

CHAPTER –V

DISASTER PREPAREDNESS AND MITIGATION PLAN

5.1 Introduction

The State Plan for preparedness and mitigation attempts to protect the lives and properties of the people of Delhi from potentially devastating hazards by the implementation of an effective long term Delhi Disaster Management Policy. The initiatives under this plan lay down certain objectives and suggest definitive strategies leading to the achievement of goals in a set time frame. The ultimate goal for the Government of Delhi with respect to various hazards is to have prepared communities in a way that when the hazards strike, there is little or no loss of life; least number of injuries and the losses to property and infrastructure are not critical.

Each element in this plan has a specific role and significant contribution towards the end target of a safer Delhi. All the elements attend to a distinct but interrelated with the area of concern. The plan rests on the conviction that well defined strategies, goals and end targets with identified players, roles and responsibilities are the precursors of successful implementation of any project. The strategies for hazard loss reduction aim at reducing losses in the event of a future occurrence of a hazard. Mitigation measures need to be considered in land use and site planning activities. Necessary mitigation measures need to be built into the design and costing of development projects.

5.2 Disaster Preparedness

Preparedness and focuses on plans to respond to a disaster threat or occurrence. It takes into account an estimation of emergency needs and identifies the resources to meet these needs. It also involves preparation of well-designed plans to structure the entire post-disaster response, and familiarising the stakeholders, particularly the communities through training and simulation exercises. Preparedness has to be supported by the necessary legislation. means a readiness to cope with disasters or similar emergencies which cannot be avoided.

The first objective of preparedness is to reduce the disaster impact through appropriate actions and improve the capacity of those who are likely to be affected most (that is,

marginalised, poor and handicapped) to get maximum benefit out of relief. The second is to ensure that ongoing development continues to improve the capacities and the capabilities of the system to strengthen preparedness efforts at community level. Finally, it guides reconstruction so as to ensure reduction in vulnerability. The best examples of preparedness activities are the development of local warning and community evacuation plans through community education, evolving local response structures such as Community based Disaster Management Teams (DMT) and administrative preparedness by way of stockpiling of supplies; developing emergency plans for rescue and relief.

Since disasters affect economic and social processes, preparedness and mitigation must emphasise the socioeconomic rather than just the physical aspects. If disasters demonstrate the vulnerability of the social system, then any policy for disaster management must include the potential reduction of such vulnerability.

5.2.1 Important Components of Preparedness Plan

Generally community preparedness depends upon following four major components (Cottrell et al- 2001):

- Population characteristics (number of children, squatter settlement etc)
- Building and critical infrastructure such as road, drinking water, communication network, health and sanitation
- Physical environment
- Social environment (social groups)

In view of these components risk assessment study has been conducted and identified that Delhi is densely built and consists of a high number of urban population. Any major earthquake or fire/chemical explosion can affect district very badly. Although various steps have been taken by the Delhi Government but still a high degree of awareness and training is required to lay down an organization system within communities.

Looking at the complexity of repose mechanism during disasters two sets of components have been studied to prepare this plan i.e. components of community preparedness and administrative response.

5.2.2 Components of Community Preparedness Plan

Several previous attempts have been made by researchers to measure community preparedness within various indicators. Some of the important components of measuring preparedness are given below¹.(refer fig 1)

- 1. Physical Safety:** i.e. how safe community members are in view of the physical danger from these hazards? The parameters essentially tries to measure how effective structural mitigation measures are e.g. resistance of building structures for earthquakes, availability of safe shelters and its capacity etc.
- 2. Hazard awareness** i.e. awareness level about hazards which have a reasonably higher probability of occurrence
- 3. Organization preparedness** i.e. how far the community is organized to face a disaster i.e. existence of committee at community level, task forces, volunteers of civil defence and other local volunteers , trained disaster management teams and community disaster management plan etc
- 4. Infrastructure and services** which tries to measure current state of these services and how well restoring critical services as and when disruptions occur
- 5. Recovery ability** i.e. ability of the community members to recover from the impact of the hazard
- 6. Physical environment** i.e. state of environment to face hazards e.g. Condition of sub-surface aquifers and vegetation etc
- 7. Social capital** i.e. degree to which social networking and cooperation exists among community members
- 8. Psychological preparedness** i.e. how safe and prepared do community members feel in view of these hazards
- 9. Cultural capital** i.e. cultural richness such as existence, recognition and use of traditional mechanism to cope with such disasters
- 10. Household preparedness** i.e. preparedness at a house hold members

¹ Cottrell et al (2001)

Fig 6.1: Components of Community Preparedness



5.2.3 Components of Administrative Preparedness

Administrative preparedness is also an important component which helps in reducing relief and response time in a disaster situation. Preparedness plan is based on below-given components

1. Operation readiness of facilities, equipments and stores in advance
2. Maintaining response inventory of equipments and materials required for response
3. Assignment of responsibilities to agencies and organizations
4. Management training of crisis group members, desk officers and officers of respective departments likely to be assigned management duties
5. Specialized trainings of district disaster committee members, officials, community organizations through seminars and workshop
6. Training of taskforces
7. Raising community awareness
8. Improving response mechanism through conducting practice drills etc
9. Annual updating of State, District and community level plans

5.3 Preparedness Plan for Delhi

Based on above-mentioned components following arrangements are required to enhance State level preparedness level.

5.3.1 Establishment of Emergency Operation Centre (EOC): To ensure coordination within State, district and local authorities, EOC plays a very important role. Directing the operations at the affected site, the need for coordination at the district headquarter and the need for interaction with the state government to meet the conflicting demand at the time of disaster are the responsibilities of the Divisional/Deputy Commissioner and his team members. State/District EOC helps Incident Management Team to meet these conflicting demands. Keeping this in view, Delhi has identified 2 State level Emergency Operations Centres and nine Emergency Operations Centres for all the districts. At present, these Operations Centres are temporarily running in all the Districts and State but there is a plan for further strengthening the EOC building with equipments, manpower and other facilities. Below, important activities of EOC have been described.

(a) Normal Time Activities of Emergency Operations Centre

- Ensure warning and communication systems are in working conditions
- Collect and compile of district-wise information related to hazards, resources, trained manpower etc.
- Conduct district, sub-division and community level mock drills
- Generate coordination within Community, District and State level departments
- Monitor and evaluate community(Residential colonies, schools, hospitals, institutions, business establishments) level disaster management plans
- Develop a status report of preparedness and mitigation activities under the plan
- Allocate tasks to the different resource organizations and decisions making related to resource management
- Review and update response strategy
- Supply of information to the state government

(b)Facilities with EOC

Presently, the Emergency Operations Centres in districts and state are equipped with computer related facilities. In future, EOC would include a well-designed control room

with workstation, wire-less communication, hotlines and intercoms etc. Following other facilities will be made available within the EOC:

- A databank of resources, action plans, state and district disaster management plans, community preparedness plans would be maintained at EOC
- Maps indicating vulnerable areas, identified shelters, communication link system with state government and inter and intra district departments would strengthened
- Inventory of manpower resources with address, telephone numbers of key contact persons has been maintained
- EOC will have provision of desk arrangements in advance
- Frequently required important phone numbers would be displayed on the walls so that they can be referred. Other phones and addresses would be kept under a easy-retrieval and cross-referring system
- Reconstruction/ Retrofitting of building will be done so that it can remain operational during disaster also.
- EOC will be made operational for 24 hours with the help of Police, Fire and Home Guard Department

(c) Communication Room (Main Message Room)

The police wireless system should be in contact with EOC. In addition to that following facilities would be available in the communication room:

- Telephones, fax and intercoms units for contact within the Commissioner
- Civil wireless network (up to *tehsildar* level-suggested)
- One computer with internet and printer facility and photocopying machine
- Help lines numbers will be setup for emergency related queries

(d)Transport Facility

A jeep with wireless communication may be assigned to the EOC for normal times. Additional vehicles may be requisitioned during the emergency.

(e)EOC Staffing/Manning EOC

Manning of EOC is required for making EOC operational during and post disaster situation. In the district there would be a need of keeping adequate staff. There is a need of regular staff, staff-on requirement and staff-on disaster duty. Regular staff is required to manning communication room on 24 hours. Staff on call can be acquired immediately on requirement. Two officers of the rank of DC/ADM can be appointed during emergency. Staff on disaster duty can be appointed by Deputy Commissioner. This staff can be drawn from the various government departments.

(f) Desk arrangement

In case of emergency Incident Commander/Deputy Commissioner and other team members would be present round the clock in the office in EOC. Senior officers should be appointed in the capacity of desk officers for maintaining coordination for Emergency Support Functions:

Table 6.1 List of ESF and desk officers

Nos.	Emergency Support Functions	Desk Officers
1	Communication	MTNL
2	Evacuation	Delhi Police
3	Search and Rescue	Delhi Fire Service
4	Law & Order	Delhi Police
5	Medical Response and Trauma Counseling	Directorate of Health-CDMO
6	Water Supply	Delhi Jal Board
7	Relief (Food and Shelter)	Department of Food and Civil Supplies
8	Equipment Support, debris and road clearance	MCD
9	Help lines, warning dissemination	Department of Revenue
10	Electricity	B.S.E.S./N.D.P.L.
11	Transport	Transport Department

5.3.2 Preparation of Resource Inventory

Resource inventory means listing of various useful materials, manpower and vehicles etc with their contact addresses and system of procurement. State/District EOC has already been fed in India Disaster Resource Network(IDRN) which is a sub-component of 'GOI-UNDP Disaster Risk Management Programme'. The resource inventory is available online and can be

accessed from the server residing at MHA and NIC. The District EOCs are responsible to update and manage these details in a user-friendly manner.

5.3.3 Reliable Communication Systems

Delhi being a capital city already has well-established communication system but yet disasters like earthquakes has witnessed partial or total collapse of general communication system which delays flow of information from the disaster site consequently resulting delays in relief operations. Therefore, establishment of reliable communication also plays a very crucial role. Till now, Police Communication System has been found most suitable to rely upon. The plan also seeks for installation of satellite phones and HAM equipments in the EOC for strengthened communication system in all nine district offices and state headquarter office. Training to volunteers of home guards would be provided in HAM operations.

5.3.4 Preparation of a Response Plan

One of the important tasks during preparedness phase is formulation of a response plan. It basically helps in quick mobilization of manpower, resources and in performing various duties. The response plan explains a hierarchal system of Emergency Response Functions in term of tasks and assigned responsibilities to different agencies. It also lay down an Incident Command System under the directions of Deputy Commissioner of every district or divisional Commissioner (depending upon the extent of disaster). This whole exercise will help in reducing confusions and result in prompt and coordinated response. Activation of trigger mechanism by Incident Commander, Functioning of EOC and Response of Emergency Support Functions can be tested every year for resolving perplexity occurring during actual scenario. Broad details of response plan has been included in the Chapter 6.

5.3.5 Training and Capacity Building

Disaster Management is a multi-organizational effort requires training on execution and coordination related subjects. Therefore wide ranges of trainings related to management and planning skills are highly required for potential officers in order to equip them for specialized disaster-related tasks.

Training requirements are likely to comprise of core activities of emergency management such as Incident Command System, Emergency Response Functions, basic management

skills and specialized training on search and rescue, first aid etc. Persons to be trained shall be:

- Government Officers at par with the rank requirement under Incident Command System
- Team leaders and members of Emergency Support functions
- Quick Response Teams at headquarter and field level
- Community level taskforces including Volunteers, NGOs and home guard volunteers, school and college students, NCC and NSS scouts and NYKS etc

Delhi Disaster Management Authority shall continue organizing several seminars and workshops with the help of various research institutions, Civil Defence and Home Guard, Fire fighting department, Health departments etc. A record of trained manpower shall be maintained by each department and their representation shall be noticed during mock-drill.

5.3.6 Community Awareness and Community Preparedness Planning

The hazard and risk analysis of the state indicates that there is a high need of community awareness through public **awareness programmes** on the following themes of disaster:

- Types of disasters and basic do's and don'ts
- Post disaster epidemic problems
- Construction and retrofitting techniques for disaster resistant buildings
- Communication of possible risk based vulnerable areas in the district
- Evacuation related schemes and community preparedness problems
- Non-structural mitigation measures

Volunteers and social organizations shall also play a vital role in spreading mass scale community awareness. Media shall also play an important role in raising awareness and educating people. Delhi Government shall develop large scale Information Communication and Education material in the form of booklets, handbooks, manuals, posters and flyers etc. These documents shall be distributed in all the offices, schools, institutions and residential colonies.

Community Disaster Management Planning is one of the vital components of community preparedness. It involves all important parameters related to hazard awareness, evacuation planning, preparation of resource inventory, formation of community level taskforces and committees which will enhance capacities in communities in combating a disaster in a predefined manner.

District authorities shall keep on fostering community planning exercises in local areas. District administration has also been imparting trainings to the communities with the help of Civil Defence and Home Guards, Nehru Yuva Kendra Sangthan, St. John Ambulance Brigade, Indian Red Cross Society and NGOs etc. Yet more steps required to be undertaken for encouraging community based disaster management planning initiative (refer Table 5.1).

5.3.7 Capacity Building of Community Task forces

District administration, Medical officers, Trained volunteers, Delhi fire Services, Civil Defence and Home Guard volunteers, NYKS etc. are responsible for building capacities of community taskforces in search and rescue, fire-fighting, warning dissemination, first-aid and damage assessment etc.

District level Medical Officer shall organize seminars for training taskforces and volunteers in basic first-aid with the help of Civil Defence & Home Guard, St. John Ambulance and CATS shall. Delhi Fire Service along with Civil Defence & Home Guard shall impart training on search and rescue and fire fighting. (table 5.1).

5.3.8 Simulation Exercises

To encourage participation in a coordinated manner simulation exercises on various disasters are very important. These exercises help in institutional building at various levels. Mock-exercises shall be promoted at state, district and community level. Those community members have completed their disaster management plans and have constituted several taskforces shall conduct regular mock-drills. At least two mock-drill shall be conducted by community representatives to improve and update plan.

Similarly, once State response plan is ready, mock-drills shall be organized by State Government. Mock exercises help in improving response time and also test reliability. Therefore at least one mock-drill shall be arranged involving all required agencies. These drills will also help in updating the response plans. Delhi Disaster Management Authority/ District Disaster Management Committee are responsible to conduct yearly mockdrills and update plans.

Table 5.1 : Community Preparedness Strategies

S. No	Tasks	Mode of conduct	Nodal Agencies	Supporting Agencies
1	<p>Information Dissemination of various hazards and their precautionary measures (do's and don'ts). Also, preparation of community based disaster management plans shall be promoted in these areas.</p> <p>First priority shall be given to the schools, industrial clusters, Market Trade Associations and Residential areas, slums and resettlement colonies etc living in the densely populated areas of North-east, East, Central, West</p>	<p>Through Nukaad Nataks, Film Shows, Rallies, Media, Newspaper Media, Posters and Pamphlets, Groups discussions and workshops etc</p>	<p>District Administration</p>	<p>Civil Defence and Home guards volunteers(CD & HG), Nehru Yuva Kendra Sangthan(NYKS), Residential Welfare Associations(RWAs), Market trade Unions(MTAs), Rotary Clubs, Non Government organizations(NGOs), Schools and colleges volunteers, NSS, NCC etc.</p>

	and North districts Second Priority shall be given to the communities living in the outer part of the South, South-West and North West districts			
2.	Formation of Community Based Disaster Management Committees and Taskforces	Through community level meetings	District Administration	Representatives of RWAs and MTAs Members, Local Volunteers etc.
3.	Capacity Building of Community Members	Through mock-drills, preparation of community plans, trainings and workshops on disaster specific topics	District administration	CD & HG, Local NGOs, NYKS, St. John Ambulance, C.A.T.S etc.
4.	Trainings to the taskforces and committee members - First-Aid and Trauma Counseling - Search and rescue and fire-fighting - Warning Dissemination etc.	Trainings and workshops	Revenue Department along with Health, Police and Fire Departments	CD & HG, St. John Ambulance and CATS and NGOs
5.	Post disaster epidemic problems	Seminars and community meetings	Health department	Local health departments, and NGOs
6	Trainings for construction of seismic resistant buildings and retrofitting of the buildings.	Showing Films, videos, distributing posters and brochures, reading materials, etc in trainings and workshops or any other	Revenue department	MCD, PWD, Private contractors and NGOs etc

	Target groups are contraction contractors, masons, engineers, architects and local communities (especially those who are taking loans for building constructions and provided assistance under Indira Awas Yojana and other developmental programmes)	community gathering		
7.	Orientation/Training of government and non- government officers and various other stakeholders	Organising state level sensitization programmes in their roles in disaster management	State Nodal Agency/Delhi Disaster Management Authority	DHS, Social Welfare Department, Fire Department, Research /Academic Institutions like IIT- Kanpur and Roorkee, School of Planning and Architecture, Delhi College of Engineering, Jamia Milia Islamia University, Delhi University etc
8.	Establishment and Strengthening of Emergency Operations Centres	Construction/Restrengthenin g of the building for EOC Manning of EOC Strengthening of EOC with equipments and IT facilities	Delhi Disaster Management Authority	Funds of United Nations Development Programme
9.	Response Planning and Simulation	Based on Incident Command System and Emergency	Delhi Disaster Management	

	Exercises	Support Functions Developing Partnership with various public support units and private agencies Organising mock-drills exercises at state/district level	Authority/District Authority	
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5.4 Disaster Mitigation

Disaster mitigation focuses on the hazard that causes the disaster and tries to eliminate or drastically reduce its direct effects. The best example of mitigation is the construction of dams or levees to prevent floods or coordination of release of water from various irrigation dams to avoid flooding in the downstream areas. Other examples include strengthening buildings to make them earthquake resistant, planting of crops that are less affected by disasters, controlling land-use patterns to restrict development in high-risk areas and diversification of economic activities to act as insurance to offset losses in different sectors.

A mitigation strategy however, cannot be successful unless it has the backing and support of all concerned – the administrative machinery, the research institutions, the non-officials and the community. So, it also becomes imperative to have built-in institutional arrangements and/or legislative backing to oversee the mitigation strategy over a period of time.

The main elements of mitigation strategy which can further broadly divided into non-structural and structural mitigation measures are:

- Risk Assessment and Vulnerability Analysis
- Applied Research and Technology Transfer
- Public Awareness and Training
- Institutional Mechanisms
- Incentives and Resources for Mitigation
- Land Use Planning and Regulations

5.4.1 Non- Structural Mitigation

Many of the non-structural mitigation measures are being carried out by the Government of Delhi under the Disaster Risk Management Programme.

1. Promotion of Research and Technology

Objective-To promote research projects for studies like microzonation, risk assessment, systematic study on evaluating construction typology, identification of cost effective methods to improve seismic safety and to facilitate the implementation of research outcomes.

As per Vulnerability Atlas of India (1997), for shaking intensity VIII, 6.5% houses in Delhi have high damage risk, and 85.5% houses have moderate damage risk. These estimates are based on very simplistic assumptions. Systematic studies are needed on vulnerability of different types of constructions in the area. This will require experimental studies to evaluate strength, stiffness and ductility of different types of constructions as well as analytical studies such as the Push-Over Analysis. Experiences of past earthquakes both in India abroad have clearly outlined the vulnerability of multistory reinforced concrete buildings if not designed and constructed correctly. Huge number of multistory reinforced concrete buildings in Delhi, particularly those with open ground storey to accommodate vehicle parking, could also pose a major challenge in the event of a strong earthquake. (<http://www.gisdevelopment.net/>)

Strategies

- Ensure availability of adequate funds
- Ensure applicability of study to state specific hazard risk reduction
- Monitor, review and evaluate the research activities

Outcomes

The results of microzonation study will enable the professionals to improve planning and design to achieve better performance and reduced hazard risk. The study for Cost effective techniques to retrofit existing structures in order to provide life safety will offer more options to the decision makers.

2. Capacity Building and Awareness Generation

Objective- To generate awareness about various types of hazards and associated vulnerabilities among professionals, policy makers, and the general public making them better prepared and enabling them to make effective decisions about reducing losses from earthquakes and to encourage them to undertake effective implementation action.

Strategies

- Increase public awareness through mass media campaigns
- Development of Information, Education and Communication Material
- Including the subject of Disaster Risk Management in the Syllabi of different courses.
- Sensitization of officers from the Administration, Ministry of Education, Ministry of Disaster Management, Delhi Police, Delhi Fire Service, Delhi Jal Board, Delhi Vidyut Board, Mahanagar Telecom Nigam Ltd. and all other parallel agencies.

Outcomes

Government officials, policy makers, professionals and public will be better educated and aware of their vulnerabilities and will have a positive attitude towards mitigation measures. The preparedness will reduce losses in the event of any disaster and considerably reduce the funds required for relief and response activities in a post disaster situation.

3. Training and Capacity Building

Objective- To develop a force of trained professionals, community members, specialized groups like first aid teams, search and rescue teams, Evacuation teams, damage assessment teams etc.

We have very few experts in disaster mitigation and planning. We must focus our attention to the institutionally and manpower development at all levels. There is a need to train architects, engineers, planners and masons in developing safe housing and infrastructure facilities. State has already arranged about six state level trainings for engineers, masons and architects of public and private sectors. But still many more are required to cover in the process. Manuals need to be developed outlining methodologies for new constructions and

retrofitting of old ones. A strong legal and enforcement framework with appropriate incentives and punitive measures is required together with awareness programmes for general public. All these components must be taken up simultaneously; ignoring one aspect for the other could be counterproductive. (<http://www.gisdevelopment.net/>)

Strategies

Organize training programmes for specialized groups like, disaster management teams in district, sub division and community level, teachers and principals, doctors and engineers, architects and mason and builders & contractors etc.

Outcomes

A large number of skilled people shall be utilized in emergency services in a post disaster situation when time of response is critical. Trained disaster management teams can be involved in response functions by the government of NCT of Delhi.

4. Insurance cover for disasters

Objective- To develop a better understanding and general awareness of the insurance procedures and develop strategies for reducing the premium cost for a complete cover.

Insurance brings quality consciousness in the infrastructure and a culture of safety by insisting to follow building codes, norms, guidelines, quality materials in construction. It would enforce safety standards by bringing accountability. Hazardous area should be announced, notified and publicly displayed so that people would be motivated not to settle in those areas and insurance be mandatory in insurance prone areas. Premiums can be changed on the basis of risk proneness. Since many areas are prone to multi-hazards, there should be multi-hazard insurance provisions. Insurance should be made against all natural and man-made disasters for houses, buildings and other important resources. Incentives should be paid to the insurers who have followed building-codes and other prescribed guidelines prevailing in the area. Insurance companies should have their own experts and supervisors to check and determine insurance amount. Government may provide special incentives to cover the people in the areas not yet covered by insurance and district administration and

other development agencies may take up steps to facilitate it. Issuing I-cards and preparation of insurance policy etc can also bring awareness and also facilitate insurance oriented information. In due course of policy, the provisions of compensation should be taken over by insurance.

Strategies

- Meetings with the heads of Insurance agencies and brainstorming on possible strategies for making insurance a better and cost effective option
- Review of tariff rates for Fire, Earthquake and STFI (Storm, tempest flood and inundation) cover with the help of Tariff Advisory Committee
- Implementation of the revised policies and tariffs by Insurance Regulatory and Development Authority (IRDA)
- Encourage insurance agencies to promote insurance against fire and other hazards by way of advertisements in media.

Outcomes

Public will be more aware about the benefits of insurance. Revised policies and tariffs for insurance will lead to cost effective mitigation.

5. Development of Delhi Earthquake Loss Scenario

Objective- To develop a scenario of possible losses to life and property in Delhi due to an earthquake of expected intensity as per the Seismic Zone IV, in the region.

Strategies

- Allocate funds and engage experts to carry out the analysis.
- Ensure availability of all the information required for the study by coordinating with various departments.

Outcomes

Increased awareness of potential local earthquake risks to provide local emergency responders with reasonable descriptions of post earthquake conditions for planning purposes.

6. Amendments in Master Plan of Delhi

Objective- To incorporate amendments in the Master Plan of Delhi so that a balance is achieved between the needs of the state's increasing population and economic growth, growing commercialisation and the constraints imposed by various hazards.

Strategies

- Promote the incorporation hazard risk reduction practices into general plans.
- Recommend inclusion of hazard mitigation features
- Incorporation of results of microzonation study into development and modification of Master plan.
- Incorporation of Urban Disaster management into development planning.

Outcomes

A development planning that incorporates urban disaster management and disaster mitigation strategies and minimizes the impact on life and property when disaster strikes.

7. Mitigation of Non Structural Risks

Objective- Aggressively promoting the securing or replacing of non structural hazards in places of human occupancy or of high property loss potential.

Strategies

- Develop awareness programmes on non structural mitigation
- Develop cost effective methods of non structural mitigation.
- Develop manuals on non-structural mitigation measures

Outcomes

Reduction in number of deaths, injuries and loss of property and movable assets from earthquakes. A sense of confidence in the community gained from mitigation activities.

5.4.2 Structural Mitigation

Structural mitigation is typically much more complex than non-structural mitigation, and usually has a higher associated cost. Mitigation plan for Delhi shall include all the activities that prevent a hazard or lessen the damaging effects of unavoidable hazards. Investing in preventive mitigation steps now such as repairing deep plaster cracks in ceilings and

foundations, retrofitting of existing buildings and following local seismic building standards will help reduce the impact of earthquakes in the future

Broadly the components of this plan shall be

A. Ensure all existing lifeline buildings remain operational immediately after a Seismic event by 2015

The Bureau of Indian Standards(BIS) has developed its first code on a seismic design in 1962 (IS:1893-1962). However, till date there is lack of efficient legal framework to implement seismic code provisions in Delhi. As a result most of the building in Delhi does not meet codal requirements on seismic resistance. Even if new constructions may fulfill the requirement of seismic code provisions in their buildings, still a very large inventory of old buildings will remain deficient for seismic safety. Therefore, we need to develop a **rational seismic retrofitting plan** for the government- owned buildings and private constructions on priority bases. Generally public buildings are given first priority because they are lesser in number and at the time of disaster people can take shelter in these public buildings. Some of the important public buildings are schools, hospitals, government officers, community halls, fire and police stations, cultural buildings, communication buildings, cinema halls, meetings halls, historical monuments and important installations etc. the second priority goes to the buildings like offices, warehouses, residential colonies, factories and hostels etc.

Following strategies are being adopted:

1. Actual Retrofitting of the five critical buildings identified under the Delhi Earthquake Safety initiative and subsequent identification of more life line buildings spread geographically around the state.
2. Involvement of more agencies like MCD, DDA, NDMC etc for retrofitting of their own buildings as well as other critical buildings.
3. All the concerned departments to make financial commitments and earmark funds in their budget plans every year for retrofitting.
4. Develop appropriate policy instrument for budget allocation for carrying out retrofitting of identified life line structures

5. Identification and development of Retrofitting plans for all Lifeline buildings in Delhi by 2010 using the current project as a model.
6. Complete retrofitting of all Lifeline Buildings by 2015.
7. Training of all departments in Retrofitting methodologies.
8. Establish seismic performance standards for all life line buildings.
9. Promotion of retrofitting technologies

10.

17. Development of manuals on various methodologies of retrofitting with guidance from experts

1.

B. Ensure all existing lifeline bridges and fly-overs remain operational after a Seismic event by 2015

1. Establishment of Seismic performance standards for all lifeline bridges and fly-overs.
2. Identification, assessment and development of Retrofitting plans for all Lifeline bridges and flyovers in Delhi by 2010.
3. Complete retrofitting of all Lifeline bridges and flyovers by 2015 to existing codal provisions of the day.

C. Ensure all new Governmental constructions are Earthquake resistant by 2010

1. Setting up of Hazard Safety cells in various departments to oversee all Governmental constructions (Only a few departments have constituted this so far)
2. Developing integrated approach to seismic design
3. Developing methodologies for seismic retrofit including minimum standards and enhanced performance- based standards for structural elements of buildings.
4. Training of all departments in Earthquake Resistant design and construction.

D. Ensure all new Private constructions are Earthquake resistant by 2020

1. Adoption of Model Building Byelaws (MHA-Gol Document) into building Bye-laws of Delhi State agencies
2. Enhance enforcement of byelaws
3. Making mandatory, the use of disaster resistant codes and guidelines related to disaster resistant construction in the houses and buildings in all sectors of the society by law and through incentives and disincentives.
4. Training of staff in all departments dealing with construction.
5. Training of construction fraternity in all sectors.
6. Development of simple guidelines for aspiring house owners

E. Construction Control

The best mitigation measure is to build strong built-in environment in the State. The State must ensure the implementation of building codes. The quality of buildings measured by their seismic resistance has its fundamental importance. Minimum designs and constructions standards for earthquake resistant structures legislated nationally are an important step in establishing future minimum level of protection for important structure. India has building codes and regulations for seismic resistant design which needs to be enforced by municipal bodies.

Table 5.2: Important Mitigation Measures

	Strategies	Actions involved	Suggested Institutions involved
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1	Retrofitting of buildings	Identification of vulnerable buildings in the district	MCD/PWD engineers
		<p>Prioritization of buildings according to their importance during emergency.</p> <p>First priority buildings are:</p> <ol style="list-style-type: none"> 1. Delhi Disaster Management Authority, District administration office building, Sub-divisional offices 2. All police and fire stations 3. Major Hospital 4. All Schools (Government, MCD and Public etc) 5. Residences of Deputy commissioner, Deputy Commissioner of Police and important Doctors <p>Second priority buildings are:</p> <ol style="list-style-type: none"> 1. Hospitals and clinics 2. Community centres 3. Residences of other key officials 4. Office buildings of MCD, PWD, CD & HG and DDA <p>Third Priority buildings are</p> <ol style="list-style-type: none"> 1. Remaining Government Buildings and colonies 	District Disaster Management Committee
		Arrangement of teams to take-up above mentioned retrofitting projects and fire-fighting arrangements	MCD and PWD
2.	Enforcement of Building codes	Review and updation of building codes according to the required	BISS
		Implementation of codes in new engineered and non-engineered constructions	MCD

3.	Community Awareness	Large-scale information dissemination about basics of new constructions and retrofitting of existing buildings and encouraging fire-fighting arrangements in the building	MCD, PWD, District Administration, NGOs
		Information dissemination about dos' and don'ts at the time of earthquake event and fire-outbreak	District administration, social organizations, Fire and police department.
4.	Capacity Building	<p>Priority-wise training to the engineers, architects, and masons for disaster-resistant buildings should be arranged. These people may further utilized for assisting in retrofitting and reconstruction exercises.</p> <p>First priority shall be given to government engineers, architects and masons</p> <p>Second priority shall be given to the private engineers, architects and masons</p> <p>Third priority should be given to contractors and builders</p>	District administration, MCD, PWD and DDA
5.	Insurance	Identification of hazardous areas in the district	DC Office, MCD
		Provisions of insurance according to building bye laws, codes and hazard proneness	Insurance companies, MCD

5.3 Conclusion

- Delhi consists of weak and illegal constructions which compounds its vulnerability to earthquake and fires.
- Buildings constructed through good design are not necessarily built with earthquake safe design
- There is a need of an urgent of mitigation planning under which new constructions should come up as per building-byelaws and standard codes.

- Retrofitting techniques are very much important to re-strengthen old and weak constructions which needs to be taken up by MCD and district administration
- Fire safety assessments and fire-fighting arrangements shall be promoted in multistoried buildings and residential communities
- Insurance of buildings according to their hazard proneness is important to promote in the district under the supervision of local administration
- Although various steps have been undertaken by deputy commissioner to train government-engineers, architects and masons but more steps towards this are highly required.
- Life-line buildings like Major hospitals, deputy-commissioner office, residences of key officials, schools, community spaces, police and fire stations etc. shall be retrofit on priority basis.