INTRODUCTION:
Spatial planning is increasingly regarded as one of the important instrument in disaster risk reduction. It facilitates decision on the future use of space in any administrative unit, which in some cases may be confronted by natural hazards. This would be an important component of any society and government if they want to become spatially enabled. Multi hazards approach is required since a location may receive threat from numerous type of natural hazards. A coordinated policy, which contains laws and regulations, is needed to provide organizational and technical guidelines for the incorporation of disaster risk reduction strategy in spatial planning. This document discusses various thesis report done by the students of Masters of Planning in the School of Planning and Architecture – New Delhi in the past few years. The main focus of all these thesis reports is to integrate disaster risk reduction into spatial planning at various levels. Prerequisites for proper integration are elaborated and methods for the integration based on integrated risk map and vulnerability map are proposed.

1. DISASTER RISK MANAGEMENT IN DOON VALLEY
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Being the capital city of Uttranchal massive development is going on in and around Dehradun. It has attracted thousands of people from other cities of Uttranchal and other states which has caused increase in the density of the city. Seismic hazard wise Dehradun, Mussoorie and the surrounding areas in Doon Valley are quite vulnerable.

It falls in the Zone IV of the seismic zonation map of India. Based on the past earthquake evidences, active tectonics or study of fault planes along which movement is still going on and seismic vulnerability studies indicate one conclusion, that is an earthquake of magnitude of 1905 Kangra earthquake is overdue in the region. Apart from earthquake, flood, fire and landslide are also the major disasters in the valley and in the recent years they have wreaked havoc in the region.

At the valley level forest fire is a major problem and engulfs thousands of hectares of forest every year. Sandy soil and geology of the valley have made it prone to Seismic hazard. Dehradun and Mussoorie have been found more prone to disasters and are at high risk in terms of lives and property. Building bye-laws have not been followed in both the cities. The
institutional set up specified in the Disaster Management Act, 2005 have not been followed in the valley and the Dehradun district.

Dehradun has large number of slum population which faces flash flood every year. In past years rainfall in the region occurred than the average amount normally and caused flooding in the river. Out of 113 slums of the city, 90 slums grew along the bank of the two rivers. More than 30 percent of the area has been observed under high and moderate risk.

Steep slope, haphazard construction, multi storey buildings and narrow roads are the major problems of Mussoorie which have jeopardized thousands of lives and property here. Landslide occurs every year in and around the city which blocks the highways and cuts off the city from rest of the valley and district.

With such scenario the purpose of the Disaster Risk Management in Doon Valley is to formulate strategies to avoid and reduce the risk in the valley mainly in two major urban centres like Dehradun and Mussoorie. Planned development, compliance with planning, disaster management norms & building bye-laws and proactive approach can only ward off the danger of high risk in the valley.

2. PLANNING FOR DISASTER MANAGEMENT IN HILL SETTLEMENT - CASE STUDY SHIMLA

Pawan Sharma, M.Plan; (Urban Planning-2011)
School of Planning and Architecture-New Delhi

Hill settlements are more vulnerable to natural disasters, where development over the years has further increased the problem by upsetting the natural balance of various physical processes operating in the mountain eco-system. The state of Himachal Pradesh, which forms part of the North-western Himalayas, is environmentally fragile and ecologically vulnerable. Natural hazards are a matter of immediate concern, as every year the state experienced the-
earthquakes, cloudburst, flash flood, landslides, and snow avalanches. An increase in the severity and frequency of natural disasters in urban areas is closely related to the impact of human activities and urbanization. However, the pressure of population expansion in high risk areas is often unavoidable. Conditions of excessive exploitation of land resources, unplanned urban growth conditions exacerbate the vulnerability to disasters, such as earthquake, landslides and fire.

Shimla has seen a very rapid population growth in last three decades due to huge housing and tourism demand. This combined with lack of planning and haphazard growth has resulted in the construction of buildings on steep and unstable slopes with improper construction practices. High priority. Lifeline structures like hospitals, power stations, and telecommunication installations and water supply stations are located in high-vulnerability areas with poor connectivity. Weak enforcement of byelaws and poor emergency management capacity has added the risk.

The fast pace of growth and expansion without comprehensive understanding or preparedness has brought forth a range of issues that seek urgent attention at all levels. In the absence of such measures, the growing numbers in our population are at risk of prospective hazards such as air accidents, rail accidents, road accidents, boat capsizing, building collapse, electric fires, festival related disasters, oil spills, serial bomb blasts, and fires. The safeguards within the existing system are limited and the risk involved is high.

Reducing the risk associated with disasters cannot be dealt with in isolation assessment of risk factors is a key prerequisite in planning and implementing measures to mitigate their impact. Mapping areas of extreme risk, strengthening existing buildings, protecting
infrastructure, setting standards of construction through building codes and enforcing compliance to set standards could be initiated to regulate or discourage development in vulnerable areas, so that future disaster impacts can be substantially reduced.

3. POST DISASTER REHABILITATION AND RESETTLEMENT – CASE STUDY BHACHAU TOWN

RohitVirmani, M.Plan; (Urban Planning-2008)
School of Planning and Architecture-New Delhi

This report gives an overview to evaluate attempts to rehabilitation and resettlement effort, with sensitive approach to policies regarding the same. They are many treats faced by settlements, dated years back, to mention few such as earthquakes, cyclones, floods etc, these usually have adverse effect and some of these are followed by loss of life and property. During such depression, usually government takes up the responsibility providing the incentives such as rehabilitation and resettlement, this includes reconstruct and resettle all people, in a manner which not only achieves status, to their pre existing life. With a twist of sustainability practice, a brief note on community involvement has been exclusive of well off sections of the society. A large no of these communities have all been under guidance’s of policy, Most of the disaster affected population, it is the economically weaker section of the society which is further marginalized after the disaster strikes, taking away the limited assets, and thus becomes even more vulnerable.

Rehabilitation of people, especially vulnerable sections of the society, in a sustainable manner becomes utmost
important. Implementation of the policy provisions has been hampered by the complex and corrupt administrative structure, involved in disaster management. The sustainability of the rehabilitation is not looked upon, in these areas. Sustainability in terms of social, economic and environment, which shall ensure that the efforts made today are long lasting, and mitigate the impacts of future disasters.

4. EVALUATION OF THE REHABILITATION AND RECONSTRUCTION OF THE TSUNAMI AFFECTED AREAS IN KERALA

Tsunamis are among the most terrifying natural hazards known to man and have been responsible for tremendous loss of life and property throughout history. Because of their destructiveness, tsunamis have notable impact on the human, social and economic sectors of our societies. Destructive tsunamis have occurred in the Indian Ocean. The most notable tsunami in the region of the Indian Ocean was that associated with the violent explosion of the volcanic island of Krakatoa in August 1883. A 30 m (100 feet) tsunami resulting from this explosion killed 36,500 people in Java and Sumatra. The study aims to evaluate the disaster rehabilitation methods and the programs for rehabilitation measures that are undertaken.

Some of the issues that aggravate the damage done by tsunamis include the immense congestion of the shore due to the unplanned emergence of new settlements, disordered parking of boats, etc. When rehabilitation is done close to the sea, it risks the occurrence of another disaster which may result in the loss of property and life. Low awareness levels in the community regarding prevailing hazardous conditions and mitigation techniques are also one of the reasons that intensify the calamity.
To avert disasters such as tsunamis, care should be taken to see that the long term issues associated with coastal regulation zone (CRZ) are resolved in the case of relocation of the entire village/settlement and reconstruction of the partially damaged houses. Relocation should not increase vulnerability and defeat the purpose of relocation. Further, new developments in tsunami run up areas should be avoided to minimize future tsunami losses. Kerala is a narrow strip of land. In most places CRZ is not applicable. In some places the land width comes only about 20m. Land availability is also very less. Therefore the CRZ for Kerala needs to be modified.

5. PLANNING FOR DISASTER MITIGATION IN ITANAGAR TOWN
(ARUNACHAL PRADESH)
Mr. Siyang Rebe, M. Plan; (Urban Planningm -2007)
School of Planning and Architecture - New Delhi

It is a fundamental truth that disaster has been with us for as long as recorded history or even before that. Of late, it has been noticed that disasters especially the natural calamities have become more frequent and diversified. It is also observed that poor people are more vulnerable to the disasters. Due to an inadequate infrastructure, poor communication facilities and an inadequate resource mobilization and lack of proper mechanism for rescue, relief, and rehabilitation work the suffer most. All over the world, disaster management became an important aspect, earlier it was post-disaster management but now, it shifted to disaster mitigation and preparedness to reduce the effects of disaster. It not only reduces the effects of disaster but also reduce the cost effective.

The hilly regions of Himalaya are more prone to disaster and as the Itanagar the capital and an administrative town of the state is located on hills where the mushrooming of the structure has been growing on which make them prone to earthquake and landslide. Because of lack of planning intervention the fire accident is also one of the major problems in Itanagar town.
So it is an imperative to study the likely disaster in Itanagar town and to bring out the problems and issues of disaster mitigation, and to formulate an appropriate strategy for the same.

In the case of Itanagar town, no technical study of various aspects of landslide and fire had been done and hence no State policy for the above mentioned existed, except for earthquakes. No disaster Management Team existed in the town. About 51% of the residential area was under the high vulnerable areas and settlement in these areas kept growing because of increase in population.

The author proposes various mitigation methods for each disaster. Measures for earthquake includes F.S.I restrictions, proper setbacks, proper structural design, provision of various national codes and relocation of settlement from high vulnerable areas. Measures for landslide include slope stabilization techniques, proper land use measures and warning systems. Measures for fire includes proper setbacks, use of fire resistant materials, provision for fire escapes, proper electrification, and provision of water reservoir for fire fighting.

6. DISASTER MITIGATION AND PREPAREDNESS FOR AIZAWL CITY
C.Lalmuanawma, M.Plan; (Urban Planning - 2004)
School of Planning and Architecture-New Delhi

Aizawl is the largest city as well as the capital of the state of Mizoram in India. The City is located north of the Tropic of Cancer in the northern part of Mizoram and is situated on ridge 1132 metres (3715 ft) above sea level, with the Tlawng river valley to its west and the Tuirial river valley to its east. In the summer the temperature ranges from 20-30 degrees Celsius, and in the winter 11-21 degrees Celsius. A study is undertaken as a thesis report to study the
disaster mitigation and preparedness for the city Aizawl to ensure development in a sustainable manner. The high intensity of rainfall, loose soil and rugged topography cause instability in slope and these physiographic factors cause the natural hazards. Aizawl is also highly susceptible to earthquakes and landslides. Aizawl city falls under the seismic zone IV and highly vulnerable to earthquakes. There is an absence of development control and excavations for construction buildings and roads are higher.

It is recommended that i). Sub regional plans to be developed to minimize migrating population at district level. ii). Creation of development authority and municipal corporation for the preparation of development strategies and coordinate the functions and services within the city. iii). There is a need to rationalize urban landuse system, iv). NBC, especially seismic considerations and local policies should be incorporated, v). Measures for channelizing surface run-off by sufficient drainage system, monitoring the tensional cracks on vulnerable slopes and provision of vegetation cover can be seen as long-term solution in the city.
Floods in urban areas have disastrous consequences as they affect human life, property, urban infrastructure and economic productivity. Kolkata faces floods every year. In recent years the duration and depth of water logging in some parts of the city has increased greatly. Unplanned urbanization under tremendous demographic pressure has lead to loss of urban greens and open spaces, encroachment and filling up of natural drainage channels, reclamation of wetlands and increased construction in low lying flood prone areas of the city.

The thesis aims to propose strategies to mitigate the effect of floods in the city of Kolkata. The study analysis the phenomena and characteristics of flooding in Kolkata by studying the past trends to observe changes in the spatial extend of the areas inundated during floods and the duration of water logging. The critical features of the flood prone areas and the causative factors have been analyzed to suggest measures to mitigate urban floods.

The present drainage system of Kolkata consists of underground sewers (covers 60% of the city), open drains sewers (covers 30% of the city) and canals (covers 10% of the city). The near flat terrain of Kolkata makes drainage under gravitation difficult, for which waste water is pumped to the canal system by pumping station.

Over the past decades there has been an increase in water logged areas, especially in TopsiaTangra Basin, Churial and Hoogly basin. Out of the various areas under study Churial basin is the most critical area, which remains under water logging for over 3 days due to lack
of infrastructure facilities. Increase in built up areas and high siltation and eutrophication compounds the drainage problem of the city.

The study urges towards planned urbanization – it proposes to arrest further eastward extension of the city and preservation of the existing wetlands, open areas and agricultural spaces through reinforcement of TCPO Legislation. Urban greens can serve as ground water recharge points and can be used for play. Water bodies are to be conserved as they can act as buffers for absorbing excess rainwater during heavy storm.

The study also points that in increase in density in the borough should not be proposed by KMC as the carrying capacity in terms of drainage has already exceeded and no further densification should be allowed. Identified flood critical areas should be declared as special areas developing on the lines of preserving open spaces and provision of infrastructure facilities prior to new development.

The study advises dredging and de-siltation of sewers before monsoon and rejuvenation of canals by checking the dumping of municipal wastes and removal or up gradation of encroachments along these channels. Underground drainage facilities should be upgraded.

Daily collection of solid waste should be done to avoid disposal in drains and on street. The gap between the estimated budget and annual spending should also be bridged.

The study proposes making rainwater harvesting mandatory in and around the city. Formulation of Nodal Drainage Authority, with representatives from KMC and other adjoining municipalities, irrigation and water ways department would help in better management of drainage in the city of Kolkata.

8. ROLE OF LAND USE PLANNING IN DISASTER RISK MITIGATION AND MANAGEMENT, CASE STUDY- DELHI
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Sustainable reduction in natural disaster risk in some of the most hazardous prone districts in selected states of India is the goal of the programme. Disaster management becomes important issue these days. The strategies, mitigation and response plan have to be thought about. There is a need to study how vulnerable are the mega cities and what measures are undertaken for disaster management in developing policies. The main objectives of the study are to study the disaster management framework and measures adopted for mitigation of disasters in Delhi, seismic vulnerability in physical development at the city and local level, land use policy and land use planning, and mitigation measures in spatial development. The study limits to Delhi urban area as per M.P.D 2021. The study limits to the preparedness and mitigation for disaster management in Delhi with respect to earthquakes. The study is limited to the land use policy. The limitation of the study being time and resources, accuracy of vulnerability analysis, unavailability of data and issues related to governance. The issues identified in both pre and post disaster situations are: Organisational and legislative framework for disaster management, community participation, spreading awareness, capacity building of communities and organization, disaster planning, international cooperation and risk assessment and early warnings. A correlation on disaster and development factors that are found are: poor land management, increased population density in hazardous areas, environmental mismanagement and degradation, lack of regulation and enforcement of
regulation, social destitution and social justice, unprepared populations and institutions and inappropriate use of resources. A seismic vulnerability of Delhi is charted out both at city level and at local level. The city level seismic vulnerability list includes earthquake hazard microzonation, land use, population density, vulnerable houses and fire proneness and the local level list includes building use, structural condition, height of buildings, accessibility and lifeline buildings. An organisational setup is also suggested and that includes a combined functioning of DMA, DDMC, and further State EOC, and onsite EOC.

Delhi is a megacity, with a population of around 12,791,458 in a continuous agglomeration around the city. The majority of the population it concentrated in me core of the city. It is well known that 60-70 percent of the population of Delhi lives in unauthorized colonies. Census of India 2001 reports that 2,025,890 persons lived in slums in Delhi. The cramped, congested and unhygienic conditions are compounded by unavailability of infrastructure and lack of enforcement of building codes. Delhi is located in zone IV which has fairly high seismicity where the general occurrence of earthquakes is of 5-6 magnitude, a few of magnitude 6-7 and occasionally of 7-8 magnitude. Delhi thus lies among the big-risk areas, far the past five earthquakes of Richer Magnitude 5.5 to 6.7 are known to have occurred in the Union Territory of Delhi or close to it since 1720 AD. Two major lineaments namely Delhi-Haridwar ridge and Delhi-Moradabad faults pass through, both having potential of generating earthquakes of magnitude up to 8 on the Richter scale will be quite probable in the Delhi territory (DDMA, 2006).

The premise of this thesis is that disaster management needs to be integrated with development policies and practices. This thesis examines the seismic vulnerability in physical development of Delhi, to be integrated as a component of development planning. The tools of land use zoning and development code need to be sensitized to concerns of disaster mitigation to include scientific studies like seismic hazard microzonation in order to guide the development towards sustainability. Studies that document the impacts of earthquakes can be integrated in planning to make aware of the potentially risky situations created unknowingly. The thesis attempts to shed some light on the readily used tools of development planning and introduce disaster mitigation in the physical development of our cities.
Disaster exerts enormous toll on development. Urbanization has evolved to become one of the main driving forces of anthropogenic related environmental changes making the area susceptible to severe disruptions in systemic structure. Increase in severity and frequency of natural disasters. Increasing population, rising density in high risk disaster areas and exploitation of land resources are important factors contributing to increase in losses from disasters.

Kohima is a fast growing city, which lies in zone prone to seismic and geological disasters and is facing the adverse impact of urbanization. The study aims at assessing land use planning as an important tool to enhance disaster risk mitigation and management in kohima.

The objective of the study is to study the trends and nature of disasters, growth and land use changes with regards to disaster risk and vulnerability in the study area. The study also analysis factors affecting land use planning and disaster risk mitigation and management in the study area and suggests measures for disaster risk mitigation and management in the landuse planning context.

Disaster trends indicate rise in frequency especially landslides and fire incidences in the study area. Majority of the fault lines and landslide prone areas lie within the municipal area and along major transport routes.high percentage of population and built-up falls in landslide areas.Fire incidences are mainly in the high population density core areas.

Urban growth is mainly concentrated in the municipal area, and new growth towards north and south-east direction is along the transport network. Old areas have high density and small household industries of which many are fire hazardous in nature, which also correlates to high
fire incidences in these areas. There is inadequate disaster infrastructure and development has been insensitive to fragile quarters in the urban areas. Lifeline building, vital services etc. have not been identified.

The study also indicates strong control on land and land use by traditional customary land laws, which is insensitive to disaster risk and vulnerability and majority of the land is under private ownership. Also there are no planning regulation tools for implementing and regulating urban development. There is lack of coordination among various agencies involved in disaster management and their focus remains on formulating response mechanism rather than mitigation measures and there is no vulnerability and risk assessment carried out for disaster mitigation and management.

The study recommends restriction of development for high hazard prone areas. For this carrying out scientific vulnerability assessment and micro zoning of disasters has to be worked out. Also digital database can be established which provides reliable spatial information base to assess disasters.

The study also proposes working out of incentives and disincentive efforts to discourage construction on high hazard zones and preparation and enforcement of planning tools that integrates risk and vulnerability assessment. As a next step amendment of existing building byelaws and strict adherence to building BIS CODES can be done in connection with disaster management. Land management model should be made which incorporates traditional as well as modern land management systems.

As part strategies for infrastructure, major roads with utilities should be kept perpendicular to the direction of seismic waves and there protection from landslide hazards should be done. Assessment and identification of life line buildings and their retrofitting should be done. Formulation of city level disaster management committee at urban level should also be done. Urban renewal program like JNNURM can be used to fund redevelopment in disaster prone areas.

As per the studies conducted in various parts of the world, it is seen that the number of people living and working in disaster prone areas for developing countries has increased tremendously and is on Increasing at an alarming rate. Adding to the problem of the initial selection of sites for human settlement is the urbanization phenomenon, which has caused more concentration and increased density of population in vulnerable areas in some of the areas in the Developing countries, densities are quite high which pose a great potential threat at the time of natural disasters Location decisions are made by individuals or public authorities also increase the degree of vulnerability to disasters. Construction of residential quarters in seismic risk areas are examples of such wrong decisions. Post-disaster planning programs are concerned with reconstruction and rehabilitation. In contrast to the pre-disaster
situation, the recovery process can be ordered and predictable. Choices can be made and policies can be adopted to return to normalcy and to reduce future vulnerability. Long-term recovery is usually characterized by efforts to rebuild, to restore major services, and to review pre-disaster land uses as they relate to hazard conditions.

Thus it can be seen that, there is a direct relation between the degree of disaster and urban planning. The potential of an area to a natural hazard can be accentuated or minimized depending upon the planning of that area in terms of physical planning, policy level and implementation.

The study deals with studying the city of Anjar, Gujarat as it existed prior to the earthquake and as it became after the earthquake, to study the town in terms of the damages occurred; to examine the proposed development plan that has been formulated by the Gujarat Urban Development Company Limited and to suggest measures in order to ensure safe and optimized use of land in the Anjar town with a view to minimize the impact of natural hazard in the Anjar town.

The methods devised for the study were to prepare a detailed methodology which contained an extensive study of the literature review; detailed case study analysis both primary and secondary; arriving at conclusions and findings; finding out the emerging issues and constraints and suggesting recommendations and proposals for the same. The suggestions and the proposals recommended also include recommendations regarding the changes in the policy level and the legislation along with the other physical planning aspects. The recommendations that have been proposed have been on the basis of the detailed analysis and observations and the extensive literature review.

11. PARTICIPATORY APPROACH FOR POST-EARTHQUAKE RECONSTRUCTION IN THE VILLAGES OF KACHCHH, GUJARAT

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Natural disaster is becoming an increasingly recurring phenomenon in most parts of the world. Generally, disasters occur due to earthquake, cyclones, floods and landslides. In India, it has been observed that the Intensity and the Impact of natural disasters have magnified during the recent decades. With this increasing trend and the non-predictability of the natural disasters, the focus has shifted towards the post-disaster relief, reconstruction and rehabilitation strategies. With the experience of a number of post-disaster plans, the roles of the people, who are the real sufferers of these calamities, have increasingly been realized.

How should one identify the roles and functions of communities and community-based institutions in the process of post-disaster rebuilding is currently a critical research issue. From a viewpoint of disaster management and community development, there are three significant points: redefining the roles and functions of communities and community-based institutions in post-disaster rehabilitation; develop a community based disaster management institution to help Improve the capacity of communities in disaster prevention; and integration of the suggested community-based disaster management Institution into the formal governmental disaster planning system and the social networks of local communities in order to developed a comprehensive and efficient post-disaster rehabilitation process.
Since the commencement of Maharashtra Emergency Earthquake Rehabilitation Programme (MEERP) after the Latur earthquake, the World Bank insisted on complete involvement of earthquake affected population in the rehabilitation process. Active participation of the affected people for both pre-construction and post-construction activities was deemed essential to implement both the rehabilitation policy and the programme successfully. The objective has been to extend the community participation beyond the consent of the Sarpanches (village leaders) and ensure that the views of all sections of the community were sought and understood. The involvement of the communities in the rehabilitation programme is also to ensure that the people's concerns and needs were better understood and incorporated in the plans. It permitted the communities to develop a stake in the rehabilitation process.

The villages in real terms require an area specific approach for the rehabilitation and reconstruction. The agencies working in rehabilitation programs need to deal each area according to its own merits and demerits. The process of rehabilitation followed by them should satisfy the specific needs of that area. This would require the involvement of the people living there in each step of this process. By this way the needs and desires of the people are transformed in to reality with the guidance of the engineers to make it resistant to the disaster. This also leaves a psychological impact on the people that they are healing themselves.

With the increasing stress of various organizations like World Bank, Red Cross Society etc on this very aspect of post-disaster rehabilitation process, there is an increasing need to study this in context to the present crisis of Gujarat. It is found that People Centric Approach is much more preferable option for people participation in reconstruction process. But it also
needs some changes in village level organization and also the role of stake holders needs to be refined. Thus following recommendation has been proposed at the organization level.

Every Village should have one Villager Samity.
It will consist of NGO, Community leaders, Women representatives from each caste group and also the Sarpanch.
Role of the Village Samity includes Mentoring, actual implementation of the project, providing building materials, technical assistance, financial support etc.
The role of each stakeholder is different under this organization.
Villagers will work simultaneously with the VillageSamity members.

12.EVALUATION OF THE RECONSTRUCTION AND RESETTLEMENT OF THE TSUNAMI AFFECTED AREAS OF KERALA
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School of Planning and Architecture

Tsunamis are among the most terrifying natural hazards known to man and have been responsible for tremendous loss of life and property throughout history. Because of their destructiveness, tsunamis have notable impact on the human, social and economic sectors of our societies. In the Pacific Ocean, where the majority of these waves have been generated, the historical record shows wide scale destruction. In Japan, which has one of the most populated coastal regions in the world and a long history of earthquake activity, tsunami has destroyed large coastal populations. There is also a history of tsunami destruction in Alaska, in the Hawaiian Islands in South America, Japan and elsewhere in the Pacific. Destructive tsunamis have also occurred in the Indian Ocean and in the Mediterranean Sea. The most notable tsunami in the region of the Indian Ocean was that associated with the violent explosion of the volcanic island of Krakatoa in August 1883. A 30 m (100 feet) tsunami resulting from this explosion killed 36,500 people in Java and Sumatra.

Most of the rehabilitation and reconstruction programmes end up strengthening an external economy, rather than that of the affected area, which is in more need for a revival of its economy. The choice of technologies, materials, designs etc determine the reconstruction and rehabilitation approach, but this is not look into it where we have a rich vernacular tradition of building that offers appropriate solutions to local climatic conditions. This study brings out the evaluation of the disaster rehabilitation methods and the pogrammes for rehabilitation.
measures that are under taken. Care should be taken to see that the long term issues associated with coastal regulation zone (crz) are resolved in the case of relocation of the entire village/ settlement and reconstruction of the partially damaged houses. It is recommended that:-

Appropriate location of site at safe distance and safe elevation need to be made. Location of land should facilitate social networks, economic networks and livelihood needs.

Affected communities have to be involved in site location and site planning.

Relocation should not increase vulnerability and defeat the purpose of relocation.

Habitat plan should be developed using participatory approach involving the community, civil society organizations and local government.

Avoid new development in tsunami run up areas to minimize future tsunami losses.

Kerala is a narrow strip of land. In most places CRZ is not applicable. In some places the land width comes only about 20m. Land availability is also very less. So we have to modify the CRZ for Kerala.

To disperse the energy of the waves and to prevent soil erosion sea wall should be constructed. There should be thick vegetation after that. The proposed road width (R.O.W) should be of 8m with closed drainage on both sides. Only after 200m buildings should be allowed. Within 200m no development should be allowed.

Local communities need to be actively involved in planning, decision-making and implementation of the resettlement programs. people of various socio economic categories should have equal participation and domination of one group is to be avoided.

Community should be given a choice to adapt owner driven approach with the support of the
organizations or leave it to the support organizations to construct.
Design and construct new buildings to minimize tsunami damage where land use and site planning determine that structures are built in areas subject to tsunami inundation, construction techniques, building materials, enhanced engineering design and building configuration can help to reduce property damage in future tsunamis.
There was a great variation of houses before tsunami, So when we provide new houses it should be of various sizes according to the people's convenience.
For temporary shelters they should provide smokeless chulas or community kitchen.

13. REHABILITATION PLAN FOR EARTHQUAKE AFFECTED RURAL SETTLEMENTS IN GUJARAT
Sarika Chaudhari; M Plan (Housing-2002)
School of Planning and Architecture

The earth of Gujarat has created a history of being susceptible to earthquakes. Maximum 24 incidents have been chronicled out of which Kachchh and Bhavnagar are the most vulnerable districts. The state of Gujarat can be divided into three broad regions based on the geographical position and drainage characteristics, South Gujarat, North and Central Gujarat (mainland), and Kachchh and Saurashtra. Most of the earthquake-affected area is classified as seismic zone v (very high risk) or zone IV (high risk). The affected area is located in arid and semi-arid agro climatic zones where water resources are limited and even scarce. The state is exposed to hydro meteorological and geophysical hazards.
On January 26th, 2001, at approximately 8:46 a.m. local time, an earthquake occurred in the western India measuring 6.9 on the Richter scale; as reported by the Indian Meteorological Department (IMD). While the earthquake was felt as far as Nepal and neighboring Pakistan, it’s most severe destruction was unleashed in the state of Gujarat causing substantial loss of life, injury and damage to private property and infrastructure. The epicenter of this quake was located 20 kilometers northeast of Bhuj.
In Bhuj and the rural areas of northern Gujarat are undoubtedly the worst affected areas, however, information from these isolated areas is limited. the following areas have been hit hardest:

In Kachchh district, the talukas (blocks) more affected are: Bhuj, Lakhpat, Naliya, Abdasa; Rapar and Bhachau

In Saurashtra district, three talukas which require also urgent rescue operations are Dhangadra, Halvad and Dashada (Paladi)

In Patan district, Santalpur and Radhanpur talukas are the most affected.

This study recommends that:-Presently the relief material is being distributed directly from Bhuj to the villages all over the district. This distribution mechanism is very effective because of the following reasons:

- The access to some of the interior villages is very poor. At the time of disaster, accessibility to the disaster prone area is the most important factor. The State should identify interior areas, which should be connected properly with the overall region by all-weather roads. The District Rural Development Authority should undertake the construction of the roads.

- To further facilitate the distribution of relief material, nodal villages should be identified and these should be centers for coordinating relief distribution in the neighboring villages. The criteria for selection of the nodal villages should be as follows:
  - Close proximity to the National highway or the State highway.
  - The village should hold the status of a service village for the neighboring villages.
  - The village should have the infrastructure required for storing the relief materials. This can be in the form of a multipurpose shelter, for e.g. a school building which earthquake resistant and at the time of disaster all operations of relief distribution can be conducted from here.
The distribution of the relief material should be coordinated by the Dept. of Disaster Management at State level and by a branch office at the district headquarters. The NGOs should be assigned villages wherein they will distribute the relief material. This will avoid the duplication in distribution of the relief material and ensure optimum utilization of the available resources. This will also increase the satisfaction level of the beneficiaries and will avoid discrimination of any kind.

It has been observed that the foreign aid (relief material) is not suitable for the local lifestyle. In order to put it to effective use, it is suggested that the foreign aid should be given in cash instead of kind to the local authorities who will then buy the relief material sensitive to the needs of the people and distribute it amongst them. The financial aid given by the government is felt to be inadequate by the people. The people should be made to realize that this assistance is just to kick start the development process and to tend to the immediate, medical or any other, needs of the people and not as a compensation for their loss. Better communication between the Government and the beneficiaries is desired to make the people realize the financial constraints of the Government.

The State Government should clarify the unit of relief and reconstruction assistance. It should be on the building basis and not on household basis. This will sort out all the false claims made by the people in order to get more relief and rehabilitation aid.

14. EVALUATION OF TRADITIONAL HOUSING PRACTICES IN EARTHQUAKE PRONE AREAS
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This thesis investigates the past and present status of local knowledge, skills of the traditional techniques in India and abroad for reducing their vulnerability to earthquakes. The disaster vulnerability is investigated on the basis of types of traditional techniques used irrespective of rural and urban communities. The study had been made by the settlement pattern, characteristics of the buildings, their structural characteristics, seismic deficiencies and seismic strengthening. To get a closer understanding a case study of Dhajjidiwari of Srinagar (India) is taken. The study had been made on temporal basis. The structures chosen are under three categories, namely more than 200 years old, between 50 to 200 years old and below 50 years old. Various parameters under categories like Building features, Socio-Economic features, Building Material and Construction Process are assessed.
Higher the grade higher is the vulnerability. This is an analysis of traditional buildings of Srinagar where 11 buildings were selected in each group as per their age. The groups being 1) Above 100 yrs old, 2) Between 50 to 100 yrs old and 3) Below 50 yrs old structure.

In a country like India which have diverse climatic conditions calls for numerous types of natural hazards. Major damage and destruction of life and property are caused by flood and cyclone apart from the earthquake. So, for designing a house we have to take care of earthquake, cyclone and flood. Here the task becomes more difficult because design for earthquake prone areas contradict to the design for cyclone and flood prone areas. To add to the difficulty is the non-availability of the appropriate building materials. So to sum up it can be said that building a house is area specific in nature.

This study recommends that a steep slope may be improved by terracing and constructing a retaining wall. Site liable to liquefaction may be improved by compaction stabilization or, sand piling.

A building shaped like a box i.e. rectangular in both plan and elevation is recommended. Openings should be placed symmetrically in the walls. They should be placed away from the corner of the walls. The openings should not be of large size. This prevents diagonal cracking in piers between doors and windows.

For Rafted roofing use of truss or a frame arrangement for connecting rafters with piers. For Trussed roof iron straps should be provided to prevent the failure of truss joints for wooden trusses. Secondly x-bracing should be provided in the rafters so that it doesn’t slip from their original position in the event of an earthquake. For tiled roofing use tiles with holes and tie those to purloin by binding wire to prevent the falling of tiles.

Use of lintel bands in internal and external walls in continuity in all the walls to prevent cracking and separation of walls at corners and at junctions. To prevent vertical cracks near top of walls use of ceiling level band below roof and floor should be used. Generally tie beam should be used for connecting the individual column footings. For soft soil with low water table raft foundation or pile foundation is necessary. In case the soil is liable to liquefaction the soil should be improved to a depth of 7 to 8 meters by sand piling.

Disaster is an event concentrated in time and space in which a society or a community faces a severe danger and incur losses to its members and to physical properties that the social structure is disrupted and fulfillment of all or some of the essential functions of the society are prevented. Disaster can also be defined as disruption of human ecology which can't be absorbed by the adjustment capacity of affected community within its resources.

Disasters may take many forms and occur as a result of one or more than one wide range of events both natural and those induced by man. The duration of these events range from a few seconds to many years. Disasters are the consequences of two different kinds of phenomenon:
Events induced by natural physical process

Events induced by human activities and habitation

One of these is *earthquake* which is considered to be one of the most disastrous and destructive natural hazards which universally motivate man urge to panic. The slightest tremor can cause great fear because very few people are acknowledgeable about the origin, intensity and magnitude of earthquake at the time of occurrence. They strike without warning and causes wide spread damage to life and property. It is very difficult to estimate the extent of damage as it varies from place to place even in earthquake of same magnitude and depends upon how the peoples in different parts of the country equipped themselves in facing the fury and forces of earthquake.

The Indian Standards Institutions (ISI) in 1976 published a map dividing India into 5 seismic zones, Zone I being the region of lowest activity and Zone V being the regions with the highest hazard. This map was created on the basis of the maximum MM intensities recorded in various parts of the country, in historic times. Zone V is the most vulnerable to earthquakes, where historically some of the country's most powerful shock have occurred. This region included the Andaman & Nicobar Islands, all of North-Eastern India, parts of north-western Bihar, eastern sections of Uttaranchal, the Kangra Valley in Himachal Pradesh, near the Srinagar area in Jammu & Kashmir and the Rann of Kutchh in Gujarat. Earthquakes with magnitudes in excess of 7.0 have occurred in these areas, and have had intensities higher than IX. Much of India lies in Zone III, where a maximum intensity of VII can be expected. This map has been redrawn a couple of times since and now has 4 hazard zones according to seismic zoning map of India. In this zone I of is 1893-1984 is abolished merged in II. Though earthquake is a natural hazard every damaging earthquake confirms that people have yet to learn with earthquakes. In India where civilization is several thousand years old earthquake records older than 200-300 years are not available. Several disastrous earthquakes have occurred in Gujarat especially in Kutch district where Anjar lies.

These earthquakes have been studied by seismologists, architects, planners, engineers but the step towards the construction of earthquake resistant structure, earthquake hazard mitigation plans are not at all satisfactory. We have insufficient infrastructure for implementing effective measure in anticipation of the impending earthquake hazard. Lack of general awareness at different levels in public and government is a major hurdle in improving upon the present situation.

It is observed that though earthquake has hit Kutch region so many times before the recent damaging earthquake of Jan'2001 but still we were not able to mitigate its devastating effects. Therefore now better planning at post disaster level becomes important to mitigate not only the effects of recent earthquake but also any other earthquake in future. This study recommends the following suggestion for the study area:-

- Reinstate the central and commercial status of Gamtaal area in the reconstruction programme:- The ring road surrounding the Gamtaal area is major corridor of movement linking Anjar to Gandhidam leading to port town Kandla, Bhachau, Bhuj, Mundra. Thus therefore the location and linkage does give prominence to Gamtaal in terms of its accessibility and connectivity and thus helping it to become as major trade centre.

Therefore the commercial character of the area shall be reinstated as it is critical for
economic rehabilitation of affected community. As the area has witnessed maximum
damaged (Ward 10 and 3); it has been destroyed twice in the history of earthquakes.
Therefore Gamtaal area can’t continue to remain as residential area because of geological
condition i.e low soil bearing capacity of the area. Therefore area shall redeveloped to
achieve safer built environment, the area shall be developed as commercial center
keeping the density of the area low of the order of. The rest of the area shall be allocated
under organized green space / recreational site.

- All The houses in ward 3,10 pulled down in the old city area and given option for
  relocation, as the in-situ reconstruction shall be more costly than relocation also the
  reconstruction in ward 3,10 is unsafe for construction.
- Surrender of original plot earmarked for relocation shall be made compulsory.
- Loss of property shall be compensated through a combination of financial assistance or
  providing alternative site.
- The plots allotted would depend upon the resolution issued by the government of Gujarat
  as it fulfills the public aspiration to have bigger sized plots incase of relocation .the
  resolution issued is as follows:
  - The beneficiaries holding less than 100sq.m of land will be offered 100sqm. And those
    holding more than 100sqm but less than 125sqm. Shall be given 150sqm. Of land.
  - The beneficiaries holding more than 125sqm of plot will have an option to buy additional
    25 sqm. Depending upon the availability and shall be given on the market rate.
  - The cost of existing land will be calculated on the basis of existing jantri and therefore
    accordingly money will be paid to the owner who does not want land in return at the new
    relocated site.
  - The western part of the town shall be used for relocation keeping the distance from the
    existing area within the range of 2Km.
  - Anjar Area Development Authority shall carry out development work at the new site for
    various departments like Public Works Department (PWD), Electricity Department,
    Water and Sewerage Department all are part of AADA.
  - The affected beneficiary shall construct the house themselves; government will provide
    technical guidance, material specifications and technical supervision for building
    earthquake resistant buildings.
  - The technical cell in AADA along with NGO’s shall assist people for preparing building
    plans.
  - In order to avoid any confusion and panic during earthquake the layout of roads and
    streets shall be kept as simple as possible.
  - More than one exit for each area supplemented by emergency exits through the greenbelt
    and open spaces shall be provided.
  - Staggered type of housing shall be provided.
  - The building line shall be provided at a distance equal to the height of the buildings from
    edge of the road.
  - Grouping of houses shall be done such that it minimizes the risk due to the collapse of
    one or more buildings on the neighboring buildings and roads.
  - The desired distance between two opposite buildings shall be equal to 1.5 to 2 times the
    combined height of the two buildings.
The distance between two diagonally placed buildings shall be equal to combined of the two structures.

The emergency and evacuation roads shall always be four-lane road with a central verge having not less than two-lane width.

No roadside plantation shall be provided so that it is available if required after disaster, for additional lanes for movement and other such uses.

As the climate of the area is hot and dry therefore the building plan shall be prepared keeping in mind the climatic conditions as well as the seismicity of area.

The plan of building shall be kept compact, symmetrical, inward looking and as simple as possible.

Homogeneity in the form and structural design of the buildings shall be promoted.

Passive cooling systems like ventilation shaft shall be promoted.

Minimum Surface Area/Wall Length to optimize the building mass shall be kept.

The squares forms of the building envelope offers minimum surface area, consequently optimizing the building mass and allow minimum heat gain. The central core other than structurally binding the building also acts as shaft for inducing ventilation and removing hot air also acts as shaft for inducing ventilation and removing hot air through the stack effect thereby also making the housing units climatically responsive.

Some building units that shall be used in earthquake affected areas of Gujarat are as follows:

- Solid concrete blocks of nominal size 300x200x150mm (actual size is 290x190x200x140)
- Hollow concrete blocks of nominal size 300x200x150mm.
- Rectangularised stones such as Bela Stone of usual size.
- Cellular lightweight blocks can be used for bearing walls construction in addition to their use as infill walls in reinforced concrete frame buildings.

The structural design should take into consideration the Indian Standards and guidelines for hazard safety i.e ARE: 1893-1984 ' criteria for earthquake resistant design of structures ' . the following points shall be kept in mind:

When cement mortar is used with masonry units, the wall height from floor to ceiling shall not exceed 15 times the wall thickness and the length between cross-walls in a room shall be less than 5 times the wall thickness but not longer than 7.0m.

When cement mortar and rectangular units are used in the construction of houses the following conditions shall be met:

- Ratio of sum of the widths of openings to the length of walls in a room b1+ b2 or b3/12 shall not exceed 0.50 in one storey, 0.42 in two storey and 0.33 in three or four storeyed buildings.
- Distance of the edge of an opening from the room corner shall at least be 450mm and the pier width between two consecutive openings at least is 560mm. The following seismic bands shall be adopted as per IS-4326 for walls built using rectangular units in cement mortar. The seismic band shall be provided in all internal and external walls continuously without break.

- Seismic band at plinth level.
- Seismic band at door -window lintel level in all cases.
- Seismic band at ceiling level of floors or roofs consisting of jointed precast elements.
Seismic band at eave level of sloping roofs. Seismic band at the top of gable and ridge walls where such walls are used in case of pitch roofs.

16. SPATIAL IMPLICATION OF DISASTER MITIGATION & MANAGEMENT IN DEHRADUN DISTRICT

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India has been vulnerable to natural disaster since ancient times due to its unique geo-climatic conditions. Floods, droughts, cyclones, earthquake and landslide are regular phenomena in India. Uttarakhand has been severely affected by the natural disasters in the recent years. Its geophysical conditions and wanton economic development increase the vulnerability of the region. Dehradun, being the capital district of the Uttarakhand, has very high population density with rapidly spreading urban sprawls.

Dehradun is situated at high risk of natural disasters. Earthquake, landslide and flash flood are the most common high frequency natural disasters. The increasing rate of the unplanned expansion of urban areas with low infrastructure development put the thickly populated areas at high risk of natural disaster. The natural settings are also increases the risk of the region. The region has geological settings like steep slope, mountainous terrain, presence of the Himalayan fault line and high rainfall which makes the region highly vulnerable to the natural disaster. Dehradun district comes under the earthquake zone IV. The high rainfall and steep slope of the terrain makes the region very vulnerable to the flash flood through rivers, natural drains and river lets.
The assessment of the disaster can be done by analyzing the certain attributes like hazard profile, geophysical profile and socio-economic profile of the district. On the basis of analysis of these attributes the risk assessment can be calculated. Based on the calculated risk assessment, the most risky region can be identified and accordingly these regions can be studied from point of view of disaster mitigation and management.

The present study was done at two levels. First level is the district level and second level is the block level. At district level the study is basically dealing with the macro study of the region. It gives the study of region at broad level. At the broad level study of the region, the linkages and the overall scenario of the disaster are clearly open to the researcher. This is very helpful to find the suitable tools for the application for disaster mitigation and management. The detailed study was done at block level. One block was chosen for the model block study. The detailed study of the block will helpful to incorporate the planning intervention of Disaster mitigation and management.

The result of the study shows that Dehradun Town area and Raipur block is most risky in terms of Disaster. The urban and rural areas of the Raipur block needs the planning intervention for safe and secure future.

Landuse planning is most vital issue for the effective controlled growth of the settlement. Therefore in this regard, a disaster management plan is essential with detailed action plan. Not only the disaster management plan but also the incorporation of the disaster management aspect in the master and regional plan of the cities and region are essential. Infrastructure provides the essential facilities for reducing the vulnerability of area. The communication infrastructure must be established. In this regard, the early warning system and state of art communication network should be established. The transportation infrastructure should also improve and there must be all weather roads connectivity to all the villages. Health facilities must be up to the mark of the UDPFI guidelines and there should be nursing home (medical health center) in villages more than
1000 population. Capacity building and the strengthening of municipalities and gram panchayats is essential. Strengthening can be done by providing the training to manpower and by providing the required equipment to meet all type of emergencies. There must be emergency operation centers at Dehradun, Rishikesh and chakarata town with rapid action task force for rescue, evacuation and shelters for the victims.

Public awareness is the key for the success of the disaster mitigation and management system. So, there should be a ready reference district guide map and action plan with details of do’s and don’ts at time of disaster should be made available to public. Due to high population density and high risk, the norms for the implementation of the building byelaws and seismic safety for buildings must be stricter. The landuse and municipal byelaws regulation should also made stricter. Relocation and rehabilitation of villages in the flash flood prone area. The roads of the landslide areas must be strengthened by the construction of retaining wall and other measures. The major issue in the Chakaraa and Kalsi blocks is the inaccessibility. All villages are not accessible with all-weather roads. 66 (42%) villages in Chakarata and 67 (32%) villages in Kalsi block are not connected with paved road.

The other issue is absence of medical facility. Only 11(7%) villages in Chakarata and 10 (5%) villages in Kalsi block have medical facility. Connectivity must be increased and all villages should connected by all weather roads. Chakarata town must be developed as disaster management centre and hospital with 200 beds should be established in Chakarata town. Although this is low risk zone but 86 sq km (14.48%) areas are very prone to flash flood which covers 59 (34%) villages and 4529 (17%) population. There is not any centre for the disaster management. The region has low risk. So, the main proposal is to setup a disaster management centre at Vikasnagar, which can take care of the entire Vikasnagar block and Shahaspur block.

Due to its geological settings, this area requires very little intervention. It is also because of the very high per capita cost of the implementation of disaster mitigation measures.
An overview of the most devastating floods, which cause maximum damage to life and property in India. A case study of Madhubani district has been analyzed in depth to evaluate the technique management and some issues that have been identified and proposal are based on these. This report justifies its applicability in similar conditions happening in any other flood plains in India.

In India, most of the flood affected part lies toward the east of the country. Particularly in the lands of wet lands, North Bihar in this regard receives annual flooding and related damages due to geographical setting, channel morphology, hydrology and sediment characteristics.

Madhubani a district in Bihar, is flooded by various no. of perennial and seasonal rivers, the main river being Kamala river and Balan river located between Kosi and Bagmati river basins. The river Lamala –Balan has been constantly swinging, meandering and changing its course due to exercise sediment load that is being carried down from the hilly catchments resulting in floods.

Need for this study is justified by studying the adverse impact on the human settlement. Villages which have perennial stream in or around it, especially in North Bihar zone have flat river low basin ,People are always threatened to evacuate their homes on the commencement of monsoon. High amount of rainfall during monsoon have created havoc .With all these respect the result we often see is greater extent of migration and decline in socio–economic status of people in the district.
Urbanization is the process which must happen; the change and the transformation of those existing settlements in fringe area are an indispensable part of urban growth. The urban villages is important to consider because it encompasses a number of critical issues relevant to the design of new context of Vietnam cities, of which the two major overarching issues is probably that of integration and sustainable development. It begins to connect ideas of spatial integration, fabric integration and environmental sustainability to those of very local community-based needs. In addition, it also provides a valuable way to unravel the complexities of urban sustainability from a systemic point of view, i.e. the relationships between the needs of the people, and environmental impact. This paper will therefore reconsider the term urban village and its different manifestations in the Vietnam context and examine the possible ambiguities or relationships between these. In this sense it will also use the concept of “liveable community” to investigate the design concept, implemented project and sustainable development in Vietnam. Therefore, the basis objective of this study is to reduce the negative effect of urbanization as well as to improve the living quality in these existing settlements. Stand on the view of urban design, the physical character such as the road network, pedestrian movement, public space, built form and the distribution of social infrastructure will be studied. This study, in desire, will be the foundation to push up (by the direct or indirect effect) the living condition in such these areas and the city development as a whole.
A disaster is the result of hazard’s impact on society, on infrastructures, cities and other constructions. Consequences of disasters are losses of lives or property, and the effects of disaster depend on the vulnerability of the elements at risk and ability of the system to cope with the disaster. Good environmental management practices help to reduce natural disaster risks, because sound management enhances the ability of society to cope with the impacts of nature hazards. Jabalpur, where an M6 earthquake has occurred having a population of about 1.2 million people is taken as the study area. The aim of the study is Seismic risk assessment and mitigation plan for Jabalpur city to reduce seismic vulnerability and to form future development strategies for sustainable development. The study is focused on understanding the reason and nature of earthquake in world and India with the objective of study of earthquake vulnerability, seismic risk assessment in Jabalpur region and case study of 1997 Jabalpur earthquakes and Formulation of mitigation plan action plan. The outcome include the recommendation of a disaster management policy that should be focused on Integration into development - Disaster prevention and preparedness should be an integral part of every development policy, Equity, It must ensure community involvement, It must be transparent and inclusive, It must be efficient and effective, It must be affordable and sustainable. The study also recommends amitigation plan for future development for Jabalpur which should focus on three things 1. The future development strategies in form of land use plan, bylaws and other necessary steps to reduce the earthquake.
2. The mitigation plan for existing city to reduce the earthquake risk.
3. The earthquake preparedness plan which explain the role of individual to every authority or body in case of disaster.

The land use plan should be based on the land suitability and priority should be give to provide safest land for residential purpose because the reduction of life risk should be the main priority of any disaster mitigation policy. The land allocation for each type of land use is also identified. Certain recommendations for the mitigation plan for existing condition are also given. The focus of the pan is identified as improving the Seismic performance of lifelines, infrastructures, and services, improving the seismic resistance of these. A ward level earthquake mitigation plan is also proposed which is a model approach towards the earthquake risk mitigation plan for city at wards level. To achieve the sustainable development concepts in true manner it is very important that the disaster management aspects should also incorporate in it. Second important aspect in mitigation of disaster management is the regulation and bylaws, and its implementation.