CHAPTER- 4
PREVENTION AND MITIGATION MEASURES

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4.1 Introduction

Disaster Mitigation contributes to lasting improvement in safety and is essential to integrate disaster management in mainstream planning. Broadly mitigation ways can be divided into two parts i.e. structural measure and non-structural measures. Structural measures undertake to strengthen buildings, lifelines and infrastructure to withstand any hazard. Non-structural measures emphasis on land-use planning, programmes for sustaining awareness, dissemination of information materials on Do's and Don'ts at the time of disaster. Once the area has been identified as hazard prone, it becomes important that the government and the community should practice these above-said measures. Based on this ideology, mitigation plan may vary according to hazards. The Central district is being considered prone to earthquake and fire related hazards, incidences of building collapse are also very frequent in District Central, Delhi.

4.2 Disaster Mitigation Measures

As it has been discussed in the previous chapters that district Central lies in Zone IV. Risk gets compounded when hazard meets with Vulnerabilities as high dense population, weak physical structures and conventional construction technologies. Similarly, district is also vulnerable to high degree of fire and chemical explosions. Although, district has not faced any high intensity earthquake but studies envisages that Delhi can receive an earthquake of 6 to 7.5 ricter scale band.

Earthquakes can destroy buildings and infrastructure with secondary effects i.e. fires, embankments failures, release of poisonous gases, release of nuclear radiations, liquefaction etc. Therefore it is important to consider both primary and secondary effects into earthquake disaster mitigation planning.

So, an effective mitigation planning is necessary to reduce the risk involved in the district. For efficient disaster mitigation, the pre-disaster phase needs to be utilized for planning and implementing preventive measures on the one hand and working on preparedness activities on the other. Disaster is caused due to failure of manmade structures, lack of preparedness and awareness. So far, disaster mitigation efforts are mostly reactive. (HPC, 2001).

Structural Mitigation Measures

12 **Retrofitting of Buildings:** Generally buildings of the district can be characterized in three parts i.e. Slums and JJ clusters, non-engineered and engineered buildings (Table 4.1*).

Table 4.1: Categorization of housing typology in the district

S.No.	Categories	Construction description	Resistance

1	Slums and JJ Clusters /unauthorized colonies etc	Weak constructions	May get damaged due to moderate intensity of earthquake
2	Non-engineered buildings	Brick construction Masonry buildings	May damage due to moderate to high intensity of earthquake
3	Engineered Buildings	R.C.C. constructions with good designs but not necessarily earthquake resistant	May damage due to high intensity of earthquake.

** Note: Above table is based on reconnaissance survey and general observations*

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 offices, community halls, fire and police stations, cultural buildings, communication buildings, cinema halls, meetings halls, historical monuments and important installations etc. The proposal for certification of such critical buildings from the point of view of disaster resilience is under consideration.

b. Need of systematic study to evaluate construction typology in the district:

As per Vulnerability Atlas of India (2007), out of 33.8 Lakh buildings in Delhi, over 31 Lakh are at medium risk of being affected by an earthquake, while 1.46 Lakh are at high risk. Out of 5, 23,703 houses in Central district, only 32,381 are concrete (Census of India, 2011). 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 and 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.

c. Construction Control

The best mitigation measure is to build strong built-in environment in the district. The district must ensure the implementation of building codes. The quality of buildings measured by their seismic resistance has its fundamental importance. Minimum designs and construction 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. Some of the policy

measures taken at state level are: Municipality Corporation has been asked to bring a circular shortly to make submission of actual structural drawings, besides the structural safety certificates mandatory for all buildings while seeking building plan approval. The Urban Shelter Board, GNCT of Delhi has been asked to urgently carry out structural audit of buildings in Delhi with the assistance of experts from NDMA, using RVSA (Rapid Visual Screening Assessment) and DVA (Detailed Vulnerability Assessment) methods.

4.2.2 Non-Structural Measures

a. Capacity Building and awareness generation

Country have a very few experts in mitigation 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. District has already arranged two trainings for engineers, masons and architects of public and private sectors where 100 such participants got trained. Manuals have also been 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 but ignoring one aspect for the other could be counterproductive**.**

b. Insurance

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 awared and 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.

Table 4.2: Important Mitigation Measures

Sl. No.	Strategies	Actions involved	Suggested Institutions involved
1	**Retrofitting of buildings**	Prioritization of buildings according to their importance during emergency. ***First priority buildings are***: - District administration office building, all police and fire stations - All Schools (Government, SDMC and Public) - Residences of District Magistrate (Revenue), District Magistrate of Police	**South/North Delhi Municipal Corporation (SDMC)/PWD engineers**

		Second priority buildings are: 1. Hospitals and clinics 2. Community centres 3. Residences of other key officials 4. Office buildings of SDMC, PWD, CD & HG and DDA ***Third Priority buildings are*** 1. Remaining Government Buildings and colonies	
2.	**Enforcement of Building codes**	Review and updation of building codes	**BIS**
		Implementation of codes in new engineered and non-engineered constructions	**SDMC/NDMC**
3.	**Community Awareness**	Large-scale information dis-semination about basics of new constructions and retrofitting of existing buildings and encouraging fire-fighting arrangements in the building	**SDMC, PWD, District Administration**
		Information dis-semination about dosô and donôts at the time of earthquake event and fire-outbreak	**District administration, Fire and police department, NGO**
4.	**Capacity Building**	Priority-wise training to the engineers, architects, and masons for disaster-resistance. These people may be further utilized for providing assistance in retrofitting and reconstruction exercises.	**District administration, SDMC, NDMC, PWD and DDA**
5.	**Insurance**	Identification of hazardous areas in the district	**DC Office, SDMC, NDMC**
		Provisions of insurance according to building bye laws, codes and hazard proneness	**Insurance Companies, SDMC NDMC**

4.3 Conclusion

1. District consists of weak and illegal constructions which compounds its vulnerability to earthquake and fires.
2. Buildings constructed through good design are not necessarily built with earthquake safe design
3. There is a need of an urgent mitigation planning under which new constructions should come up as per building-bye-laws and standard codes.
4. Retrofitting techniques are very much important to re-strengthen old and weak constructions which needs to be taken up by SDMC and district administration
5. Fire safety assessments and fire-fighting arrangements shall be promoted in multistoried buildings and residential communities
6. Insurance of buildings according to their hazard proneness is important to promote in the district under the supervision of local administration
7. Life-line buildings like Major hospitals, Deputy Commissionerôs office, residences of key officials, schools, community spaces, police and fire stations etc. shall be Organizatio on priority basis.