develop the tactical objectives, organization and directs all resources.

Logistics Desk provides support to meet incident needs. The desk Provides resources and all other services needed to support the incident command.

Finance and Administration Desk monitors costs related to incident management. It Provides accounting, procurement, time recording, cost analyses.

6.1.3 Physical Layout the NEOC

The NEOC is equipped with State of the Art equipment related to telecommunication and computing systems. The telecommunication system includes following as shown in the Box 13:

The purpose of providing these systems is to create redundant system for seamless communication from incident sites to the control room.

The control center should be linked to all national and private TV channel to get the feedback from media from the affected sites. The control room should be equipped with GIS based mapping system for better decision making.

The NEOC should also have the following facilities:

- Census reports of the area covering the high seismic hazard
- Micro- zonation maps
- Vulnerability maps
- GIS and remote sensing data for the areas concerned
- Detailed demographic maps
- Detailed Road network with alternative arrangements

Telecommunication System

- *HF/VHF sets*
- *Radio /wireless communication system*
- *Satellite phones*
- *Mobile telecommunication system*
- *Ham Radio*
- *Broadband Internet connectivity*
- *VSAT system*
- *Hotline*
- *High Accuracy Global Positioning Systems*

Box 13

The physical layout of the NEOC layout may be referred at Figure 6.2.

6.1.4 Administrative Setup

The NEOC works on 24 X 7 basis. This requires large number of trained manpower in various sections. For running round the clock, there is a requirement for two shift work force. The administrative section will monitor and regulate the activities of personnel involved. Also the separate section will look after telecommunication and system operation. The team of telecommunication experts and engineers will work on round the clock basis. Their main responsibility is to ensure the flawless communication at any section of time. The set of people will always keeping eye on warning communication systems related to other type of hazards also(mainly hydro- metrological, Tsunami, epidemics etc). Also, in peace time, group of trained personnel will liaison with other agencies and NOEC will conduct training and capacity building activities for other agency staff on NOEC functions. The administrative staff will conduct regular meetings with other agencies control desks to review readiness and coordination of reporting etc.

6.1.5 Standard Operating Procedure

For facilitating quick, rapid and efficient emergency response, it is necessary to have Standard Operating Procedure. The SOP has been developed for First responder organizations to undertake various activities and functions for coordinating with NEOC.

In addition SOP will be developed for following sections of NEOC:

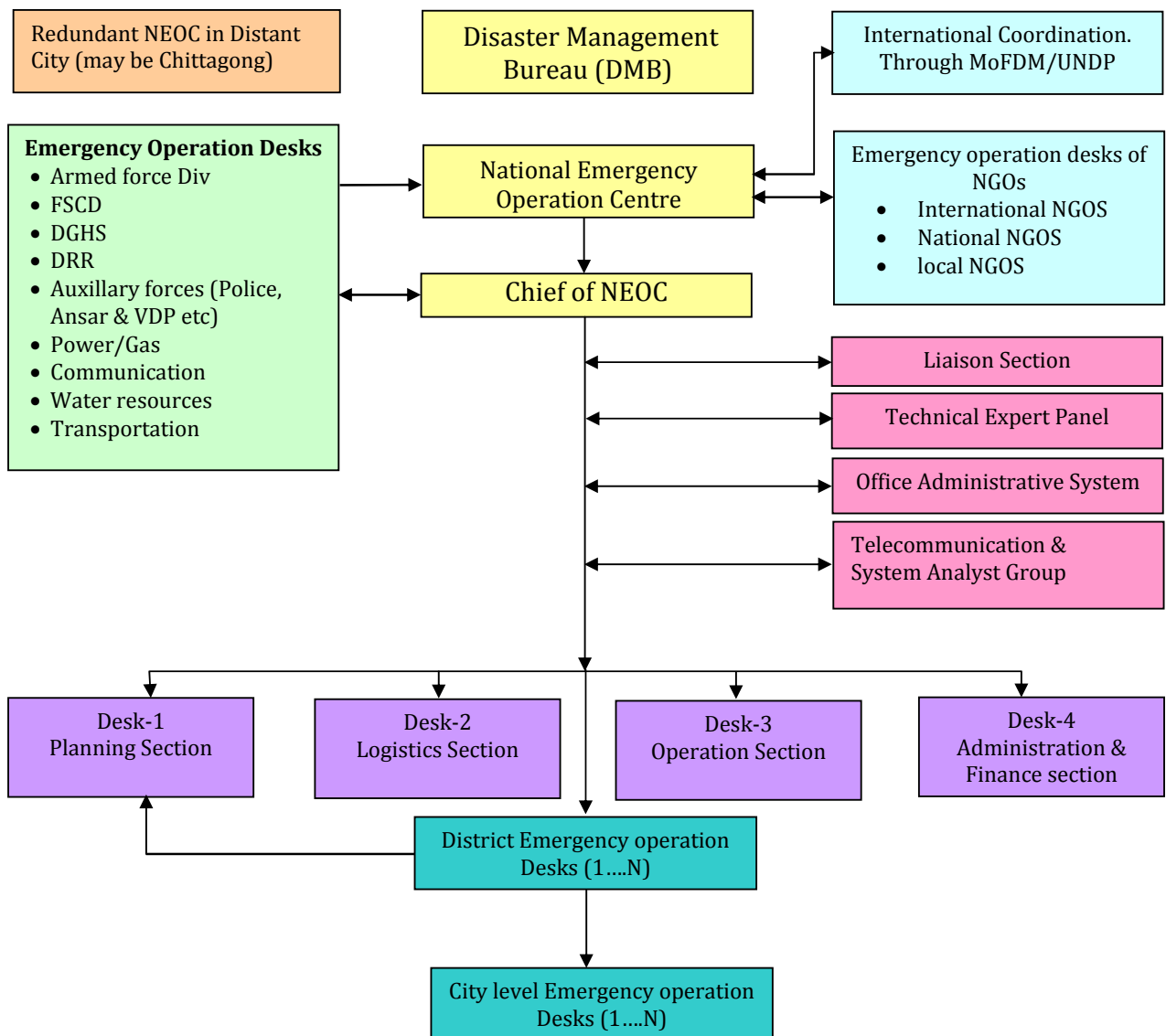
- Administrative setup of NEOC
- Telecommunication and system section
- Chief of NEOC
- All desk in charge
- Coordinating national, district and Porushawa level agencies
- Redundant NEOC, District EOC functions desks

The SOP will include vertical and horizontal roles and responsibilities of the organization and for specific functions of NEOC. The SOP of NEOC will be made in close collaboration with various associated agencies. A strategy will be formed to train and equip all the agencies to act as per provided SOPs.

6.1.6 Roles and Responsibilities of Various Desks

NEOC is working for 24X7. The NEOC will be working during peace and disaster time with all capacities. The broader roles and responsibilities are described in the Figure 6.3.

Figure 6.1: Organisational Structure for National Emergency Operation Center



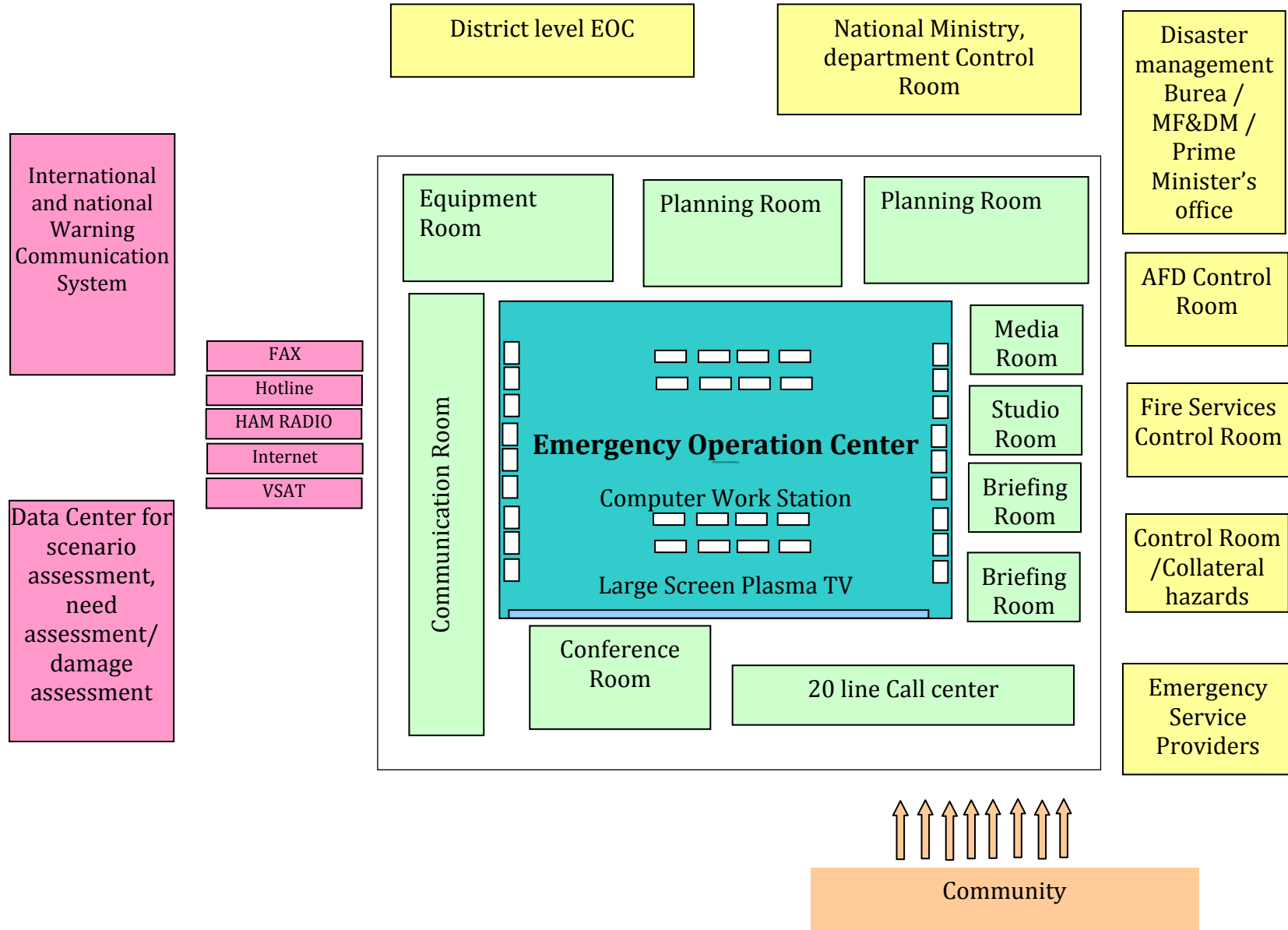
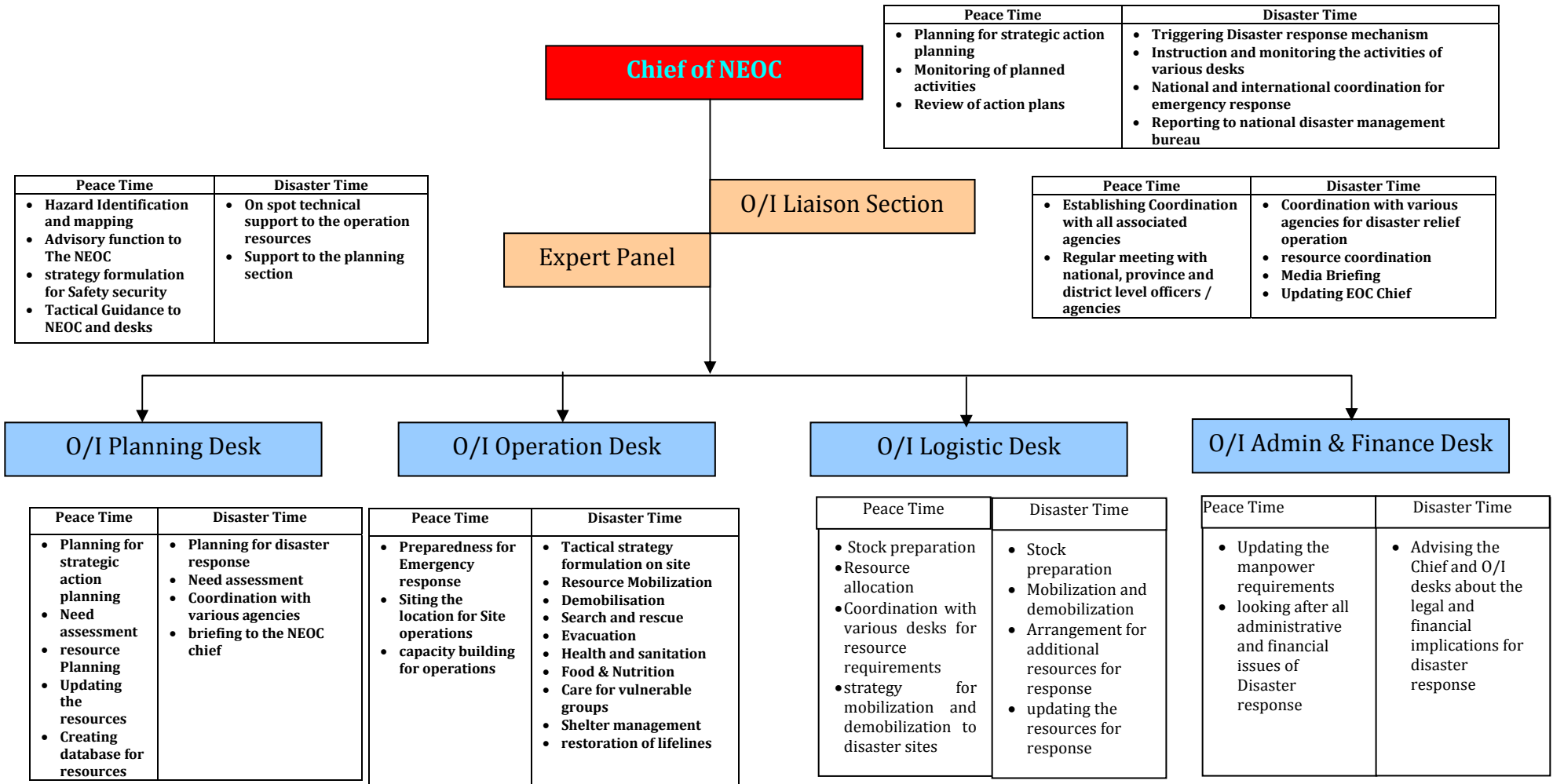


Figure 6.2: Emergency Operation Center

Figure 6.3: Roles and responsibilities of NEOC functions



6.2 Establishment of reporting system for reporting the Readiness of different agencies

6.2.1 Reporting on the readiness of First Responder Agencies

During the Plan development stage each and every first responder agency should agree to provide a bi-annual report to the National Earthquake Emergency Operation Centre (NEEOC) about the preparedness level. This format is annexed to Agency level Plan prepared by each First responder agency.

Each agency will minimum provides information on:

1. Whether the staff within the agency is familiar with of the Earthquake Contingency Plan of the Agency
2. Orientation and training for Earthquake Contingency Plan and procedures undertaken or not?
3. Understanding of each relevant officer about the earthquake disaster response procedures s/he has to follow during earthquake event?
4. Whether arrangements are in place to impart Special skills required during Earthquake emergency operations to the officials and the staff.
As example;
 - No of Master Instructors for CSSR
 - No of master Instructors for MFR
 - No of specially trained cadre of First Responders for CSSR and MFR
5. Whether following tasks have been Reviewed and updated:
 - Earthquake Precautionary measures and procedures.
 - The vulnerability assessment of buildings
 - The precautions to be taken to protect equipments and material have been undertaken.
 - Post earthquake disaster procedures to be followed.
6. No of Buildings which were strengthened to have high standard of safety
7. Name of the officer , who has been designated as Nodal Officer for Earthquake Disaster Response
8. Name, designation and contact details of the officer is as follows;
9. Details about the Additional Sources of supply of materials, manpower, equipment required/identified to support the Response capacity of the respective agency in Earthquake response operations.

The National Earthquake Emergency Operations centre will develop a report on the Readiness or Preparedness level of each agency to Respond to an earthquake disaster event and submit it through DMB to the Secretary MoFDM for onward transmission to the National Council.

Depending on the situation Secretary of MoFDM and DMB will be able to lobby for additional financial/man-power/material assistance to First Responder agencies to

achieve the expected levels. They also can present such needs to Un-Agencies, International Donor agencies for possible assistance by them to First Responder Agencies.

6.2.2 Reporting during disasters:

During earthquake emergencies AFD will take over the command in Responding to disaster event.. The reporting at each level will be done to each level Response commander. For example- on arriving at the scene of any rescue site, the Officer-in-Charge will immediately provide the following information to the Incident Commander:

- Location
- Type of structure
- Number of victims alive and trapped.
- Any dangers which might exist - live wires, gas, hazardous materials, etc.
- Assessment of resources needed to effect rescue
- Any medical assistance needed
- Any other relevant information

The Officer in Charge will commence rescue operations as necessary and will provide reports every three hours (3 hours), then every six hours (6 hours), then twelve hours (12 hours) at discretion of the Officer in charge at site to higher levels. Such operations will be cascaded up to high level command and the reports will flow to the National Earthquake Emergency Operations Centre.

Reports will be sent to the National Earthquake EOC from each Operational Head Quarters every 12 hours. The following information will be provided:

- Number dead
- Number injured
- Number of victims still trapped
- Number of persons reported missing
- Type of structures damaged
- Existing co-lateral hazards
- Availability of water
- Road conditions

In case or rescue operation, the reporting system would also cover and maintain the following priority list:

- i. Hospitals and Emergency Services Facilities
- ii. Schools, Educational and Residential Institutions
- iii. High Population Areas
- iv. Hotels/Government Buildings
- v. Other Buildings(factories, commercial buildings etc)

6.2.3 Reporting after disasters

The reports will mainly deal with the Recovery aspects and improvements that are needed to increase the efficiency of Contingency Plans (Difficulties, Challenges faced, and opportunities, what went well, improvements suggested).

Those plans also should be submitted to NEEOC, DMB and to the Secretary, MoFDM.

6.3 Emergency Telecommunication System

For effective implementation of National Earthquake Contingency Plan, it is indispensable for identifying the needs and procedure of establishing an effective emergency telecommunication system for response during earthquake events. In Annex-1, required resource inputs for establishing the best alternative emergency telecommunications system as a component of National Emergency Operations Center (NEOC) have been proposed for effective plan implementation. This proposal would facilitate achieving the following two objectives:

- To meet intra- as well as inter-agency communication needs among emergency response and humanitarian agencies for data transmission & sharing (including daily progress reporting) during emergencies.
- To update on-going GIS database of NEOC using on-site rapid loss assessment survey and provide spatial information/ on-site assessment of destructions, degree of loss, possible evacuation routes etc. within the first day of Earthquake so that concerned emergency response and humanitarian agencies can use the spatial information for ensuring effective emergency operations management.

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Glossary of Terms

Building Codes	Ordinances and regulations controlling the design, construction, materials, alteration and occupancy of any structure to insure human safety and welfare. Building codes include both technical and functional standards.
Capacity	<p>A combination of all the strengths and resources available within a community, society or organization that can reduce the level of risk, or the effects of a disaster.</p> <p><i>Capacity may include physical, institutional, social or economic means as well as skilled personal or collective attributes such as leadership and management. Capacity may also be described as capability.</i></p>
Capacity Building	<p>Efforts aimed to develop human skills or societal infrastructures within a community or organization needed to reduce the level of risk.</p> <p><i>In extended understanding, capacity building also includes development of institutional, financial, political and other resources, such as technology at different levels and sectors of the society.</i></p>
Cluster	A “cluster” is essentially a “sectoral group” and there should be no differentiation between the two in terms of their objectives and activities; the aim of filling gaps and ensuring adequate preparedness and response should be the same. (IASC Guidance Note on Using the Cluster Approach Nov 2006)
Cluster Approach	The Cluster Approach aims to strengthen humanitarian response capacity and effectiveness in five key ways: i) ensuring sufficient global capacity is built up and maintained in key gap sectors/areas of response; ii) identifying predictable leadership in the gap sectors/areas of response; iii) facilitating partnerships and improved inter-agency complementarity by maximizing resources; iv) strengthening accountability; and 5) improving strategic field-level coordination and prioritization in specific sectors/areas of response by placing responsibility for leadership and coordination of these issues with the competent operational agency. (IASC Guidance Note on Using the Cluster Approach Nov 2006)
Cluster Leads	A “cluster lead” is an agency/organization that formally commits to take on a leadership role within the international humanitarian community in a particular sector/area of activity, to ensure adequate response and high standards of predictability, accountability & partnership. (IASC Guidance Note on Using the Cluster Approach Nov 2006)
Disaster	<p>A serious disruption of the functioning of a community or a society causing widespread human, material, economic or environmental losses which exceed the ability of the affected community or society to cope using its own resources.</p> <p><i>A disaster is a function of the risk process. It results from the combination of hazards, conditions of vulnerability and insufficient</i></p>

capacity or measures to reduce the potential negative consequences of risk.

Disaster Risk Management

The systematic process of using administrative decisions, organization, operational skills and capacities to implement policies, strategies and coping capacities of the society and communities to lessen the impacts of natural hazards and related environmental and technological disasters. This comprises all forms of activities, including structural and non-structural measures to avoid (prevention) or to limit (mitigation and preparedness) adverse effects of hazards.

Disaster Risk Reduction (disaster reduction)

The conceptual framework of elements considered with the possibilities to minimize 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.

The disaster risk reduction framework is composed of the following fields of action, as described in ISDR's publication 2002 "Living with Risk: a global review of disaster reduction initiatives", page 23:

- *Risk awareness and assessment including hazard analysis and vulnerability/capacity analysis;*
- *Knowledge development including education, training, research and information;*
- *Public commitment and institutional frameworks, including organisational, policy, legislation and community action;*
- *Application of measures including environmental management, land-use and urban planning, protection of critical facilities, application of science and technology, partnership and networking, and financial instruments;*
- *Early warning systems including forecasting, dissemination of warnings, preparedness measures and reaction capacities.*

Earthquake

An earthquake is a series of vibrations on the earth's surface caused by the generation of elastic (seismic) waves due to sudden rupture within the earth during release of accumulated strain energy.

Emergency Management

The organization and management of resources and responsibilities for dealing with all aspects of emergencies, in particularly preparedness, response and rehabilitation.

Emergency management involves plans, structures and arrangements established to engage the normal endeavours of government, voluntary and private agencies in a comprehensive and coordinated way to respond to the whole spectrum of emergency needs. This is also known as disaster management.

Emergency

Consists of all activities taken in anticipation of a crisis to expedite effective emergency response. This includes contingency planning,

Preparedness but is not limited to it: it also covers stockpiling, the creation and management of standby capacities and training staff and partners in emergency response. (Source: ODIHPN Contingency Planning Review Paper 2007)

First Responder The term 'first responder' refers to those agencies/ individuals who in the early stages of an incident are responsible for the protection and preservation of life, property, evidence, and the environment, including emergency response providers as well as emergency management, public health, clinical care, public works, and other skilled support personnel (such as equipment operators) that provide immediate support services during prevention, response, and recovery operations.

Source: Homeland Security Act of 2002 (6 U.S.C. 101, Washington, U.S.A.)

Geographic information systems (GIS) Analysis that combine relational databases with spatial interpretation and outputs often in form of maps. A more elaborate definition is that of computer programmes for capturing, storing, checking, integrating, analysing and displaying data about the earth that is spatially referenced.

Geographical information systems are increasingly being utilised for hazard and vulnerability mapping and analysis, as well as for the application of disaster risk management measures.

Hazard A potentially damaging physical event, phenomenon or human activity that may cause the loss of life or injury, property damage, social and economic disruption or environmental degradation.

Hazards can include latent conditions that may represent future threats and can have different origins: natural (geological, hydrometeorological and biological) or induced by human processes (environmental degradation and technological hazards). Hazards can be single, sequential or combined in their origin and effects. Each hazard is characterised by its location, intensity, frequency and probability.

Hazard Analysis Identification, studies and monitoring of any hazard to determine its potential, origin, characteristics and behaviour.

Land-use Planning Branch of physical and socio-economic planning that determines the means and assesses the values or limitations of various options in which land is to be utilized, with the corresponding effects on different segments of the population or interests of a community taken into account in resulting decisions.

Land-use planning involves studies and mapping, analysis of environmental and hazard data, formulation of alternative land-use decisions and design of a long-range plan for different geographical and administrative scales.

Land-use planning can help to mitigate disasters and reduce risks by discouraging high-density settlements and construction of key

installations in hazard-prone areas, control of population density and expansion, and in the siting of service routes for transport, power, water, sewage and other critical facilities.

Mitigation	Structural and non-structural measures undertaken to limit the adverse impact of natural hazards, environmental degradation and technological hazards.
Natural Hazards	<p>Natural processes or phenomena occurring in the biosphere that may constitute a damaging event.</p> <p><i>Natural hazards can be classified by origin namely: geological, hydrometeorological or biological. Hazardous events can vary in magnitude or intensity, frequency, duration, area of extent, speed of onset, spatial dispersion and temporal spacing.</i></p>
Planning Assumptions	The key elements of a scenario that form the basis for developing a contingency plan (for example, projected caseloads) (Source: IASC Contingency Planning Guidelines 2001)
Preparedness	Activities and measures taken in advance to ensure effective response to the impact of hazards, including the issuance of timely and effective early warnings and the temporary evacuation of people and property from threatened locations.
Prevention	<p>Activities to provide outright avoidance of the adverse impact of hazards and means to minimize related environmental, technological and biological disasters.</p> <p><i>Depending on social and technical feasibility and cost/benefit considerations, investing in preventive measures is justified in areas frequently affected by disasters. In the context of public awareness and education, related to disaster risk reduction changing attitudes and behaviour contribute to promoting a "culture of prevention".</i></p>
Recovery	<p>Decisions and actions taken after a disaster with a view to restoring or improving the pre-disaster living conditions of the stricken community, while encouraging and facilitating necessary adjustments to reduce disaster risk.</p> <p><i>Recovery (rehabilitation and reconstruction) affords an opportunity to develop and apply disaster risk reduction measures.</i></p>
Relief / Response	The provision of assistance or intervention during or immediately after a disaster to meet the life preservation and basic subsistence needs of those people affected. It can be of an immediate, short-term, or protracted duration.
Resilience / Resilient	The capacity of a system, community or society potentially exposed to hazards to adapt, by resisting or changing in order to reach and maintain an acceptable level of functioning and structure. This is determined by the degree to which the social system is capable of organizing itself to increase its capacity for learning from past disasters for better future protection and to improve risk reduction measures.

Retrofitting (or upgrading)	<p>Reinforcement of structures to become more resistant and resilient to the forces of natural hazards.</p> <p><i>Retrofitting involves consideration of changes in the mass, stiffness, damping, load path and ductility of materials, as well as radical changes such as the introduction of energy absorbing dampers and base isolation systems. Examples of retrofitting includes the consideration of wind loading to strengthen and minimize the wind force, or in earthquake prone areas, the strengthening of structures.</i></p>
Risk	<p>The probability of harmful consequences, or expected losses (deaths, injuries, property, livelihoods, economic activity disrupted or environment damaged) resulting from interactions between natural or human-induced hazards and vulnerable conditions.</p> <p><i>Conventionally risk is expressed by the notation $Risk = Hazards \times Vulnerability$. Some disciplines also include the concept of exposure to refer particularly to the physical aspects of vulnerability.</i></p> <p><i>Beyond expressing a possibility of physical harm, it is crucial to recognize that risks are inherent or can be created or exist within social systems. It is important to consider the social contexts in which risks occur and that people therefore do not necessarily share the same perceptions of risk and their underlying causes. (Source: ISDR)</i></p>
Risk Assessment/Analysis	<p>A methodology to determine the nature and extent of risk by analysing potential hazards and evaluating existing conditions of vulnerability that could pose a potential threat or harm to people, property, livelihoods and the environment on which they depend.</p> <p><i>The process of conducting a risk assessment is based on a review of both the technical features of hazards such as their location, intensity, frequency and probability; and also the analysis of the physical, social, economic and environmental dimensions of vulnerability and exposure, while taking particular account of the coping capabilities pertinent to the risk scenarios.</i></p>
Scenario	<p>An account or synopsis of a possible course of events that could occur, which forms the basis for planning assumptions (for example, a river floods, covering a nearby town and wiping out the local population's crop) (Source: IASC Contingency Planning Guidelines 2001)</p>
Scenario-building	<p>The process of developing hypothetical scenarios in the context of a contingency planning exercise. (Source: IASC Contingency Planning Guidelines 2001)</p>
Seismic Hazard	<p>Seismic hazard in the context of engineering design is defined as the predicted level of ground acceleration which would be exceeded with 10% probability at the site under construction due to occurrence of earthquake anywhere in the region, in the next 50 years.</p>

Sustainable development

Development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It contains within it two key concepts: the concept of "needs", in particular the essential needs of the world's poor, to which overriding priority should be given; and the idea of limitations imposed by the state of technology and social organization on the environment's ability to meet present and the future needs. (Brundtland Commission, 1987).

Sustainable development is based on socio-cultural development, political stability and decorum, economic growth and ecosystem protection, which all relate to disaster risk reduction.

Vulnerability

The conditions determined by physical, social, economic, and environmental factors or processes, which increase the susceptibility of a community to the impact of hazards.

For positive factors, which increase the ability of people to cope with hazards, see definition of capacity.