Global Scientific JOURNALS

GSJ: Volume 6, Issue 3, March 2018, Online: ISSN 2320-9186

www.globalscientificjournal.com

EARTHQUAKE VIBRATION EFFECTS IN PAKISTAN

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Keywords: Fault Line, Landslides, Seismology, Disaster, Earthquake

Abstract

Earthquake creates serious vibration during its lifetime. It results from harmless to sever structural damage. Most of the destruction created by earthquake is unpredictable. Landslides displacement, Soil fertility and breakage of plate tectonics generate fault lines and earthquake. Mostly Earthquake Occur due to calibration of nonlinear static displacement and hit civil infrastructure system and economy. It bitterly effect the life and livelihoods that it cannot be recover even after few years of its occurrence. Most of the Pakistan area lies on fault lines which may cause great destruction after few years. Chaman Fault Line is the long line which starts from the north of the country i.e. Gilgit Baltistan and ends in the Balochistan. It may cause a big loss which will affect the all provinces of the country. By applying an integrated, reliable and refined assessment and planning the direction of destruction can be avoid. Combination of all necessary components against earthquake will revert destructive effects. Base isolation of buildings should construct on the Principal of resistance against earthquake. Material of mounted building should have low lateral stiffness like rubber, flexible base etc.

Introduction

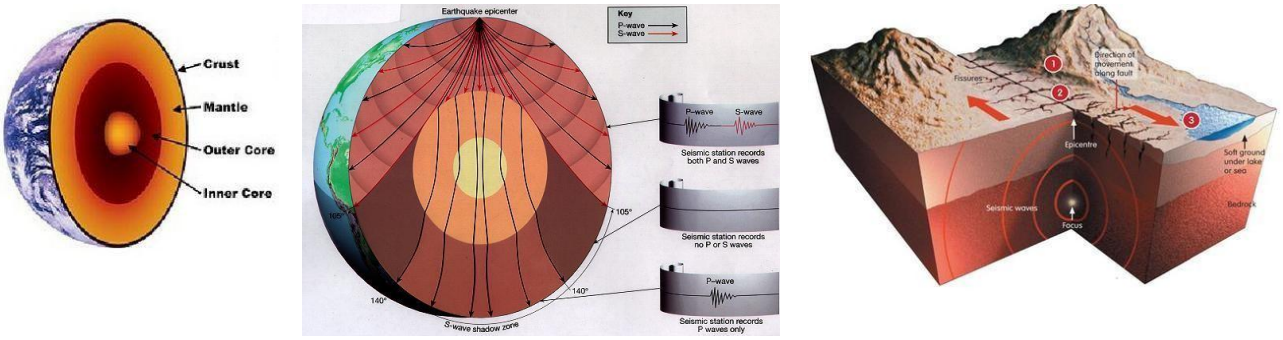

Figure 1 shows Earth crust

Earthquake is the shaking and vibrating movement underground the earth's surface. Magma beneath the earth usually become the cause of such movements. Earthquake triggered by the activity in tectonic plates, these may also become the cause of volcanic eruption. The movement in tectonic plates also become the causes of breakage of infrastructure and building. It also hit life and livelihoods. It works in form of waves. There are two types of waves. Primary waves and Secondary waves. Primary waves works in direction of Push-Pull. Secondary Waves are side waves. These are more harmful than primary waves.

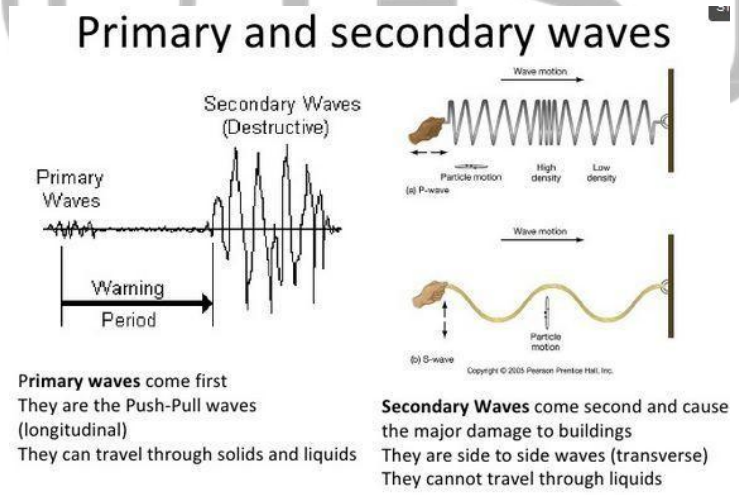

Fig 2 shows waves movement

History of Earthquake in Pakistan

Pakistan has to face many threading situation after came into being. Earthquake is one of worst disaster which has bitterly Hit not only Pakistani nation also economy of country. Fault line exist on major cities of Pakistan in which Margala Hills are the example of effected area. More than 170 million people are living along the highly risky fault line. Earthquake has mainly concern in the north and western section of Pakistan. It activities also move along the Iranian, Afghan and Indian micro-plates. Chaman Fault is worst fault of the country. It runs along the western frontier with Afghanistan from Kalat, North to Makran, Quetta to Kabul. Faults also run along Makran and Maharashtra Coast. Thrust zones exist between Arabian and Iranian Micro plates. This zones also run along Kirthar, Sulaiman and Salt ranges. Baluchistan is the most earthquake-prone region of country. Most of earthquakes has been occurred in Baluchistan but less population and lack of construction has kept it safe.

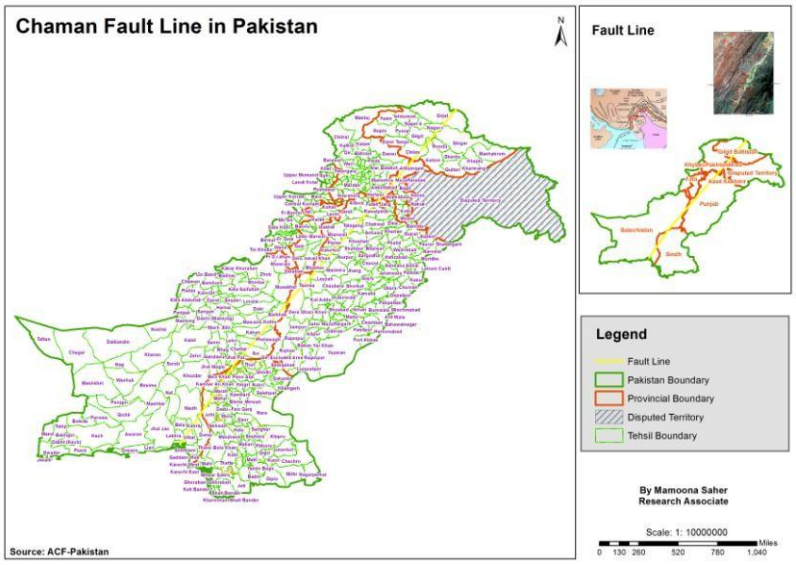

Fig 3 shows Fault Line

Hazardous Zone by Earthquake

Since last century Pakistan has bitterly hit by earthquake. On the basis of this damage its boundary has been divided into four categories" Minor to no damage, Minor to Moderate damage, Moderate to severe damage, severe damage". The Map shows that most of the Province Balochistan has been effect by severe damage but its population is not as much high.

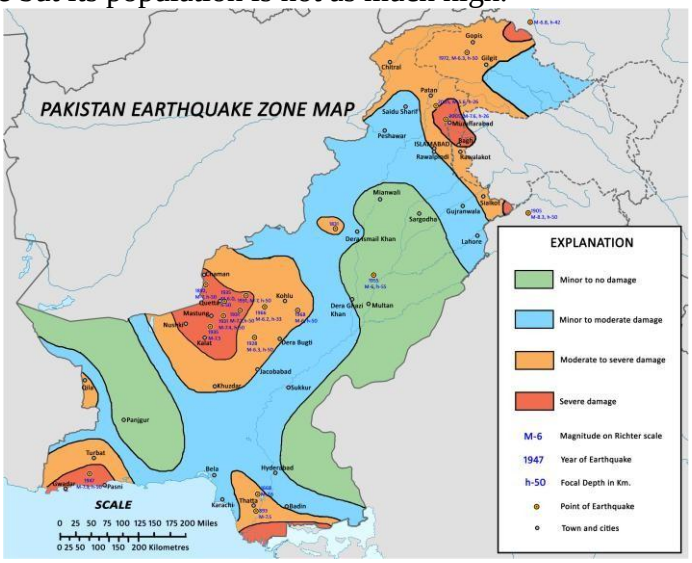

Fig 4 Seismology of Pakistan

Parameters of earthquake

1) **Epicentre**

Epicenter is the point where outbreak occur. It is also known as hotspot. Most of the destruction happen arond epicentre. It cuts the plate of earth.

2) **Landslide**

Landslide is the movement of mass of earth or rock from mountain. Landslide may also classified as falls, topples, flows, creep and lateral spread. It may cause significant loss of life and livelihoods each year. It occurs in coastal, offshore and onshore environment. Landslip also encompassing failure of slope material. North part of realm with Azad Kashmir and China has to face huge catastrophic movement. Slop displacement, rock fall effect vegetation. Rock fall occur along Murree and Muzaffarabad and may become dangerous if the steep slope slop angle is more than 70 degree. Most of landslides occur along fault lines in Pakistan. Earthquake Magnitude and possibility of trigging landslides are the major causes of creating fault lines. Landslides effect with heavy rain fall. Deforestation, heavy rain fall and Steep slope between 30 to 45 degree may cause land sliding.

Fig 5 shows destruction by landslides

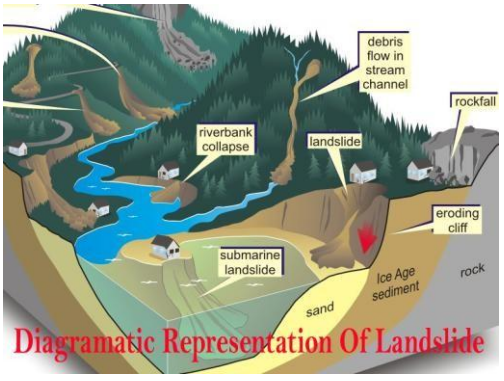

Fig 6 shows types of Landslides

3) Soil

Soil information can achieve from a soil map. It will define the soil pH, texture, depth of horizons, organic matter and soil type. It will also use for land elevation, agriculture extension, environment protection etc. Seismicity of Pakistan has increasing vulnerability from north to south regions. Fault lines and seismic may cause the destruction of infrastructure and life.

4) Magnitude

It is use to define the logarithm of ratio of amplitude of seismic waves. It is also known as Richter magnitude scale. Pakistan has suffered 2 to 7.6 magnitude on rector scale. Magnitude more than 6.2 may become cause destruction of weak constructed infrastructure. Life of victims at hilly area or hazardous area is at risk.

5) Fault Line

Fault lines are due to tectonic movements of earth. Where plates of earth meet is known as fault line. Earthquake and active fault lines exist adjacent part of Afghanistan, India and North Pakistan. These are uplifting highest mountain peaks including Karakoram, Himalayan, Pamir and Hindu Kush ranges. It is resulted as Indian subcontinent moving northward 40 mm/year. Due to these fault lines two-third of Pakistan geography lies on it. These fault lines passing beneath different areas of Pakistan. It may create huge loss and destruct cities in which most hazardous areas are Makran, Northern Areas, and Pakistan administered Kashmir areas, Quetta region, Peshawar, Karachi, Quetta, Abbotabad, Gilgit, Chitral. Islamabad and Salt Range areas are in less hazardous zone. Only upper Sindh and central Punjab are free from hazard zone.

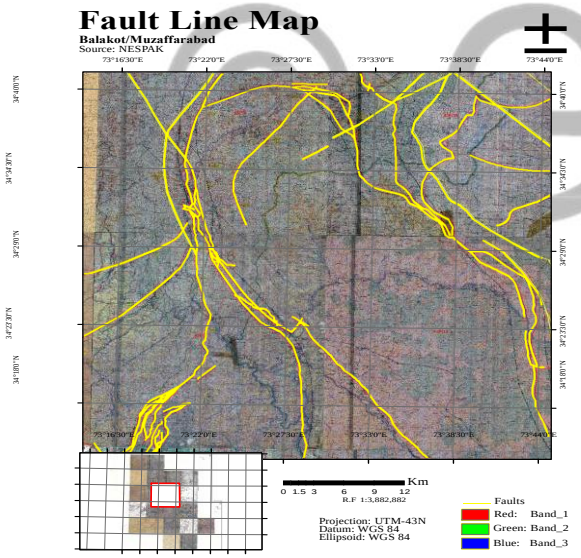

Fig 7 shows Fault line of Earthquake October 2005

Analysis along Chaman Fault Line

Chaman Fault is the Pakistan biggest Fault. It covers most of the part of country. Although it is biggest fault but it has not been prove dangerous in the past. Here it has been analyzed if an outbreak happen than how much area along the fault at any point on this fault may hit. The analysis has been made on both Tehsil and District Level of Pakistan. Tehsil Gojal, Nagar-1, Chilas, Athumqum, Muzzaffarabad, Abbottabad, Talagang, Quaidabad, Kalurkot, Darya Khan, Bhakkar, Karor lal Esan, Taunsa, De-Excluded Area D.G. Khan, Bharkan, Phelawahj, Dera Bugti, sui, Sohbatpur, Jacobabad, Garhi Khairo, Miro Khan, Kambar Ali Khan, Warah, Mehar, Khairpur Nathan Shah, Wadh, Johi, Kanraj, Dureji, Lakhra, Uthal, Liari in which Fault line cross almost in mid of these Tehsil, Shigar, Gilgit, Astore, Pindi Gheb, Chakwal, Khushab, Kahan, Kambar Ali Khan, Mehar, Johi and Dureji fault line partially cross while fault line touches

Fateh Jang and Rawalpindi.

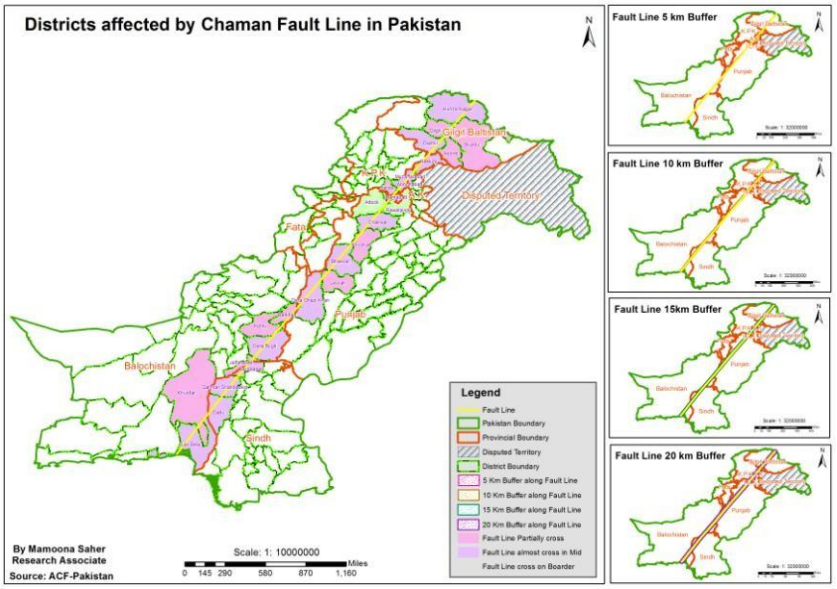

Fig 8 shows existing (District) area along Chaman Fault Line

Similarly Fault line cross almost in mid District Hunza Nagar, Diamir, Neelum, Muzaffarabad, Abbottabad, Islamabad, Chakwal, Bhakkar, Dera Ghazi Khan, Dera Bugti, Jacobabad, Qambar Shahdadkot, Dadu, Las Bela and partially cross District Gilgit, Skardu, Astore, Haripur, Khushab, Layyah, Barkhan, Kohlu, Jaffarabad, Khuzdar, and touches District Attock and Rawalpindi.

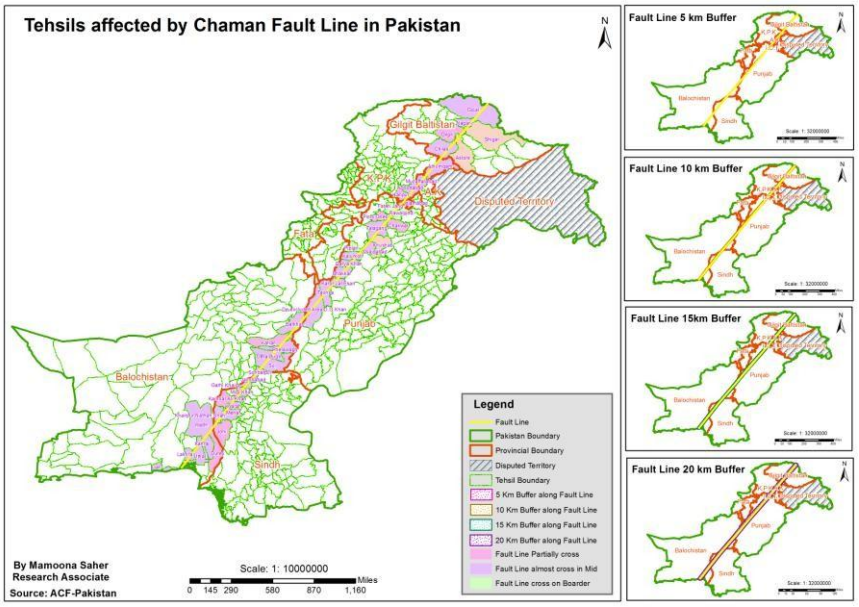

Fig 9 shows existing (Tehsil) area along Chaman Fault Line

The Maps also shows how much area cover along 5 km, 10 km, 15 km and 20 km. As it has been seen that 8th, October 2005 earthquake has created worst destruction in the history of Pakistan more than 80,000 people has been killed and 50,000 were injured. While Baluchistan is the most dangerous zone according to earthquake due to lake of construction and less populated area but it does not have created destruction like October 2005.

Analysis around Hotspot of Major Earthquake in Pakistan

In the History Pakistan has to face few major earthquake before and after Independency. There are 21 Major Earthquake in Pakistan where location of nineteen hotspots are available in which two are outside boundary of existing boundary of country. Available data show location but not detail of all major outbreaks. The given maps has been analyzed that how many hotspot exist within, borders And partially within and cross the border of Tehsil and District boundaries. It can be view easily that how five to twenty kilometer area cover around hot spot.

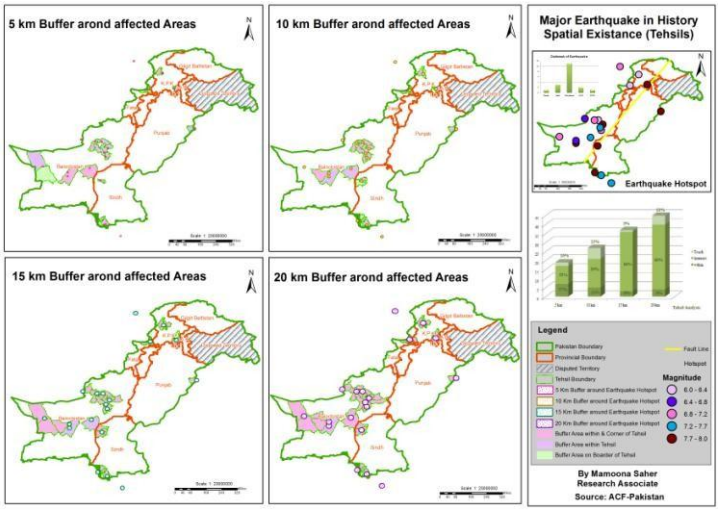

Fig 10 shows Major Earthquakes (Tehsil)

The map view shows that most of outbreak occur in Baluchistan. In Fig 4 has been seen that seismology of Province Baluchistan is severe damage.

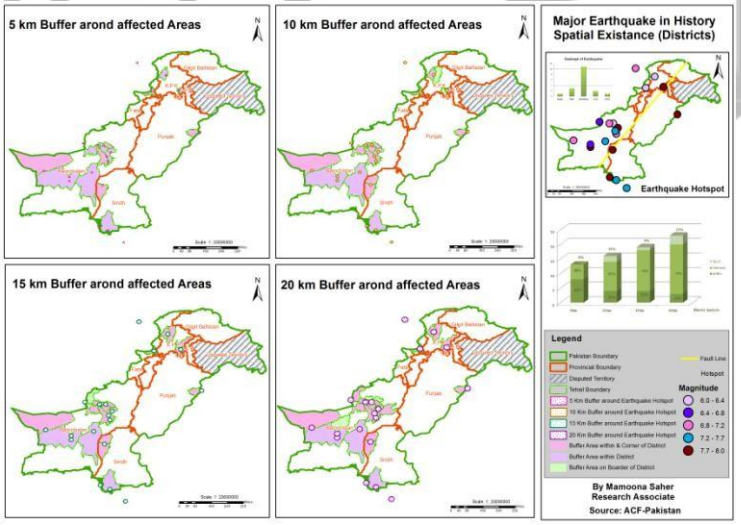

Fig 11 shows Major Earthquakes (District)

Weather Effect after Earthquake

Earthquake not only hit the infrastructure but it also effect environment. As large amount of air trap underground. Weather become hot and calm before earthquake. It is also said that earthquake occur in calm and cloudy conditions. But it's not an authentic theory according to geologist. Usually after earthquake it rain heavy. Victims have to spend their life under open sky without any safety measures.

Disaster Management by applying GIS application

All aspects of planning and responding for disaster is known as disaster management. It contains prevention, preparedness, response, recovery and rehabilitation for victims.

When an earthquake outburst, instantly Rescue teams, government, non government, individuals identify and move to the hotspot to rescue the victim. These are actions to save the humanity. GIS provide facility by collecting, storing, analyzing and managing the data.

Collect the detail information of effected area by earthquake like population, area, location, economy, existing system. Rescue teams will send to provide first aid, save the injure and keep the victim to a safe place. Recovery plans will manage for future. International and National Aid will collect and spend to build proper infrastructure and development plans. Stakeholders will use theseinformation and resources to make future plans and set a criteria for affected areas so that in future loss can minimize.

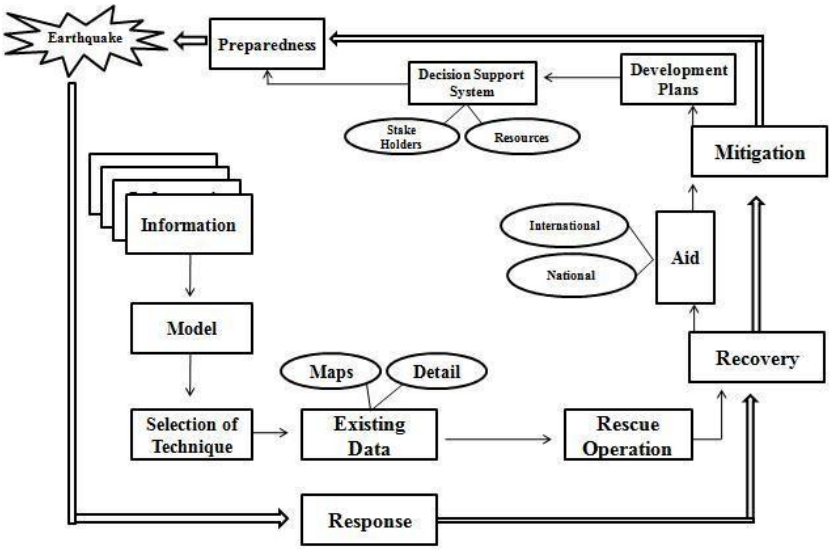

Fig 12 shows Disaster Management Diagram

A well-defined and clear model is beneficial as it facilitates support for efforts. Disaster management model is essential to manage disaster event efficiently.

Batter management can lead batter understanding of situations, facilitate planning process and comprehensive management. It integrates relief and recovery efforts. It reduce possible negative consequence of disaster. A great attention is needed while acquiring data and managing model.

Problems associated toward Disaster Management

- A large number of activities involves in disaster mitigation. These activities raise complexity in disaster management.
- Earthquake is a non-predictable outbreak. It cannot identify or warn before time.
- Preparedness and mitigation structure is very weak so that victim cannot facilitate on the spot.
- Community awareness and training are needed in hazardous areas.
- Lack of coordination between government and non-government organizations which may causes duplication and lack of basic necessities during disaster period.

limits of Model

Model moves around the four phase's prevention, mitigation, response and recovery.

This Model does not consider environmental conditions which affect severity of disaster.

Hazard Assessment

Disaster has spatial nature. Geographical referenced information such as aerial photographs, satellite imagery, digital maps and photographs etc are use to show hazardous location. This information will also use to produce hazard risk map, vulnerable situation and evacuation plans. It will also display the information about roads, schools, open area, hospitals, and tourism maps, most populated and populated areas. Hazard maps use to locate high risk areas.

Risk Analysis

Risk Analysis can made by using maps of affected area like gradient map, seismic map, Soil Map will provide the information of slop angle, soil fertility etc.

Digital elevation Model will provide height detail. Remote Sensing provide different satellite images which will define the vegetation, water vapor, height detail by using sensors.

GIS is a tool by using it evacuation routes can define. It can be use to merge the satellite data and other relevant data for disaster warning system. Maps will help to define the vulnerability and hazard conditions. Analysis of risk concentrate the interaction between "Element of Risk" and "Source of Risk".Identification and analysis of risk may involve in vulnerability and hazard forecasting activities. It will also help urban and regional planning. Identification and Analysis of Risk involved in mitigation and preparedness phase.

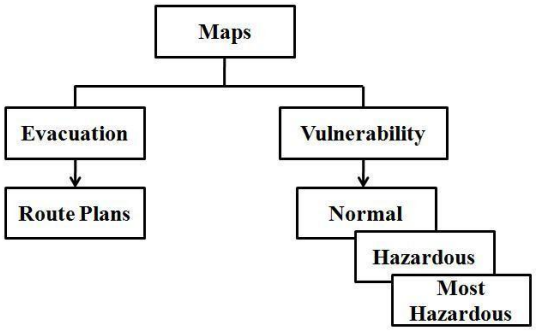

Fig 13 shows Risk Analysis

In **Emergency** services flow of information must be communicate between agencies and organizations. Major factors of emergency plan are communication, efficient work and coordination.

Web Services & Real Time Map Sharing

A Layman is the user of internet these days. People know how to use internet. To make up to date and work fast Organizations and Emergency Teams must use Web Services so that loss can control. All information will provide on a server where authorities can edit report regularly and make updating as soon as possible.

Detail along fault line living areas will provide on real time map sharing. Any authentic body will provide the detail of mitigation, preparedness of that location. It will mention that the area is Fully Secure, Secure, damage, partially damage or any certainty exist there. Authentic information will entre in the system and submit it

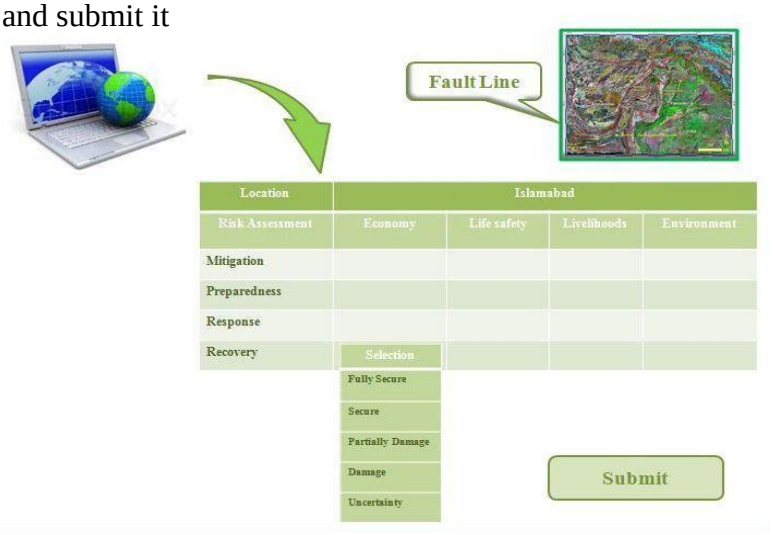

Fig 14 shows Web Portal for Earthquake data management

Than Data provider will provide personal detail to whom it has been updated and submit the "Signature".

Fig 15 shows data providing authority Authentication

Than system will response that data has been uploaded or submitted and mention CNID.

Fig 16 shows System confirmation

This Software will password protected and rights reserved. Only selected body will upload and update the system. User and all stakeholders can only view and share the detail. This information will also help for research and other projects. Students may collect desire detail for research, further strategies, laws, plans, rules can make on this behalf.

Management encompasses both Social and environmental issues of desired area. Standard of life, situation of livelihoods detail will upload in the system. Census data, grey literature, health, medical centers, open spaces, institutions, educational centers detail will provide through this portal. A holistic approach will identify the gaps in disaster management.

Data will carefully and systematically compile so that a user friendly interface can be provide. This setup will provide a free from duplication and omission errors of data. Data removing is a common problem of data losing. To generate a centralize system it will help stakeholders for understanding and decision making.

Decision Support System

A proper Decision Support system is needed for future by using existing data. From Disaster Management lifeline plan, construction law, model building for effected people living around the fault line and landslides should construct with planning. Develop and implement building construction code for risky steep slope, seismology and fault line area.

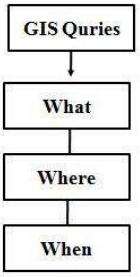

Fig 17 shows GIS Quries

In GIS we use data What, Where and when in which we provide Location, reason and time of the data. Developed data will help to collecting, storing, managing, analyzing and making the policies. Stake holders will make law and strategic plan. Biodiversity can be establish properly by analyzing it. Infrastructure can develop according to requirements. Usually mud houses, infrastructure along fault line hit by the earthquake. Margala hills are the example triggered by earthquake. Such buildings should not develop here. Flexible Model Buildings should construct in such areas.

Construction Structure in Hazardous Areas

In hazardous areas construction should strictly prohibited. In less hazardous areas if construction is Needed than it must construct on the structure of construction against earthquake resistance. Such Buildings contains flexibility so that on the moment of shaking it may remain flexible. Material of buildings should concrete based.

Model Building

When an outbreak occur, the communication of affected areas disconnect with other world. People of such areas has to spend their days and nights under open sky without any arrangement.

A model building should construct in those areas which has been announced as hazardous or risky. Such building should save necessary arrangement like clothes, bags and luggage's, food, safe water, sewerage and sanitations system, first aid boxes, medicine, solar system setup etc. So that victim may spend few time until unless Rescue teams join them or routine work start again.

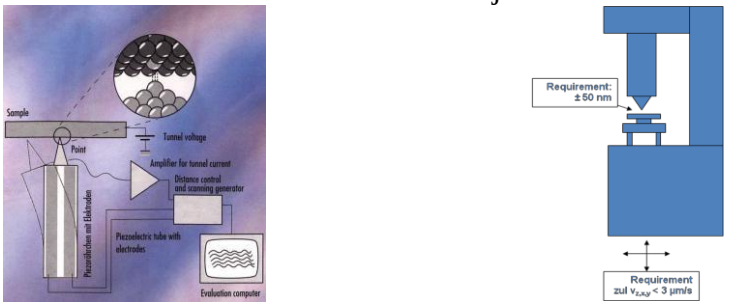

Fig 18 shows Construction structure for Earthquake Resisiting Building

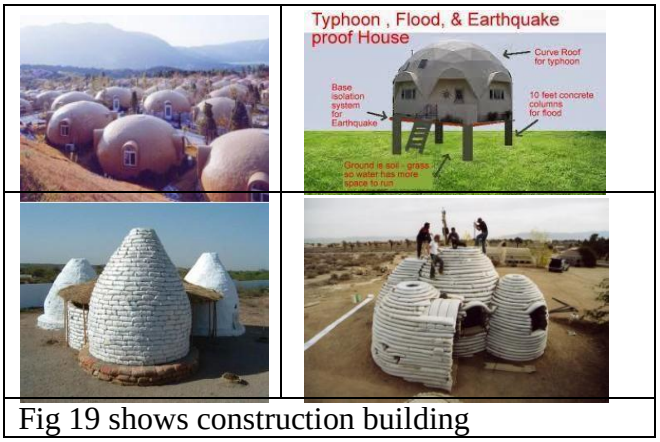

Fig 19 shows construction building

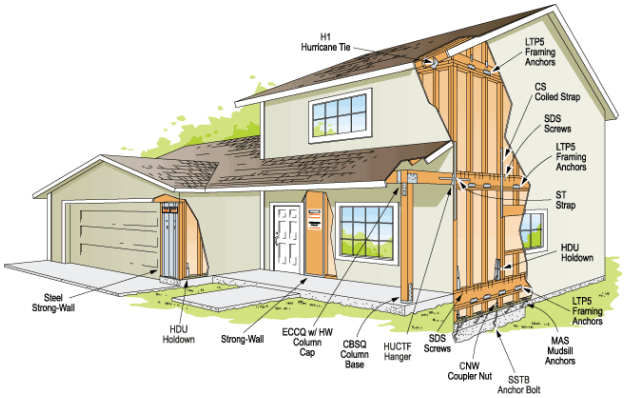

Fig 20 shows Model Houses structure

Safety arrangements for Earthquake

Destruction of disaster can never be avoid but it can minimize by applying some safety check.

- Residential infrastructure should construct according to requirements of earthquake precautions.
- Heavy Items should place lower side of racks. Bookcases, air conditioners, refrigerator and other households should keep properly.
- Wall hangings and other hanging object should place away from bed or sleeping area.
- Fire extinguisher should located strategically.
- Earthquake survival kit should ready whenever it is needed.
- One member of each family must trained about First aid.
- Awareness about earthquake should teach to kids and make them trained so that they may aware how to behave during that earthquake period.
- Number of family members should mention on the door so that rescue teams may provide them services and indicate those people.

Recommendations

People are not allowed to construct residents upon fault line area, near landslides and risky seismology.

Model Buildings should construction in every hazardous and risky area.

Community based awareness should arrange how to behave during land sliding and earthquake.

Government bodies and other stake holders must develop good cooperation and coordination

Conclusion

Earthquake is an unpredictable activity. It bitterly hit life and livelihoods. By applying proper management and GIS system such loss can be avoid.

By apply real time map sharing we can manage Emergency services. This data will also helpful in further development plans and emergency management services. By using such services finance can utilize on a proper place and avoid loss.

It should be noticed that infrastructure along fault lines not allow to construct. It may become cause of hug destruction along fault line from 5 to 20 kilometer area. Infrastructure near fault line may cause bitter destruction.

Earthquake left bad effect on Seismology so that part of earth is not able to develop.

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