Asian Disaster Reduction Center (ADRC)
Visiting Researcher Program FY2015B

Study on Disaster Management with special focus on Landslide and Sediment related Disasters

Final Research Report

Andrew Lalhruaia
Deputy Director, Government of Mizoram
Urban Development & Poverty Alleviation Department, INDIA

Disclaimer

This report was compiled by an ADRC visiting researcher (VR) from ADRC member countries.

The views expressed in the report do not necessarily reflect the views of the ADRC. The boundaries and names shown and the designations used on the maps in the report also do not imply official endorsement or acceptance by the ADRC.

ACKNOWLEDGEMENT

As Disaster Management is not a single job and the nature that it has to be managed in collective efforts is the foremost reason that challenged me to join Visiting Researcher program. I am very much thankful to Asian Disaster Reduction Center, Japan, Government of India and my State Government for providing me this opportunity to participate in the Visiting Researcher Program. It gives me an excellent opportunity not only to study Japanese Disaster Management System but also to focus specially landslide and sediment related disasters and make a comparison of disaster management in both countries. As Japan is a well known country in term of Disaster management I want to study and learnt from their experienced. I would like to convey thanks to the Government of Japan and many Japanese organizations which provided me this opportunity to visit their facilities and offices and learn from their practices.

I am impressed and influenced by the ADRC staff who tirelessly arranged numerous visits and facilitated my learning. Special thanks are due to Kondo san, Executive Director, Shiomi san, Researcher and In-charge of the VR Program and Arakida san, Senior Researcher and my Mentor. Without their efforts it won't have been possible for me to complete the program and compile this report. I am also very thankful to my VR colleague Mr. Liyanaarachchige Chathura and Mr. Inayath Mohamed for their cooperation, support and suggestions.

I know that this research may not be useful greatly for Government of India, Government of Japan and even for the Government of Mizoram but may serve as something that can be referred and at least for a simple guide that will contribute idea in future in the field of Disaster Management specially focusing landslide.

Table of content

1. Objective of the Report

Disaster is nowadays really a global challenge in term of technology and resources. It becomes clearer and clearer that it can be predicted (some) and forecasted, prevented, mitigated and there is a possibility of reducing the effect of disaster. It is also understood that the community can be made resilient to it by effective effort. Experts have now said that through proper planning, analysis, risk assessment and with the involvement of community the consequences could be reduced. Addition, there are some basic actions which can mitigate the impact of future disaster. On the other hand disaster can be increased due to human actions. Some of these are really looks like unavoidable case of economics activities but some are based on short term gain and do not have technicality.

In today's world. People are increasingly responsible for disaster as there are many man-made disasters. If there is no human action before, many of our today's disaster would not happens or would have smaller impact to the communities. Deforestation had resulted in landslide during rainy season, some land becomes desert due to overgrazing of cattle and uncontrolled housing leads to serious disasters during earthquake and landslide.

At the same time it is the human who is responsible and could reduce the impact of disaster. Early warning can alert coastal population so as to have time for evacuation in case of tsunami and flood. Zoning code and building code if enforced properly can safe human from building collapse during flood, earthquake, cyclone etc. Responsible land uses can reduce the risk of landslide due to deforestation. **So a systematic study and approach of disaster is very much necessary for administrators, engineers, planners, disaster managers and even a community**.

2.Disaster Management(DM) in general

2.1 Introduction

The word Disaster is derived from middle French ‘desaster’ and that from old Italian ‘desastro’ which inturn comes from the Greek pejorative prefix ‘dus’(bad) and ‘aster’ (star). A disaster is a sudden, calamitous event that seriously disrupts the functioning of a community or society and causes human, material, and economic or environmental losses that exceed the community’s or society’s ability to cope using its own resources. Though often caused by nature, disasters can have human origins.

Disaster impact:

1. Alert phase- Warning phase
2. Response in the emergency phase
3. Reconstruction phase
4. Mitigation
5. Prevention
6. Preparation for next coming

While studying and talking about disaster there are few common words regularly use. They are:
Risk- The possibility of death, loss, injury etc.
Hazard- A destructive event or phenomenon
Exposure- Extend of a hazard or duration
Vulnerability- Susceptibility to damage or harm by a hazard
Management- The capacity to respond to need created by a disaster

2.2 Disaster Summary

Though there cannot be the same disasters but there exist always similarities in every disaster which is human suffering and material losses. At the same time there can be a common factor or actions which can mitigate the future disaster. Till today there is a thinking that disaster is an accident or event that con not be anticipated or reduced. This led to response instead of prevention and reduction. Disaster management conveys the important idea that protecting population and property also involves the estimation of risk, preparation activities which can mitigate the amount of impact and post disaster reconstruction. Also an important element of disaster management

is that giving awareness and changing the mind set of the community in order to reduce economic and human loss due to it.

The management of disaster is not a single unit work, it requires coordination and multi efforts done from various stakeholders. The effective response to disaster starts from planning followed by many others steps. While there cannot be a single unit responsible for disaster but the main is to the government as it need to protect its people. In many countries the management of disaster is taken up mainly by military action, some are successful and in some places they lack public coordination.

Many efforts have contributed to the ability to manage the impact of disaster in a more systematic and effectively by building better resilience among governments and citizens. The most popular are: UN international decade for natural disaster reduction, the international strategy for disaster reduction and its Hyogo Framework (HFA) and Sendai framework. The Hyogo framework focuses on building national and community resilience to disaster. The Sendai Framework which is the successor of HFA aims the substantial reduction of disaster risk and losses in lives, livelihoods and health and in the economic, physical, social, cultural and environmental assets of persons, businesses, communities and countries.

2.3 Institutional arrangements and responsibilities:

In most cases all the countries established their national disaster management agency under the chairmanship of their President/ Prime minister. This system is found effective and reasonable at the central level as enactment of laws and legislation is always needed for disaster reduction, response and mitigation. A national council or Executive council is always set up to involve all organizations that can contribute to a country's disaster management. This council usually develop national disaster management plan by contributions of knowledge and ideas from locals and international members.

As was mentioned earlier management of disaster could be done at the highest success rate by collective efforts. Even though the national level disaster management is very important, the regional or the local levels are the one who really work at the site. Therefore it is evident and clear that that the effective solution, mitigation, reduction and response can be done by joint efforts at different levels.

Even there is lack of planning at the central level, effective planning at the state, district and municipal level can protect the people and its property to a large extends. Organizations with extensive presence already at the local

level are probably in the best position to help communities both prepare for disasters and respond when it occurs. Therefore the development of community base planning on the appraisal of risk and vulnerability is the best strategy to mitigate disaster.

The effective response and mitigation largely depends on the availability of man power and resources. Disaster is not a tomorrow task and has to be attempted today and thus requires immediate deployment of resources. Hence it is always good that there should be set aside resources for disaster for preparatory, training, workshop and response effort at the time of need.

2.4 Important tool for effective Disaster Management (DM)

The community disaster management plan is one of the main important elements of disaster mitigation. Identifying the person responsible for disaster management in the specific administrative areas/ unit is mandatory to have effective DM. It should also be necessary to constitute a disaster committee. This committee may contain persons responsible for community safety like fire, police, communication, civil works and administration etc. Unless there is an active leadership or committee there is always confusions and coordination problems.

There should be disaster management implementation plan. This plan should broadly contain resources, responsible person and timelines etc. and should point to plan of action to be taken in case of disaster. Also there should be community profile and map which will show the population, geographical areas, vulnerabilities etc. Highlighted the specific person with contact number is mandatory and the map should contain evacuation route, shelter, fire, police facilities etc.

It is also very much required to have analysis on the possible hazards. For this it may be good to do mapping of vulnerable geographical areas and listing the vulnerabilities. This will show the level of how much the community will could be affected and assessing the various possible disasters. From the experienced and seeing the forecast and predictions necessary calendar could be developed.

For some disasters it is possible to make prevention plan. If the building regulation is enforce in such a way that all the house are build with seismic proof and there is a restriction in building a house at the possible flood and

even tsunami, there can be a prevention actions. In short careful analysis of potential disaster can be used to stop future hazards.

There can be preparedness action and mitigation plan for disasters. Preparedness activities may include early warning, alert system and mitigation plan may contains improving building codes, giving awareness to the community, sheltering and stockpiling of essential commodities etc.

Standard Operation Procedure (SOP) is created for emergency purpose at the disaster control site which will specify roles and actions to be taken in case of disaster. The Sop lists the specific actions needed to prepare, to alert and to respond.

Disaster managers should know that the best time to review and learn the disaster response is while the events are fresh in the minds of those affected and those who are involve in the response. Evaluation of what went well, what failed and gap in the response can be conducted immediately after the disaster. Through this analysis and lesson learnt the disaster management approach can be strengthened to prepare for the next disaster.

Nowadays the undeniable truth for every missions or project is the more or the larger community involvement, the high is the success rate. For disaster also community participation before, during and after can greatly reduced the overall mortality and improves the use of resources. The community if involve at the time of preparedness will surely reduce the affect of any disaster. Also it is to be noted that sometimes the community itself requires motivation as they used to be not worry until disaster happens.

It is always effective that the community disaster management committee carry out risk assessment. This involves gathering information about the risk that a community most concern about such as fire, earthquake, flood etc

It is found very effective to have analysis of past disaster experiences. This will help determine the priorities for future disaster response. For this committee may be constituted from emergency services and community itself. Disaster managers should always try to build community to cope with future disaster. This can be done by analyzing past experiences, conducting risk assessment and creating disaster preparedness plan.

One of the most important activities of disaster management is Recovery and reconstruction. The recovery task of rehabilitation and reconstruction starts soon after the emergency phase has ended. Recovery can be defined shortly as the restoration and improvement activities including effort to reduced disaster risk factors.

3. Disaster Management in India

Due to the physio-graphic and climatic conditions India is one of the most disaster prone areas of the world. It is vulnerable to windstorms from both the Arabian Sea and Bay of Bengal, flood, Earthquake, drought, landslide, avalanches, tsunami, forest fire etc India has the highest mountain chain on earth, the Himalayas, which are formed due to collision of Indian and Eurasian plate, the northward movement of the Indian plate towards China causes continuous stress on the rocks rendering them friable, weak and prone to landslides and earthquakes.

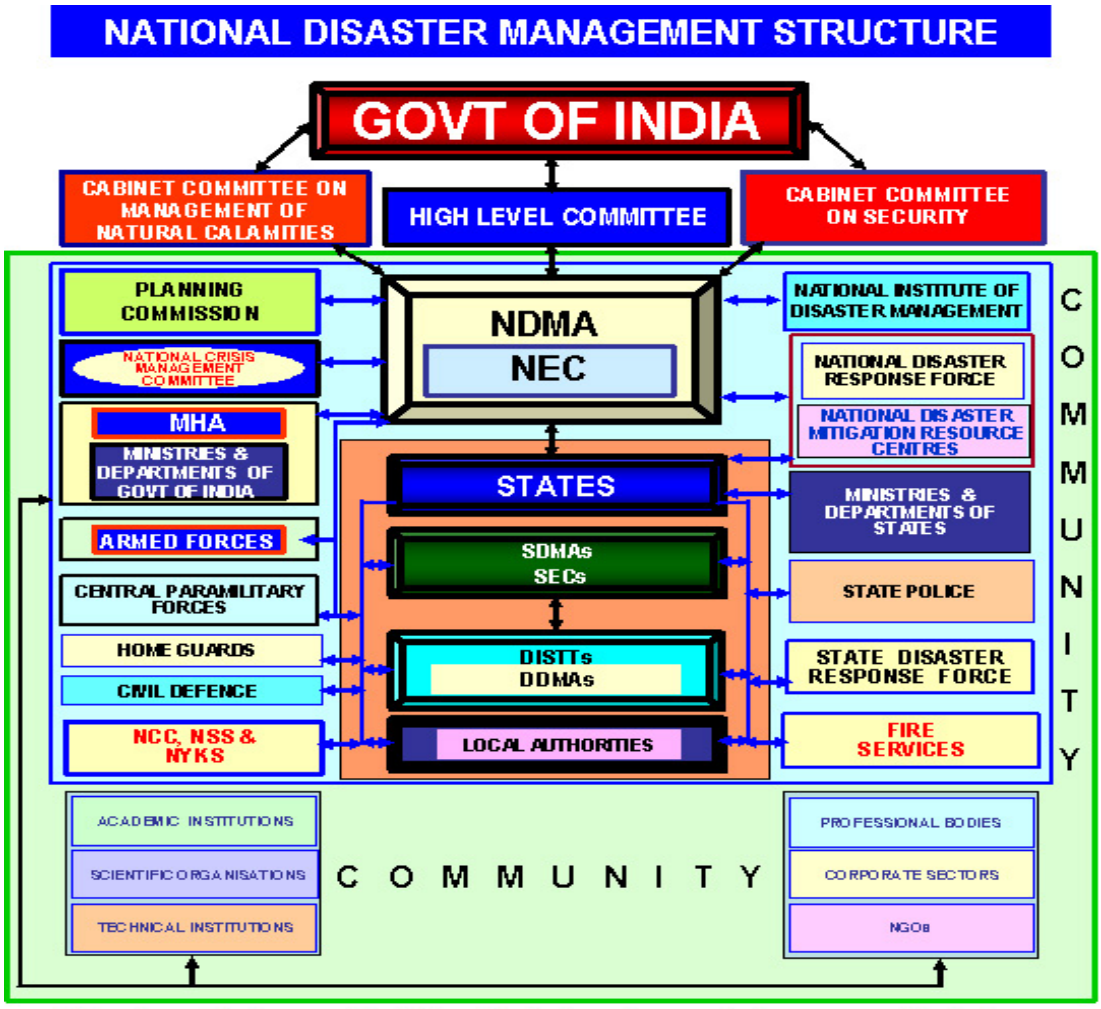
The slow motion of the Indian crust, about 5 cm/year accumulates stress to which natural disasters are attributed. Some landslides make unique, and unparalleled catastrophes. Landslides and avalanches are among the major hydro-geological hazards that affect large parts of India besides the Himalayas, the Northeastern hill ranges, the Western Ghats, the Nilgiris, the Eastern Ghats and the Vindhyans, in that order, covering about 12-15 % of the landmass. The Himalayas alone count for landslides of every fame, name and description- big and small, quick and creeping, ancient and new. The Northeastern region is badly affected by landslide problems of a bewildering variety. Landslides in the Darjeeling district of West Bengal as also those in Sikkim, Mizoram, Tripura, Meghalaya, Assam, Nagaland and Arunachal Pradesh pose chronic problems, causing recurring economic losses worth billions of rupees. A different variety of landslides, characterized by a lateritic cap, pose constant threat to the Western Ghats in the South, along the steep slopes overlooking the Konkan coast besides Nilgiris, which is highly landslide prone.

3.1 Legal and institution set up

The legal and institutional arrangement of disaster management in India is improves with the enactment of Disaster Management Act 2005. The National Disaster Management Authority (NDMA) was initially constituted on May 30,2005 under the Chairmanship of Prime Minister. Following enactment of the Disaster Management Act, 2005, the NDMA was formally constituted in accordance with Section-3(1) of the Act on 27th September, 2006 with Prime Minister as its Chairperson and nine other members, and one such member to be designated as Vice-Chairperson.

The NDMA has been mandated with laying down policies on disaster management and guidelines which would be followed by different Ministries, Departments of the Government of India and State Government in taking measures for disaster risk reduction. It has also to laid down guidelines to be followed by the State Authorities in drawing up the State Plans and to take such measures for the management of disasters, Details of these responsibilities are given as under :-

(a) Lay down policies on disaster management;
(b) Approve the National Plan;
(c) Approve plans prepared by the Ministries or Departments of the Government of India in accordance with the National Plan;
(d) Lay down guidelines to be followed by the State Authorities in drawing up the State Plan;
(e) Lay down guidelines to be followed by the different Ministries or Departments of the Government of India for the purpose of integrating the measures for prevention of disaster or the mitigation of its effects in their development plans and projects;
(f) Coordinate the enforcement and implementation of the policy and plan for disaster management;
(g) Recommend provision of funds for the purpose of mitigation;
(h) Provide such support to other countries affected by major disasters as may be determined by the Central Government;
(i) Take such other measures for the prevention of disaster, or the mitigation, or preparedness and capacity building for dealing with the threatening disaster situation or disaster as it may consider necessary;
(j) Lay down broad policies and guidelines for the functioning of the National Institute of Disaster Management. Besides the nine members nominated by the Prime Minister, Chairperson of the Authority, the Organizational structure consists of a Secretary and five Joint Secretaries including one Financial Advisor. There are 10 posts of Joint Advisors and Directors.



Notes: 1. This diagram reflects interactive linkages for synergised management of disasters and not a hierarchical structure.

2. Backward and forward linkages, especially at the functional level, are with a view to optimise efficiency.

3. Participation of the Community is a crucial factor.

State Policies on Disaster Management

At the State Level the State Disaster Management Authority (SDMA), headed by the Chief Minister, lays down policies and plans for disaster management in the State. It is also responsible to coordinate the implementation of the State Plan, recommend provision of funds for mitigation and preparedness measures and review the developmental plans of the different departments of the State to ensure integration of prevention, preparedness and mitigation measures. The State Disaster Management Department (DMD) which is mostly one of the departments of the state is nodal authority.

State Relief Codes / DM Codes

Many States have manuals and codes for management of drought, floods and other disasters and relief measures to be taken, etc. Now many states are in the process of changing their State Relief codes into Disaster Management Manuals.

In the district level the District Disaster Management Authority (DDMA) is headed by the District Magistrate, with the elected representative of the local authority as the Co-Chairperson. DDMA is the planning, coordinating and implementing body for disaster management at district level. It will, inter alia prepare the District Disaster Management Plan and monitor the implementation of the National and State Policies and the National, State and the District Plans. DDMA will also ensure that the guidelines for prevention, mitigation, preparedness and response measures laid down by the NDMA and the SDMA are followed by all departments of the State Government at the district level and the local authorities in the district.

The Local Authorities include both the rural local self governing institutions (Panchayati Raj Institutions) and urban local bodies (Municipalities, Cantonment Boards and Town Planning Authorities). These bodies will ensure capacity building of their officers and employees for managing disasters, carry out relief, rehabilitation and reconstruction activities in the affected areas and will prepare DM Plans in consonance with guidelines of the NDMA, SDMAs and DDMAs.

3.2 National Institute of Disaster Management

The National Institute of Disaster Management (NIDM) was constituted under an Act of Parliament with a vision to play the role of a premier institute for capacity development in India and the region. The efforts in this direction that began with the formation of the National Centre for Disaster Management (NCDM) in 1995 gained impetus with its re-designation as the National Institute of Disaster Management (NIDM) for training and capacity development. Under the Disaster Management Act 2005, NIDM has been assigned nodal responsibilities for human resource development, capacity building, training, research, documentation and policy advocacy in the field of disaster management.

3.3 National Disaster Response force (NDRF)

The DM Act has made the statutory provisions for constitution of National Disaster Response Force (NDRF) for the purpose of specialized response to natural and man-made disasters. Accordingly, in 2006 NDRF was constituted with 08 Battalions (02 Battalions each from BSF, CRPF, ITBP and CISF). As on date NDRF is having strength of 10 Battalions. Each NDRF Battalion consists of 1149 personnel. Union cabinet has also approved the conversion/up-gradation of 02 Battalions from SSB.

3.4 Emergency Services

In India there is no centrally managed Emergency service or it is not integrated. The existing emergency services are maintained by various organizations like Police, Fire and health department at the state level. Except for the police there is no uniform system of management of these services. The Police works under the state governments but fire and ambulance services are differently managed and run. In some states fire services are run by the ULBs whereas in some states it is run and managed by the state governments. Many public and private sector organizations also maintain their own fire services. Ambulance services are run by multiple agencies such as Red Cross, health department, private health care organizations, charitable organizations, civil defence, etc. In the recent past many states have started integrated ambulance services mainly under the National Rural Health Mission and are being run and managed by outsourcing. At the state level it is health department which is providing funds for these services.

Department of Fire: Like it is done and practiced in other countries Fire Department not only worked for fire but also for other emergency service too. In the year 1956 Government of India formed Standing Fire Advisory Committee (SFAC) under the Ministry of Home. The SFAC has given various recommendations to the government for improvement of fire services. The SFAC had recommended re-organization of fire services in India way back in 1956 and also recommended uniform fire service legislation in all states. The SFAC had also prepared a Model Fire Service Bill and the same was circulated to all the state governments in 1958. Some states have still not enacted any Fire Act of their own. The SFAC has laid down norms for setting up of fire stations based on the following parameters:-

i) Response time (3 to 5 minutes in urban areas and 20 minutes in rural areas);
ii) The scale of population to be served; and

iii) The number of minimum standard equipment that are needed and manpower required for its operation.

On the basis of above norms laid down by SFAC, the existing deficiencies as regards fire stations, fire fighting vehicles and personnel in India are as follows:

a) Fire stations – 97.54%;
b) Fire fighting and rescue vehicles – 80.04%; and
c) Fire personnel – 96.28%.

(*Source: NDMA Guidelines.)*

During their regular deliberations, the SFAC have noticed the following shortcomings in the fire services in India. Lack of:

i) Unified fire services in some of the states;
ii) Proper organizational structure, training and career progression of its personnel;
iii) Adequate modern equipment and their scaling, authorization & standardization;
iv) Appropriate and adequate funding;
v) Training institutions;
vi) Infrastructural facilities – fire stations and accommodation of personnel etc.;
vii) Vulnerability analysis;
viii) Public awareness (DOs & DON'Ts), conduct of regular mock exercises and evacuation drills; and
ix) Uniform fire safety legislation in some of the states.

(Source: NDMA Guidelines, 2012)

Civil Defense and home guard: With a view to the requirements and necessity of well trained and organized group for disaster response action the Ministry of Home Affairs gives approval to the state government to utilized the service of Civil defence and home guard for disaster prevention etc. besides their normal duty. Thereafter they are largely utilized by all the states not only in response action but also in prevention, awareness, mitigation etc. of disaster. Nowadays they are the main work force for any kind of disaster in all the states. Further the Civil Defence Act 1968 has been amended in 2009 and disaster management has been added as one of the activities of CD organization. This amendment has been notified on 21st January, 2011. However, the CD set-up is also not in good shape in the country. As per the High Powered Committee Report on Revamping of CD, only 121 towns have CD set up in the country and against the target of 1.29 million volunteers, only about 0.66 million have been enrolled so far. Only

17 states are having Central Training Institutes (CTIs) to train CD volunteers and most of them are combined training institutes for Civil Defense and Home Guards and many of these training institutions are virtually non-functional because of lack of funds and infrastructure.

Response Force: In compliance with the DM Act 2005, 10 Battalions of NDRF drawn from the CPMFs have been trained in advanced search and rescue (SAR) and stationed in different parts of the country for responding to large scale emergencies. Their services are regularly being used for disaster response of large scale or where specialized response is needed. But keeping in view the size of the country there is huge response time lag in the response of NDRF and need is being felt to raise such forces at the state levels so that maximum lives can be saved in golden hour.

3.5 National Policy on DM and Disaster Management Plans

The National Policy on Disaster Management prepared by the NDMA was approved by the Union Cabinet on 22nd October 2009. The vision of this policy is to build a safe and disaster resilient India by developing a holistic, proactive, multi disaster oriented and technology driven strategy through a culture of prevention, mitigation, preparedness and response. The National Disaster management Plan (DMP) though approved by the National Executive Council in the year 2013 is about to be finalized by the National Government and is going to lay down the broad outline of how the nation manages disasters. At the same time as per the guideline of NDMA, the states governments are in the process of preparing their own State Disaster management plan and some states already have their own State Disaster management Plan. Also the model framework for District Disaster Management Plan had already been issued by the central government which is presently utilized by many districts. An SOP for Responding to Natural Disasters, 2010 has also been issued. The state governments have been advised to formulate the similar kind of the CMP and SOPs. As per the provision of Act, DMPs have been formulated by some states and districts. In some cases plans have also been prepared at the local and institutional level such as schools, hospitals, industries and offices. But the national DMP is yet to be finalized. The national response plan has been drafted but yet to be finalized. In order to make DMPs functional and useful their thorough testing and regular updation and improvement is needed. Besides, formulating separate plans for DM and crisis management is against the principles of holistic management of disasters.

3.6 Early Warning and Forecasting Agencies and Dissemination System

As per the DM act the state government has the responsibility of setting up the mechanism for early warning and dissemination thereof to the public. Steps have been taken to institutionalize EW system in the country but the system of EWS is at nascent stages in India. The SOPs, 2010 under para 4.1.1 lists the following agencies table for forecasting and issuing EW:-

Name of the Disaster	Agency
Cyclone	Indian Meteorological Department (IMD)
Tsunami	Indian National Centre for Oceanic Information Services (INCOIS)
Floods	Central Water Commission (CWC)
Landslide	Geological Survey of India (GSI)
Avalanches	Snow and Avalanche Study Establishment (SASE)
Heat and Cold Wave	Indian Meteorological Department

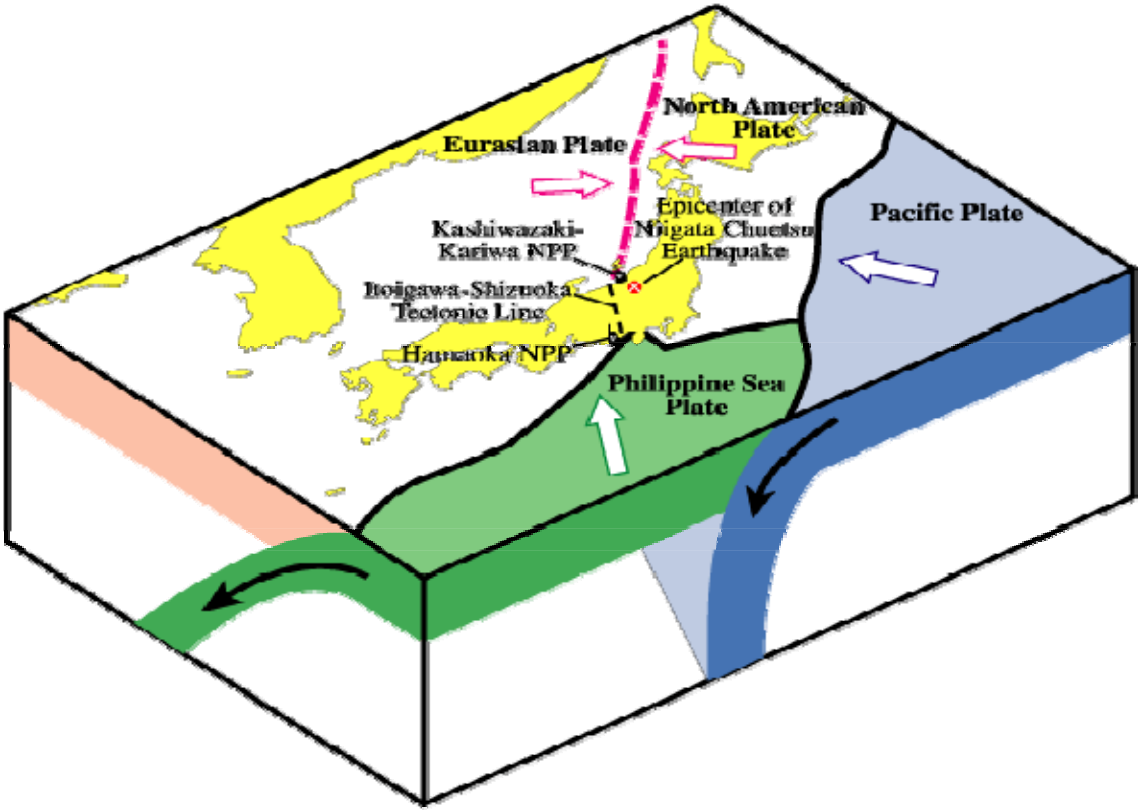
Nodal Early Warning Agencies in India

As above even though early warning or prediction of earthquake is not possible but the Indian Meteorological Department (IMD) is responsible for detecting and monitoring the earthquakes and the after-shocks. IMD operates an Earthquake Operational Centre on a 24X7 basis with the operational responsibility of keeping a round-the-clock watch of seismic activity in and around the country. The SOPs say that the Operation Centre shall retrieve waveform data from remote field stations either in real time or through VSAT/dial up communication facilities, data analyses and quickly disseminate earthquake information to various user agencies including state and national government departments dealing with relief and rehabilitation measures.

In the same manner it depends on the type of disaster that the agency responsible changes. Though the MHA is responsible for collection and dissemination of information in term of issuing alerts, the state DM authorities are to ensure early warning networks availability in their respective areas. At present regarding issuing EW even the above agencies are not fully equip and requires improvement as the information is sometimes not exact and lately arrive. Despite having laws on communication in the country the utilisation of private electronic operators to broadcast early warning seems very poor. In this way the provision made in the DM Act that the Central Government after receiving recommendation from state etc. for control of private broadcasters is needed to utilise.

4.0 Disaster management in Japan

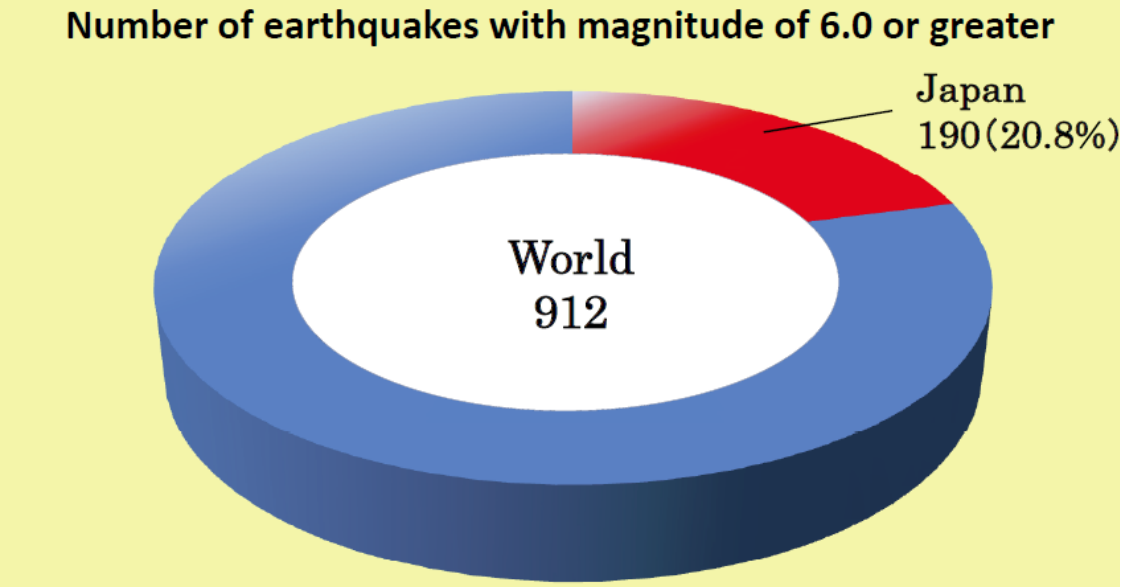
Japan is located in the circum Pacific mobile belt where seismic and volcanic activities occur constantly. Also due to the geographical, topographical and meteorological conditions the country is subject to frequent natural disasters such as earthquake, tsunami, typhoon, rain and snow fall. The four plates i.e. Philippine Sea plate, Eurasian plate, Pacific plate and North American plates which collide around Japan island causes frequent earthquake in the area. With the progress of societies in awareness, prevention, mitigation and advancement in technology and forecasting the damage due to disaster has been declining. Also there is a report which is submitted every year as 'White paper' to the National Diet by the National government about the overview of occurrence of disasters and action taken by the government. Even at such an improvement and preparations the effect of The Great Hanshin Awaji Earthquake and The Great East Japan Earthquake and Tsunami was so disastrous.



4.1 Disaster Acts and its legislation

The disaster management of Japan has been developed and strengthened following the bitter experience of large-scale natural disasters and accidents over the years. The country has 7 basic acts, 18 disaster prevention and preparedness legislations, 3 legislations governing disaster emergency response and 23 disaster recovery and reconstruction and financial measures acts. The first act i.e. Disaster Relief Act dates back to 1947 passed after the 1946 Nankai earthquake. Thereafter every disaster led to learning and experience and it led to passing of new legislation. There is almost a separate legislation for each disaster and separate legislation for every aspect of disasters such as prevention, preparedness, response, rehabilitation and recovery, building standard, financial measures, earthquake insurance, etc. The turning point for strengthening the disaster management system came after the immense damage caused by the Ise-wan Typhoon in 1959, and led to the enactment of the Disaster Countermeasures Basic Act in 1961, which formulates a comprehensive and strategic disaster management system in Japan. The DM system has further been strengthened following the lessons learnt from large-scale disasters such as the Great Hanshin-Awaji Earthquake, 1995. The learning of the 2011

Great East Japan Earthquake and Tsunami (GEJET) and nuclear disaster has been incorporated in the Disaster Countermeasures Basic Act by amending it in June, 2012 and by making changes in Basic Disaster Management Plan in December, 2011. The most notable piece of legislation is the Act passed in 2002 namely 'Act on Special Measures for Promotion of Tonankai and Nankai Earthquake Disaster Management'. The country is expecting big earthquake which may arise out of Tonankai and Nankai troughs and this legislation aims at reducing possible impact from these earthquakes and preparing the country to face them.



Note : Total for 1996 to 2005.
Source : Prepared by the Cabinet Office based on data from the Japan Meteorological Agency and world data from USGS.

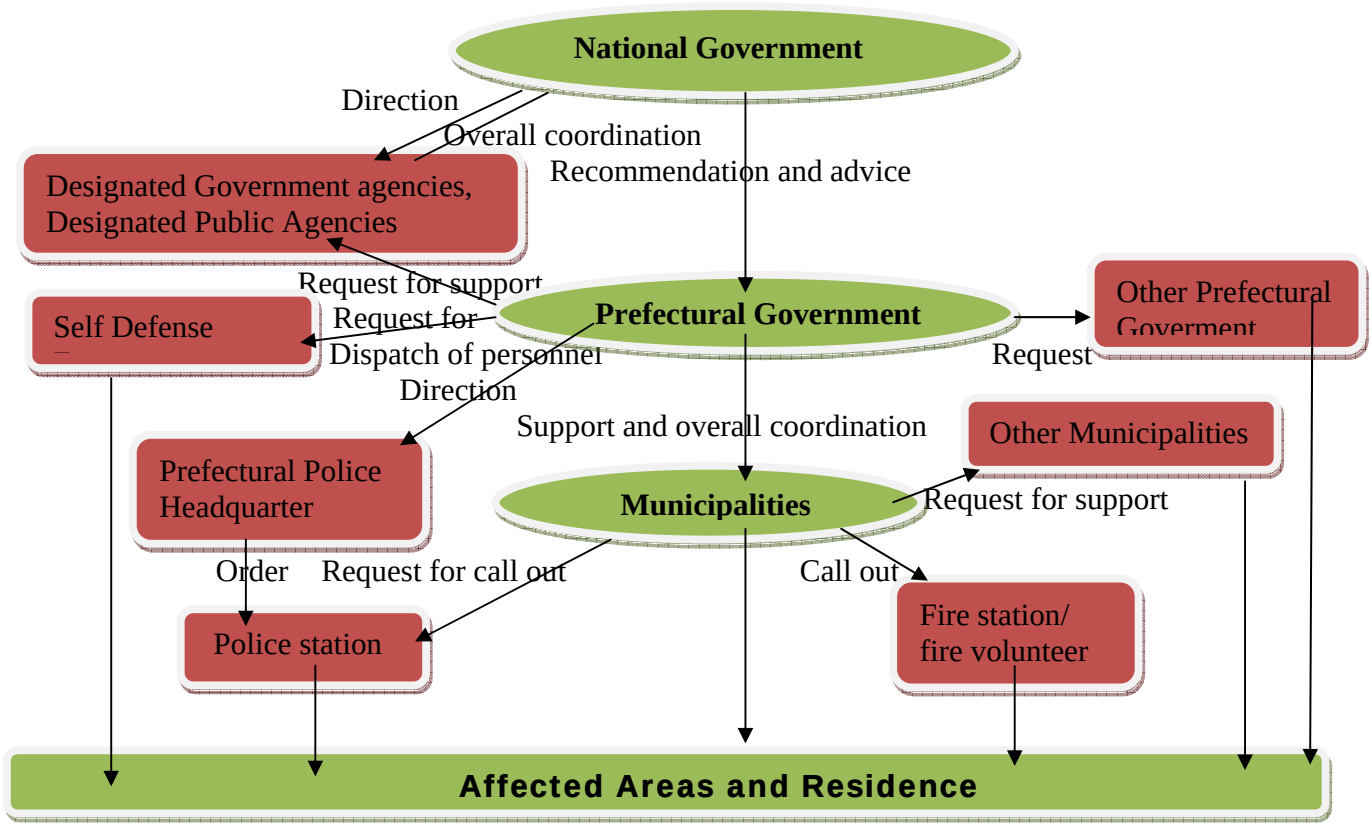
4.2 Preparedness for DM

Not only as a review but as a preparatory and preparedness, the Technical investigation Committees of Central Disaster Management Council under National government prepared the estimation on possible damaged caused by the next Tokai earthquake as well as Tonankai and Nankai earthquake as below:

Maximum Cases	Tokai EQ	Tonankai & Nankai EQ	Kobe EQ 1995
Victims(Persons)	9200 (7900 by strong Tremors)	18000 (8600 by tsunamis)	6436
House Destroyed	260,000	360,000	105,000
Economic Loss (Billion Yen)	37,000	57,000	10,000

Estimation of Damage caused by possible EQ

Response Mechanism in Japan



4.3 Governance System in DM

At the national level Central Disaster Management Council, the apex body for DM in Japan is housed within the Cabinet Office headed by the Prime Minister. Along with a series of reforms of the central government system in 2001, the post of Minister of State for DM was newly established to integrate and coordinate disaster reduction policies and measures of ministries and agencies. In the Cabinet Office, which is responsible for securing cooperation and collaboration among related government organizations in the wide-razing issues, the Director-General of Disaster Management is mandated to undertake the planning of basic disaster management policies and response to large-scale disasters, as well as conduct overall coordination.

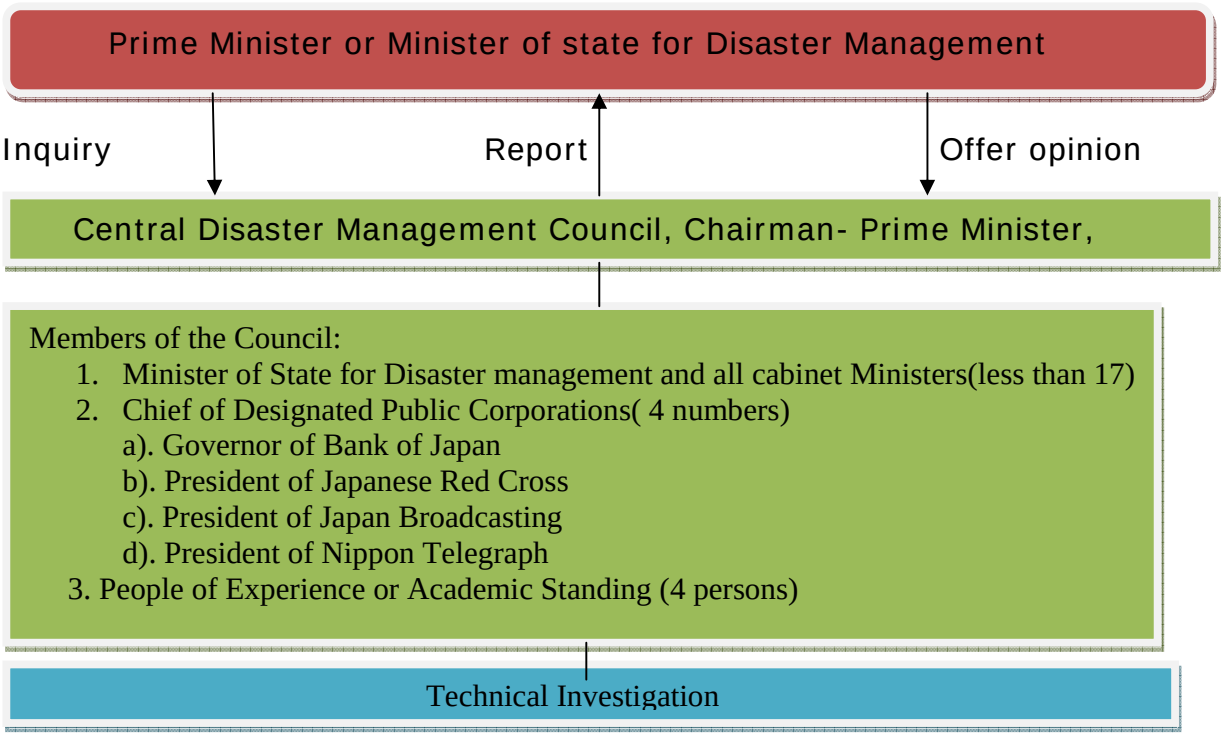
Disaster countermeasure Basic Act 1961

Central Disaster management Council chaired by the Prime Minister
National Coordinating Body with all relevant Ministers and Japanese Red Cross, Public Broadcasting, Semi Public Sector

Annual Gov't Official Report on Disaster Countermeasures
The cabinet must officially report the Disaster Countermeasures to the National Diet

Formulation on " National Basic Disaster Management Plan For Disaster Prevention"
The Disaster Management Operational Plan (Sectoral)
The local Disaster Management Plan

Central Disaster Management Council in Japan



Additionally, taking into account the lessons learned from the Great Hanshin-Awaji Earthquake, 1995, the Cabinet Secretariat system was also strengthened, including the appointment of the Deputy Chief Cabinet Secretary for Crisis Management and the establishment of the Cabinet Information Collection Center, to strengthen risk management functions to address emergencies such as large-scale disasters and serious accidents.

4.4 DM Planning System in Japan

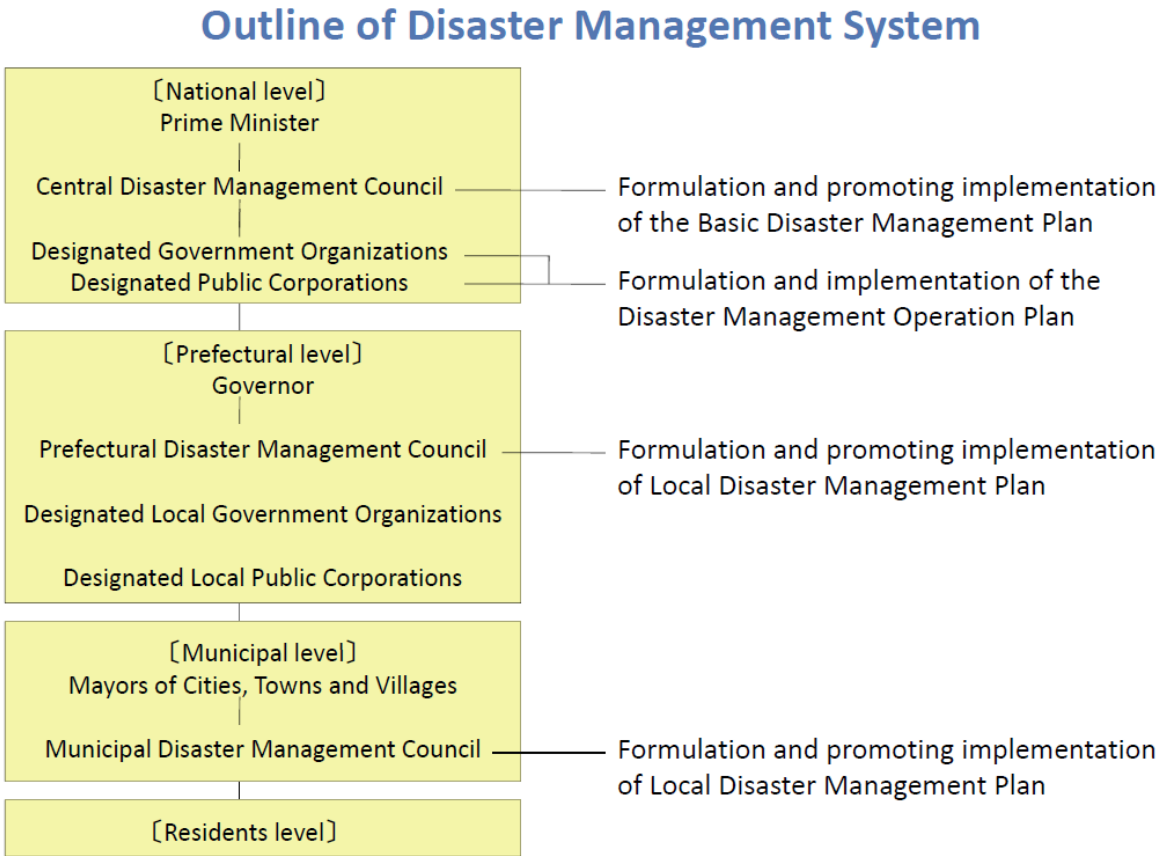
Planning for DM is done in three levels as follows:

i) National Level: Basic Disaster Management Plan - This plan is a basis for disaster reduction activities and is prepared by the Central Disaster Management Council based on the Disaster Countermeasures Basic Act, 1961. The Basic Disaster Management Plan states comprehensive and long-term disaster reduction issues such as disaster management related systems, disaster reduction projects, early and appropriate disaster recovery and rehabilitation, as well as scientific and technical research. The first Basic DMP was prepared in 1963 and subsequently revised several times. The plan was revised entirely in 1995 based on the experiences of the Great Hanshin-Awaji Earthquake. It now consists of various plans for each type of disaster, where tangible countermeasures to be taken by each stakeholder such as the national and local governments, public corporations and other entities are described for easy reference according to the disaster phases of prevention and preparedness, emergency response, as well as recovery and rehabilitation. Changes were effected in the plan in December, 2011 based on the recommendations from the Central Disaster Management Council's technical committee for reviewing earthquake and tsunami measures based on the lessons from the GEJET. The plan, it has been decided, shall be continuously revised in future in order to reflect further policy development based on the GEJET and other disasters.

ii) Department/Organizational Level: Disaster Management Operation Plan - Disaster Management Operation Plan: This is a plan made by each designated government organization and designated public corporation based on the Basic Disaster Management Plan.

iii) Prefectural/Local Level: Local Disaster Management Plan: This is a plan made by each prefectural and municipal disaster management council, subject to local circumstances and based on the Basic Disaster Management Plan.

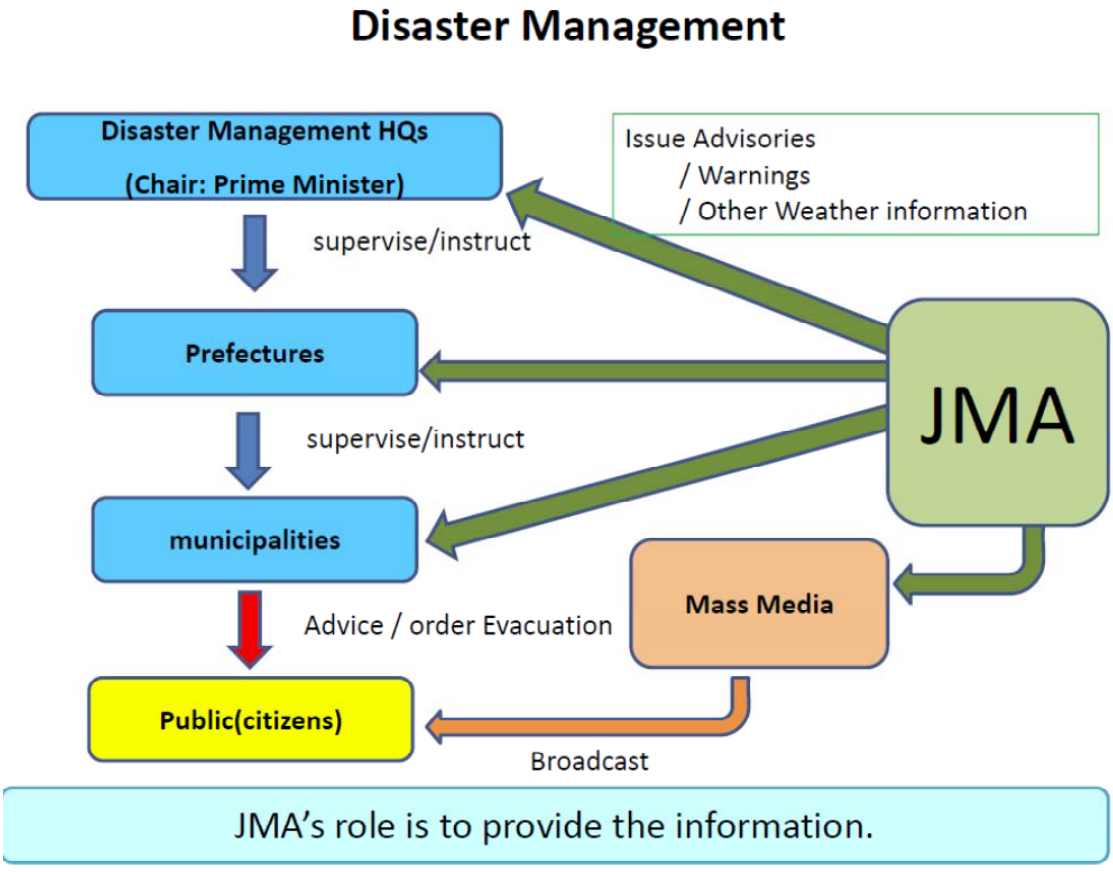
The plans at all levels have been prepared and regularly revised and updated incorporating the lessons learnt and changes made in the Basic DMP prepared at the national level. DMP is the main document which is referred to for disaster management and emergency response.



4.3 Early Warning System in Japan

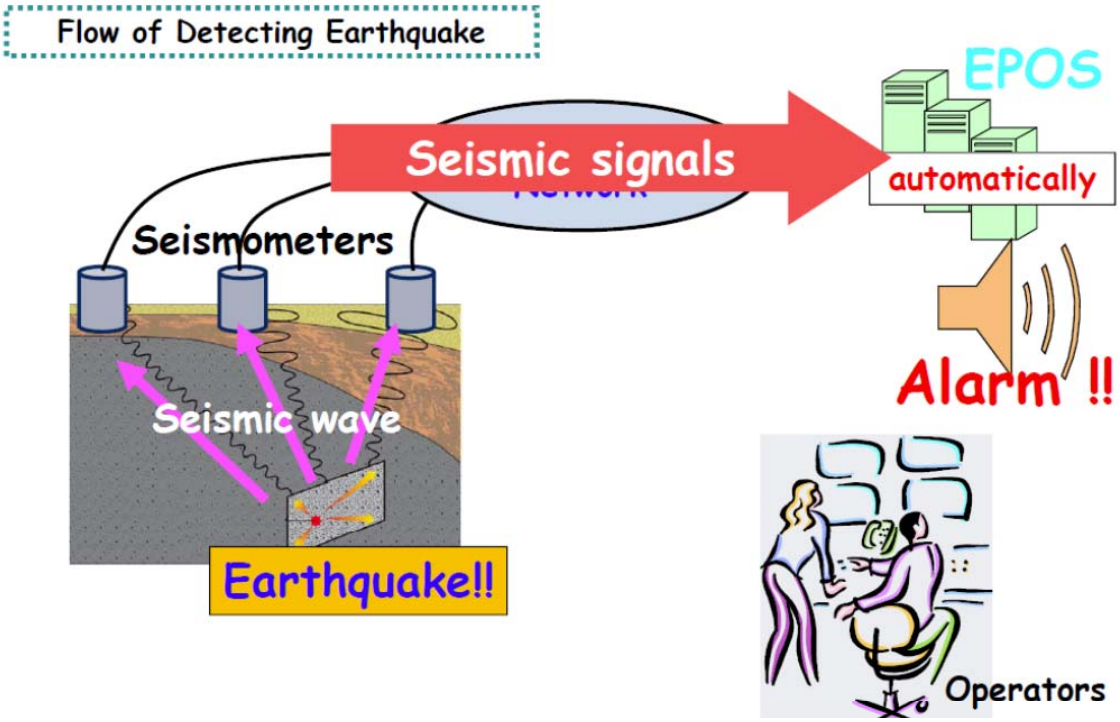
EWS Agency - Japan Meteorological Agency - Japan Meteorological Agency (JMA) is the sole national authority responsible for issuing weather/tsunami warnings and advisories, earthquake early warning/alerts, and other disaster warning and is required to provide reliable and timely information to governmental agencies and residents for the purposes of natural disaster prevention and mitigation. Within the structural framework of Japan's central government, the JMA is placed as an extra-ministerial bureau of the Ministry of Land, Infrastructure, Transport and Tourism (MLIT). When a Heavy Rain Warning is issued, Sediment Disaster Alerts are issued jointly by MLIT and prefectural government civil engineering bureaus when sediment-related damage caused by heavy rain is considered likely within the next few hours. JMA is also responsible for providing flood forecasting services in collaboration with central and local river management authorities. These services include flood warnings and advisories covering 407 rivers (as of March 2011) throughout the country that have been designated by these

authorities as sites of potential flood disasters. Flood forecasting systems for 289 of the 407 rivers are managed jointly by JMA and the MLIT, and the other 118 are managed jointly by JMA and prefectural governments. JMA operationally monitors seismic and volcanic activity throughout the country and issues relevant warnings and information to mitigate damage caused by disasters related to earthquakes, tsunamis and volcanic eruptions. JMA began issuing volcanic warnings and volcanic forecasts for each active volcano in Japan on Dec 1, 2007 to mitigate damage from volcanic activity. Volcanic warnings are issued in relation to expected volcanic disasters, and specify the municipalities where people need to take action. Volcanic forecasts are issued for less active volcanoes or those that become so.



Observation System for Earthquakes - In order to constantly monitor seismic activity, the JMA and other relevant organizations install and maintain seismometers that are used for estimating the location of the epicenter and magnitude of an earthquake as well as for tsunami forecasts, and seismic intensity meters that measure the intensity of ground motion, in numerous places nationwide. As soon as an earthquake occurs in or around Japan, the JMA analyzes the data from various seismometers and seismic intensity meters. Within about two minutes, it issues a seismic intensity information report for earthquakes of intensity 3 or greater, and within about five

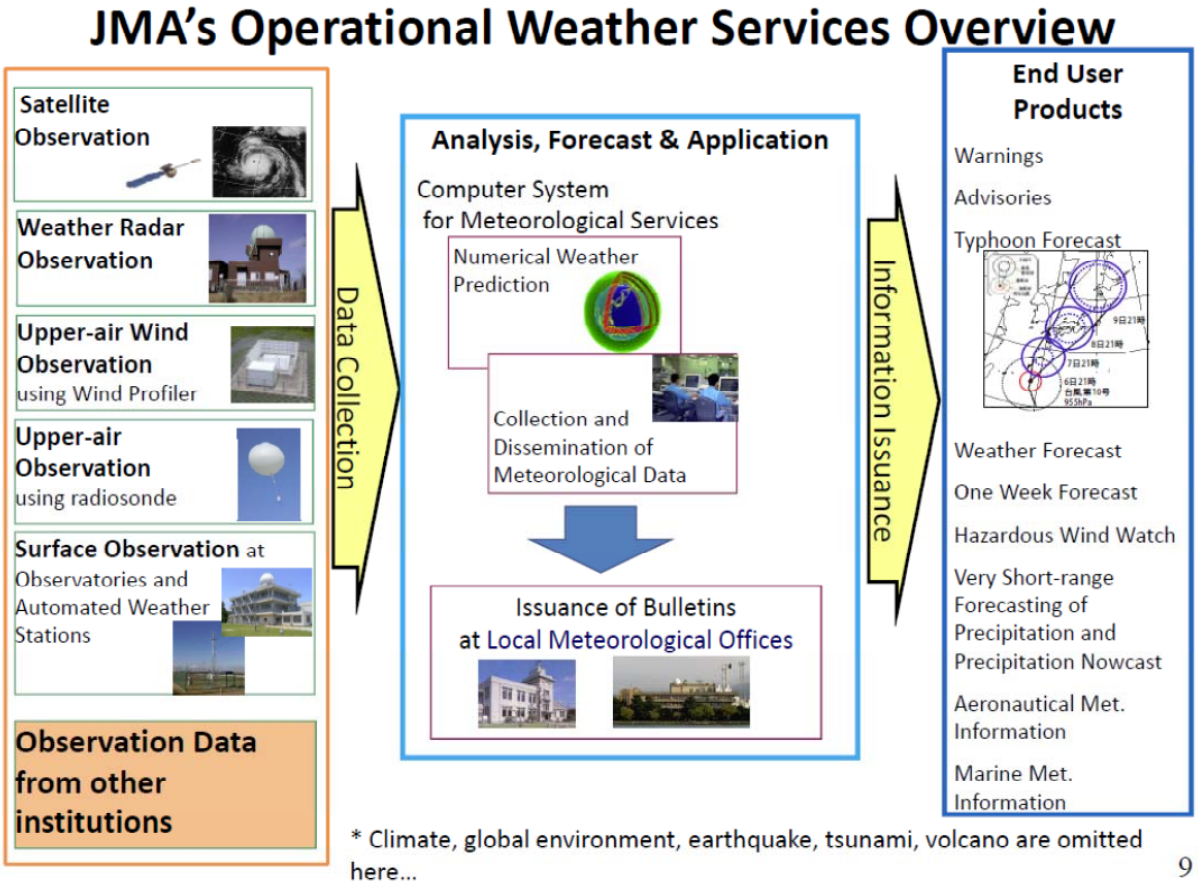
minutes issues an earthquake information report indicating the epicenter and magnitude of the earthquake and the seismic intensity in the municipalities where strong shaking was observed.



Determination of Epicenter and magnitude (JMA, Osaka)

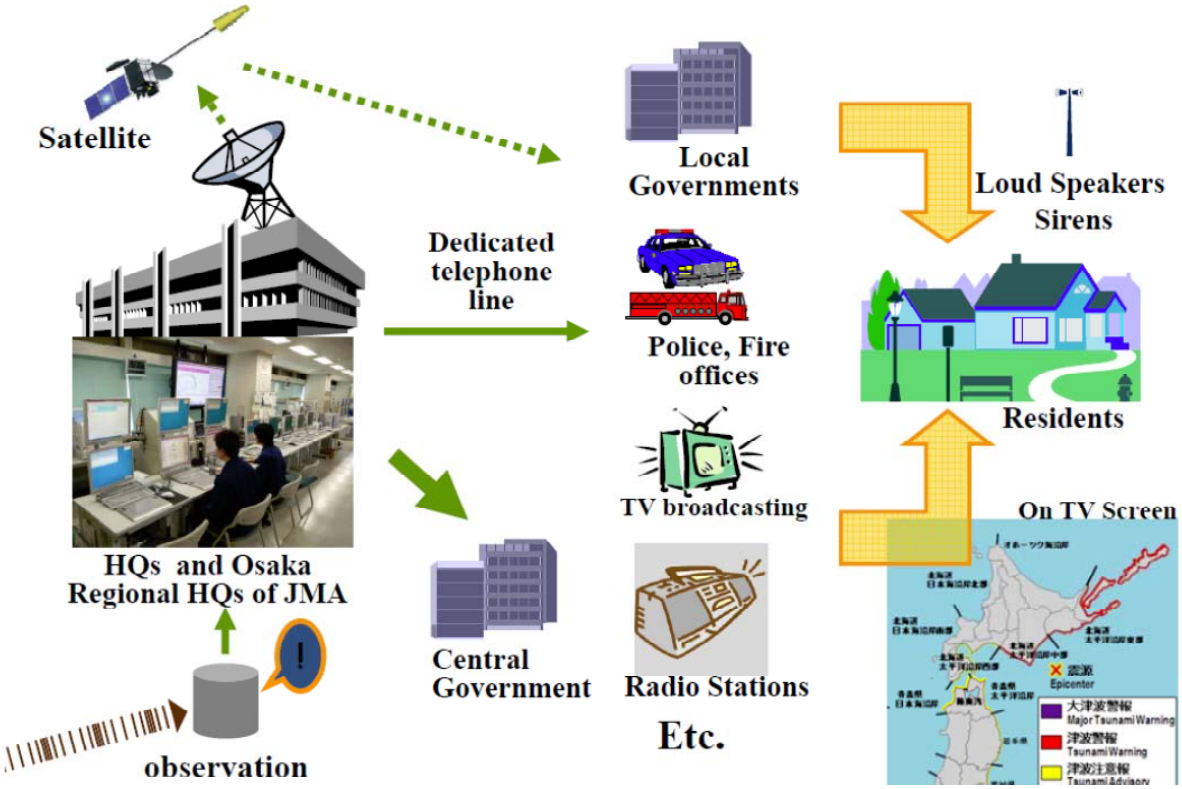
Dissemination of Forecast and EW - In order to prevent and mitigate damage caused by natural disasters and support prompt disaster prevention activities, JMA disseminates weather information and warnings via various channels to government disaster prevention agencies, local governments, the mass media and the public. An outline of EWS in Japan is given in the following figure. For this purpose, the Agency maintains direct communication links with meteorological offices and central/local governments. Strong communication with municipal governments that play direct roles in disaster management and mitigation in affected areas is essential. Such communication is ensured via various channels for information dissemination, such as prefectural governments, NTT (NipponTelegraph and Telephone Corporation), J-ALERT (an instant information broadcasting system introduced by the Fire and Disaster Management Agency (FDMA) and the Internet. To support prompt disaster mitigation activities by local governments, the Agency has introduced a new information provision system called the Information Network for Disaster Prevention (INDiP), which enables effective and rapid dissemination of data in both text and graphic form. INDiP (Figure 6) connects disaster prevention agencies and local governments with JMA headquarters via the Internet and

provides detailed weather information and warnings tailored to individual municipalities. Information for maritime users is transmitted via the JMH radio facsimile broadcast service operated by JMA and fishery radio communications services. Such information is also disseminated within the framework of the Global Maritime Distress and Safety System (GMDSS), i.e. via the NAVTEX broadcast service of the Japan Coast Guard for seas in the vicinity of Japan, and via the Safety-Net broadcast service for ships in the high seas via the maritime satellite INMARSAT. Nowadays, the Internet plays a vital role for JMA in the public dissemination of a wide range of meteorological information not only on forecasts but also on historical and current observation data.



J-Alert System - J-Alert is the system to immediately transmit emergency information such as Emergency Earthquake information, tsunami warning, information of ballistic missiles, which people have no enough time to deal with, is transmitted to the municipalities by using satellite (via the Fire and Disaster Management Agency, the Cabinet Secretariat, and JMA). It became operational on 09 February 2007 and on 01 October 2007 started sending the emergency earthquake information. As of first March 2010, 344

municipalities have introduced this system. Among them, automatic activation system of radio broadcasting and community FM have been introduced to 282 municipalities. The J-Alert framework has been given in the figure below:



J-alert/Emergency operation System (JMA)

Utilization of Earthquake Early Warning Information - Earthquake Early Warning (EEW) information announces the estimated hypocenter and magnitude of an earthquake as well as the estimated arrival time of the S-wave of the earthquake and seismic intensity in each area. This information is made possible by detecting the P-wave near the epicenter and immediately processing the data since there is a difference in the speed of the P-wave, which arrives faster, and the S-wave, which arrives later and causes more severely destructive phenomena. In the case of a large-scale ocean trench-type earthquake, there may be a time lag (several seconds to several tens of seconds) between the issuance of the EEW information and the start of severe shaking (when the S-wave arrives). This can be a critical time to be used for mitigating damage by stopping trains and elevators, extinguishing flames or crawling under tables. Research and development has been promoted by the JMA in cooperation with related organizations,

and the provision of the EEW information to specific entities such as railway companies began in 2006. Earthquake or tsunami warnings are instantly delivered to central & local governments, broadcasters, telecom carriers. After receiving this warning, local government deliver alarm through their sirens or microphones (Fig b). The flow of information in EEWS has been given in figure a, and use of this alert by train services in figure c.

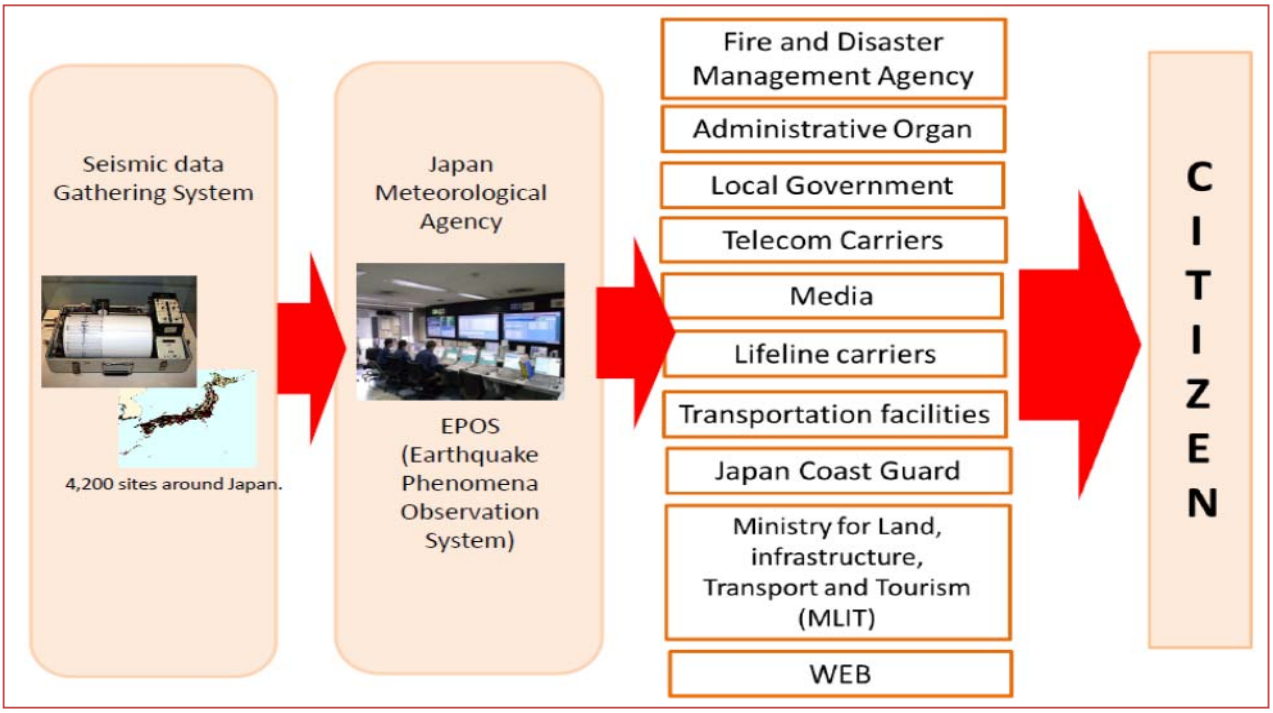


Figure a: Outline of Earthquake Early warning Information (Source: MIC, Japan)

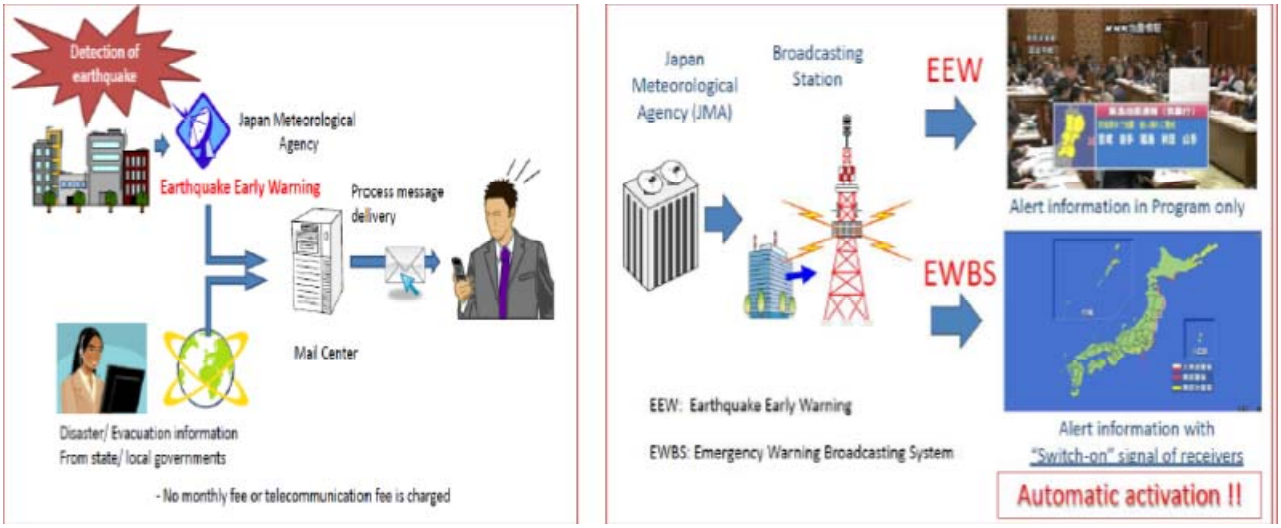


Figure b: an outline of Earthquake Early warning Information to community (Source: MIC, Japan)

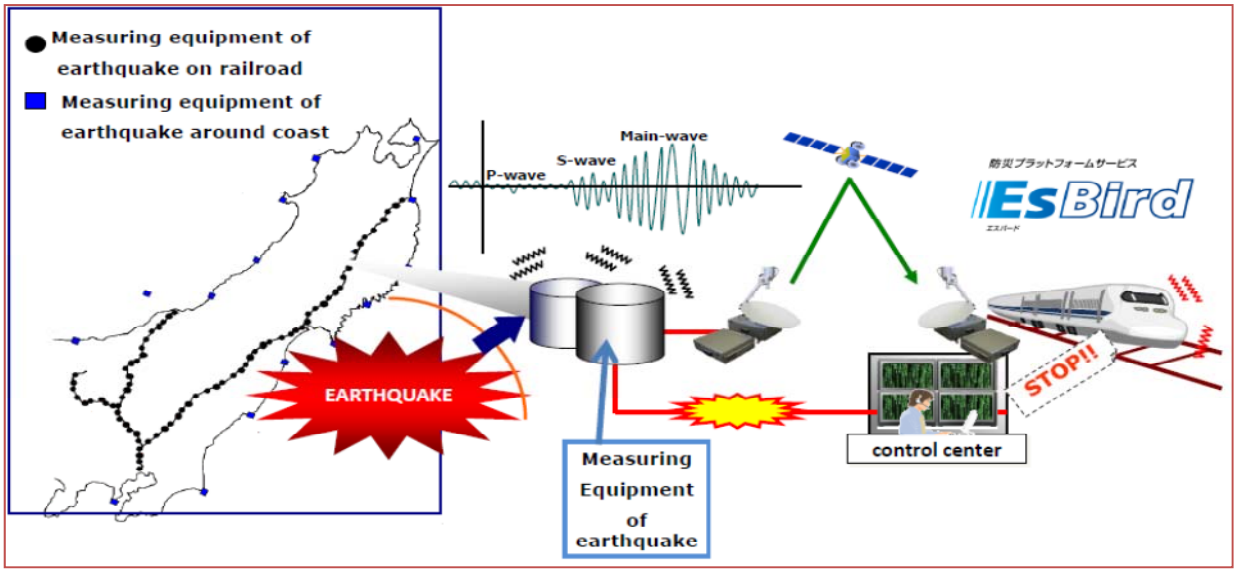


Figure c: An outline of Earthquake Early warning Information used to stop high speed trains (Source: MIC, Japan)

Legal Framework for EW Dissemination - Early warning is given too much importance by the Japan Disaster Countermeasures basic Act that it is written "In cases where notification, request, transmission or alarm …. requires urgency when there is a specific need, the governor of a prefecture, the mayor of a city or town, or the head of a village may, by ordinance unless otherwise provided by law, request broadcast thereof on a priority basis from the electrical communications businesses….". So EW is instantly communicated in all the mediums available. If warning is given by the JMA, the alert started to appear in the TV channel across the country

5.0 Landslide in general

Introduction:

Landslide is a geological phenomenon in which there is a ground movement such as slope failure, movement of debris and rock and earth down a slope. In short it is the down sliding of relatively dry mass of soil, rock and debris.

The main reason of landslide is the failure of materials which formed the hills and slope and are driven by the force of gravitation. Some landslides are very rapid in nature and some are slow gradual slide. Sudden and rapid are dangerous because of the high speed resulting into more impact and less warning. Slow landslide might move little a year but can be active for many years. Although this type of landslide is not a threat to people but it can caused huge damages to property.

5.1 Cause of landslide

Landslide can be triggered by natural causes or human action causes. If a hillside has loss its vegetation due to urbanization or fire for instance, the rain water can cause erosion and giving more chance to sliding. At the same time it is not only rain that can cause erosion but flowing rivers, moving glaciers, and crushing ocean waves. In short the slope saturation by water is the primary cause for landslides. The geology or strength of the soil inside itself can be a factor of landslide. The stronger the material is less likely to break apart and slide down to the slope. And finally, there can also be a human activities that can lead to landslide and erosion. Cutting of hillside or clearing of land for agriculture and construction are some of the human causes of landslide.

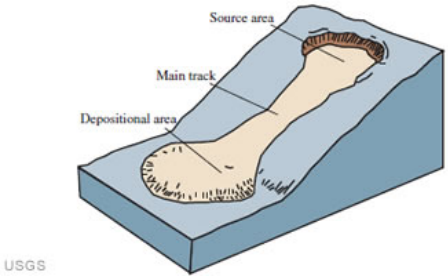
5.2 Type of landslide

Depending on the classification there can be many types of landslide, the following are the main common type of landslide:

5.1.1 Earthflow:

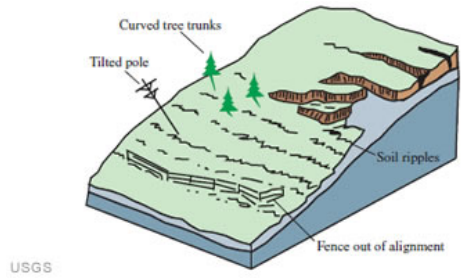
The slop materials liquefies and runs out, forming a bowl or depression at the head. This usually occurs in fine- grained materials or clay- bearing rocks under saturated conditions and on moderate slopes. At the same time

dry flow of granular materials are also possible.



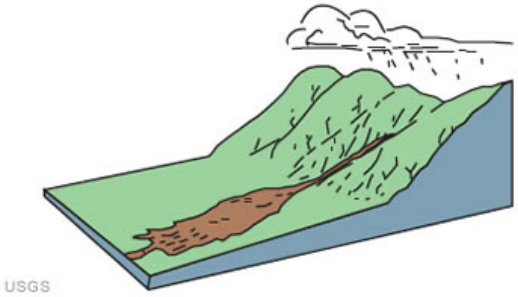
5.1.2 Mudslide/ mudflow:

It is quite similar with earthflow but consist of materials having more water that makes it easy to flow. It contains at least 50% of sand, silt and clay-sized particles.



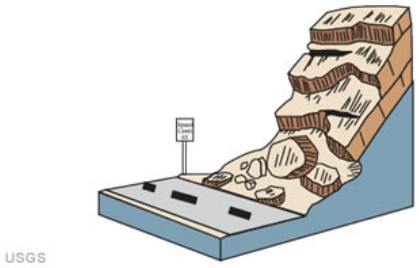
5.1.3 Debris flow:

It can be said as a down flow movement of a combination of loose soil, rock, organic matters, air and water mobilized as slurry. It is usually caused by surface water due to heavy rain or sometimes melting of snow.



5.1.4 Fall:

Falls are abrupt movement of masses of geological materials such as rocks and boulders that become detached from steep slopes or cliffs.



6.0 Overview of Landslide and sediment related disaster in Japan

Landslide/ Debris flow or any kind of sediment related disaster in Japan is supervised by what they called Sabo Department which is under the ministry of Land Infrastructure and development. As the mountainous and hilly areas contribute 70% of the total areas of Japan, there is too much possibility of landslide and debris flow in many parts of the country.

Landslide near Arima Onsen, Hyogo

6.1 History:

As the Japan experienced Sediment disasters like debris flow and landslide since ancient days, the prevention measures taken to protect hills and mountains started long years back(around 700AD). Despite various measures to control and prevent the sediment disaster they faced many problems due to debris flow and landslide hindering blockage of transportation route and sometimes flooding. So the principle of mountain and river control was developed during the Edo period (1603-1868) which lead to the starts of what they called Sabo work. ‘Sabo’ is a word originating from the Japanese language which means sediment control. The main aim of Sabo is to restore the natural environment destroyed by sediment runoff caused by natural phenomena or human-induced phenomena and mitigate the threat of natural disasters affecting human life.

The ancient people of Japanese has a clear concept that mountains have supported the production activities necessary for the establishment of the nation and it cities by providing materials for construction, living materials required for warming and cooking, fuel wood and even fertilizers etc. To prevent deforestation and maintaining the nature is given strong effort right from the beginning. Various laws and rules passed and enforced by the Emperors and Rulers. Almost all the rules are about the banning of tree felling and protection work for sedimentation in any mountain including privately owned ones.

The concept of what they called Sunodome for protecting soil erosion and sedimentation developed in around 1697AD. This Sunadome which is the first Sabo dam becomes more popular and was the main infrastructure for controlling disaster at that time and some of such Dams still remain in their original shape today.

Dodo River Sunadome build in 1773

The Sabo works of Dam was improved with the passage of time under the suggestion and guidance of Dutch engineer after 1872. The very important and notable activities done by the government is that it employed and invited expert engineers from outside. The Engineers from abroad made significant contributions and left great achievements in the improvement of entire civil engineering technology especially slopes protection and landslide preventive technology. These engineers usually proposed prohibition of unrestrained logging, implementation of hill site works and construction of Sabo dam for protecting the upstream mountain and stabilizing the downstream river section. Also a contribution made by Japanese Engineer named Yoshikata Ichikawa is praiseworthy and the large masonry dam which he constructed is still in existence for more than 130 years and famous.

6.2 Sabo law:

The Sabo law which comes into effective on April 1, 1897 is known as one of the oldest existing laws in Japan. This law state that Sabo facilities would be done to control water and flood so as to prevent the soil masses. It also promote the control of the areas for future possible disasters. This law had been modified many a times to suit the present day situation and the latest amendment is done in the year 1963. The following is the Concept of the Sabo law:

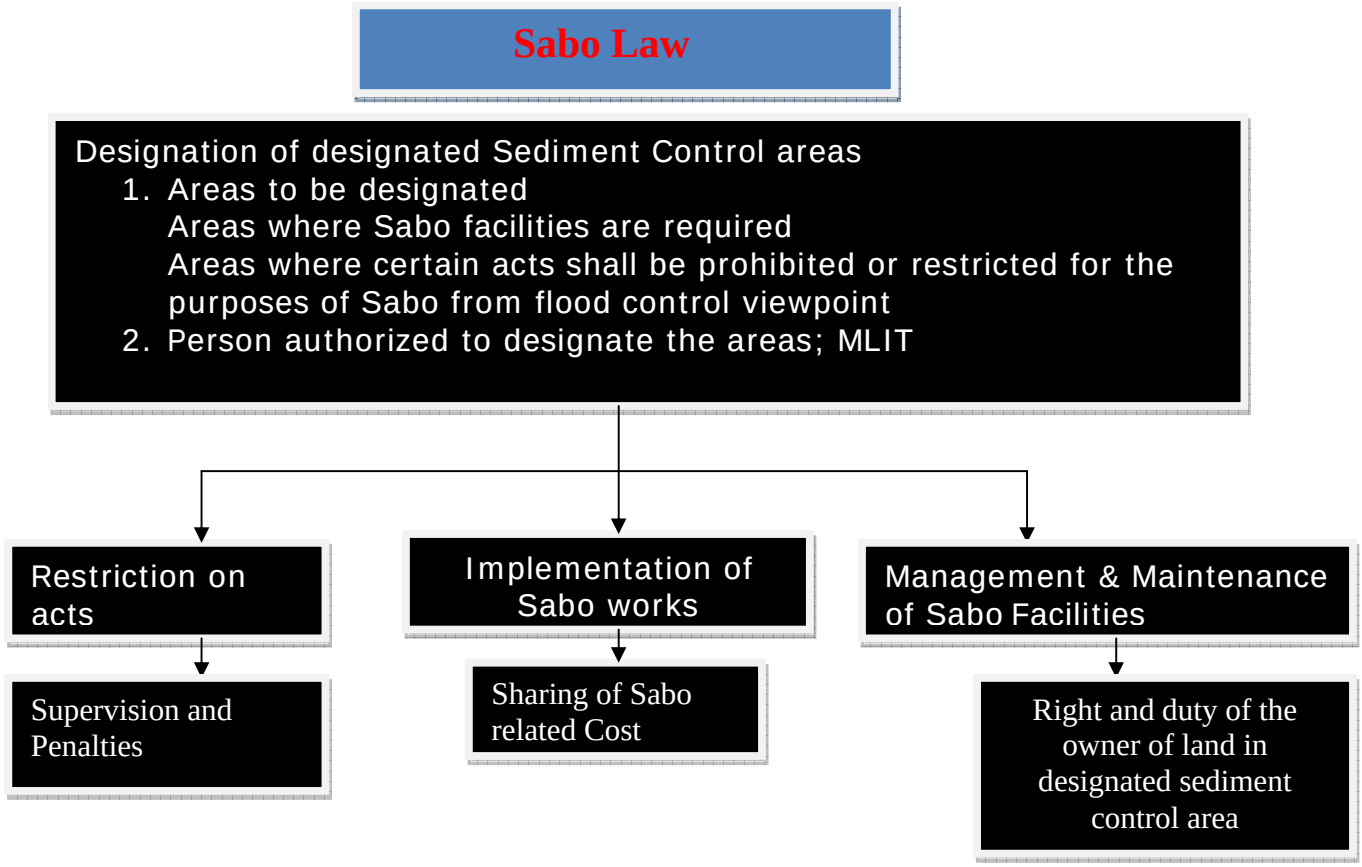
6.3 Today's Sabo

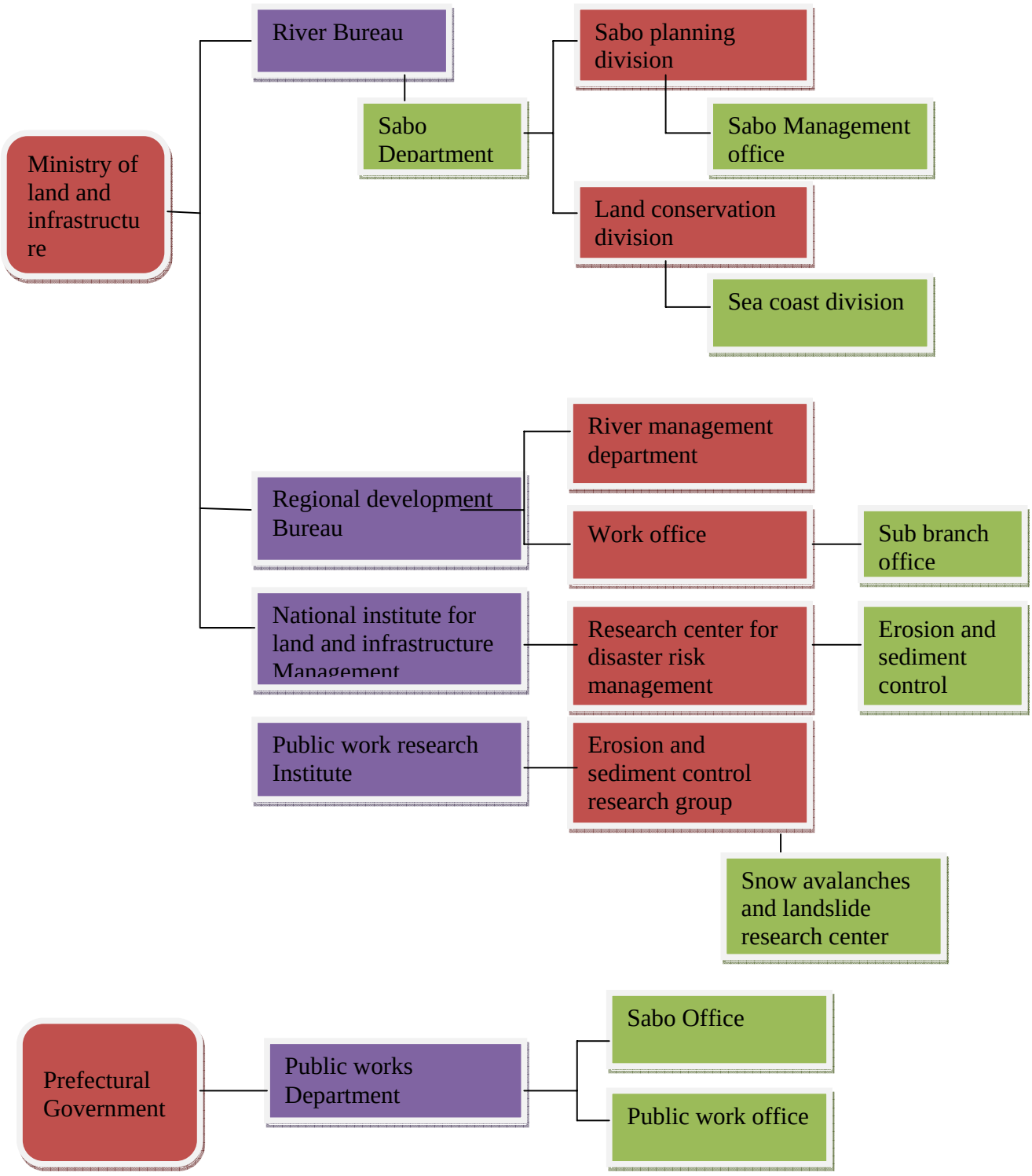
The Sabo Project can be classified by operating body into those under the direct management of National government and those subsidized by the government and those executed by Prefectures. As per the Law, the National government may directly conduct the execution of construction when-construction cost is considerable high and difficult, if necessary to prevent others prefectures interest and not limited to one prefecture.

There are also possibilities of subsidized Sabo projects. Major projects can be classified broadly as:

a) Disaster prevention- These will include Sabo dam function enhancement and general Sabo project.
b) Regional Development- These includes hometown Sabo projects, safe community model project, land space creation project and snow control Sabo project.
c) Environmental Development- These consists of green belt creation in urban areas, vegetation protection and landslide/slope failure etc.

Sabo related Administrative Organisation




Ministry of land and infrastructure
River Bureau
Sabo Department
Sabo planning division
Sabo Management office
Land conservation division
Sea coast division
Regional development Bureau
River management department
Work office
Sub branch office
National institute for land and infrastructure Management
Research center for disaster risk management
Erosion and sediment control
Public work research Institute
Erosion and sediment control research group
Snow avalanches and landslide research center
Prefectural Government
Public works Department
Sabo Office
Public work office

Steel grid Sabo Dam at Mt. Rokko

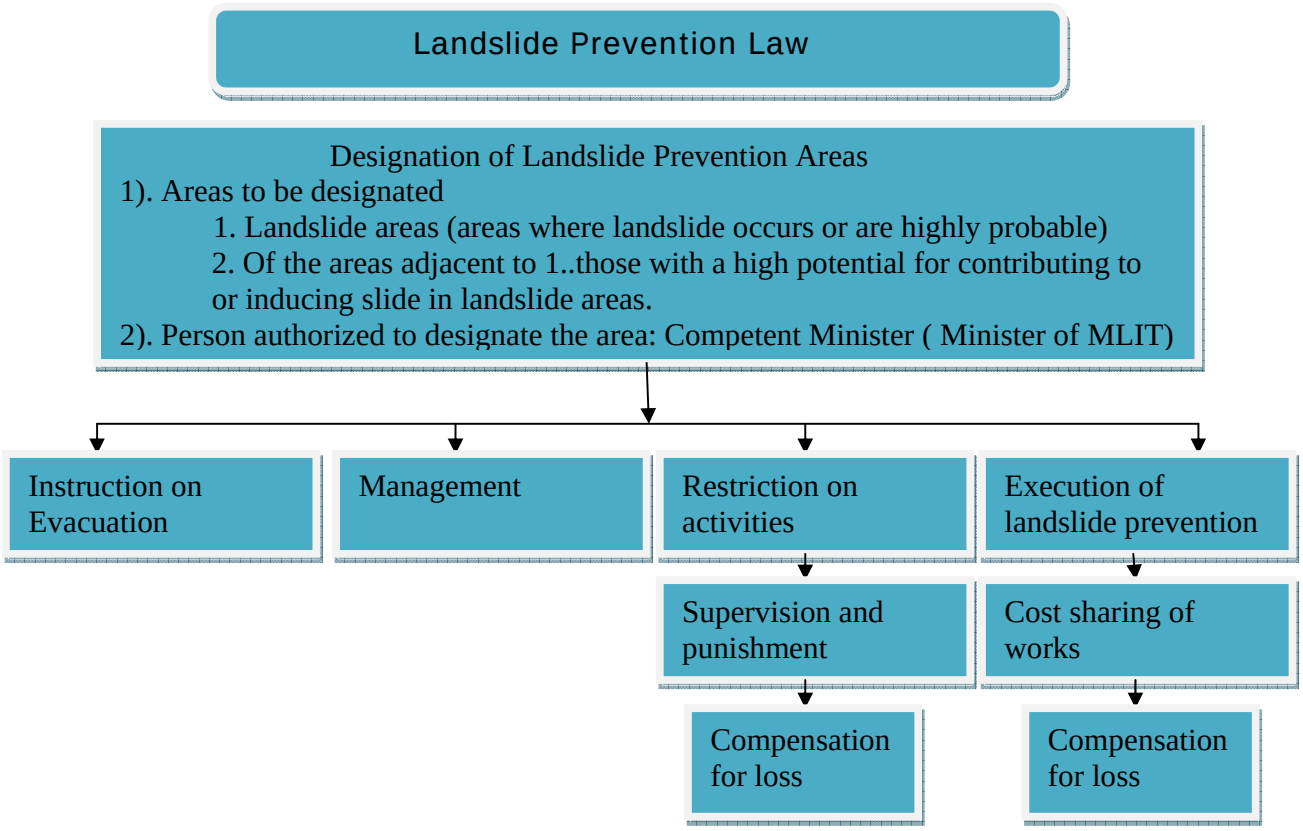
6.4 Laws for prevention of sediment related Disasters

For the purpose of conserving the national land protecting the lives of the people of Japan, various Laws have been come into effect. These laws include ‘Sabo Law’, ‘Landslide Prevention law’, ‘Law concerning the prevention of Disaster due to collapse of steep slope’ so as to promote structural preventives measures and ‘Law concerning the promotion of Sediment related disaster prevention in Sediment related Disaster hazard area’ so as to promote non structural measures.

6.4a. Landslide prevention and control

Landslide disaster have frequently occurred in various parts of Japan including Yamagata, Nagasaki, Osaka, Saga, Ishikawa, Nagano, Toyama, Tokushima prefectures and have caused serious damage to the prefecture or region as well as serious impact on the economic activities of the people. This has led to the enactment of law as the fundamental measures including the promotion of landslide protection works, restriction on landslide inducing activities and house relocations. This landslide prevention law mainly focus on urban infringes and for the purpose of comprehensive landslide measures and was issued on March 31. 1958. In the same with Sabo law, the project under this Law is also implemented in three way as- directly by National government, those subsidized and by Prefectures.

The direct management and construction by National government is done only if the project goes beyond prefectural boundaries, prevention works is large and involve huge budgetary provisions and require high technology. One Project of this kind i.e. Yamato River System which is at Kamenose will be illustrated in the coming chapter. In the same manner there are Many Projects subsidized and under taken by the Prefecture also.

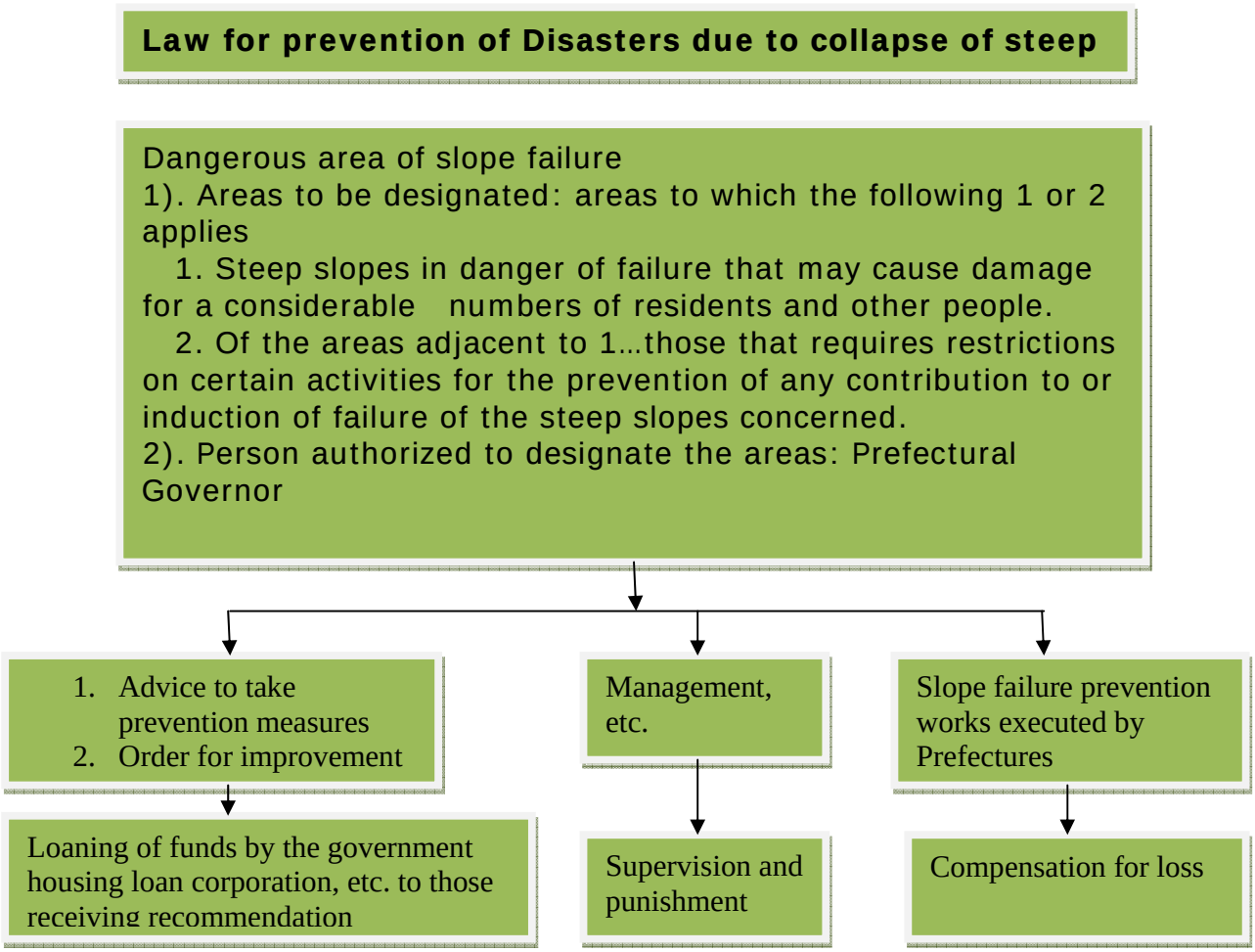


6.4b. Slope failure prevention

Although settlement in Japan from ancient time is all towards the plain and flat land but due to the inadequacy of land to accommodate the increasing population, some people are now forced to live in mountainous region which poses danger. In short people moves towards hills due to scarcity of land in urban areas and accelerated the repetition of slope failure. So for a countermeasure against this possible threat the National Government in the year 1967 decided to bear 50% of the expenses towards slope failure works.

At the same time slope failure which was not applicable under both the Sabo Law and Landslide Prevention Law needs to be separately defined. Various measures like possibilities of slope failures, areas that could be damaged by slope failure, restriction on harmful activities, relocation of houses, establishment of warning and evacuation and preventives measures are to be identified. In the mean time incidents like serious damaged due to

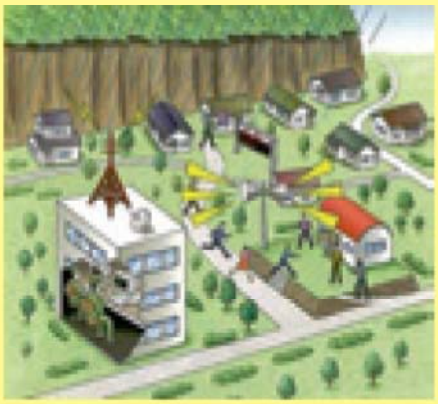
heavy rain at Nagasaki, Saga, Hiroshima, Hyogo prefectures in the year 1967 and slope failure in Kobe in the same year gives alert to the requirement of Law. These has led to the enactment of law on prevention of disasters due to collapse of steep slope commonly known as Steep slope Law on July 1, 1969.



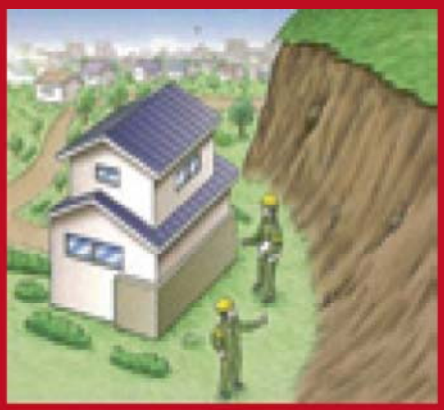
6.4c. Sediment Related Disaster Prevention Law

On June 29, 1999, an intensive rainstorm hits a region stretching from Hiroshima to Kure city as the seasonal rain become active and claimed the lives of 24 peoples due to sediment disaster. This incident has led to the enactment of law for promotion of measures for sediment related disaster which is called Sediment Related Disaster Prevention Law on May 8, 2000. This Law has no provisions of work as structural measures but to protect the citizens from sediment related disaster by non structural measures through warning and evacuation systems, restriction on new land development for housing etc.

Measures taken in warning areas

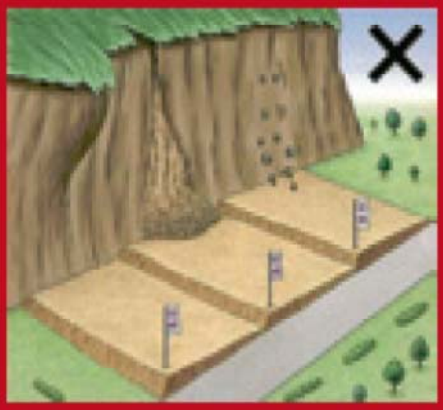


Establishment of warning and evacuation systems
To protect human life from sediment－related disasters, a warning and evacuation system is established for faster communication of disaster information and evacuation orders. (Municipalities)

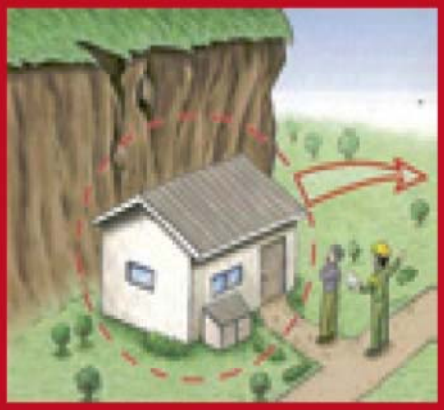


Regulation on building structures
Buildings with a living room are subject to building certification to ensure the safety of the structure against assumed impact. (Local public authorities with building officials)

Further measures taken in hazard areas



License system for certain acts of development
Development with the aim of selling residential lots and houses and constructing social welfare facilities, etc. is permitted only if it meets the criteria. (Prefectures)



Relocating buildings
Advice to relocate houses, etc. is given to the owners, etc. of buildings that may suffer great damage. (Prefectures)

6.5 Broad mechanism of various measures

a). Landslide prevention works- Ground water is drained and piles are driven into the ground to prevent the ground from starting to move and sliding downward.

b). Sabo dam- Sabo dam controls large amount of sediment outflow like a debris flow without causing damages along the downstream.

c). Slop failure prevention works- Protects people from disasters caused by a slope failure.

d) Debris flow prevention works- A Sabo dam with a sand pool is constructed where a debris flow runs down and is deposited so as to directly receive and capture a debris flow.

e). Hillside works- Vegetation works, land retainer and drainage works are given and installed on mountain and hillside to restore vegetation and prevent slope failure and sediment runoff.

f). Avalanches prevention works- Protective fences are installed to protect local community from snow avalanches.

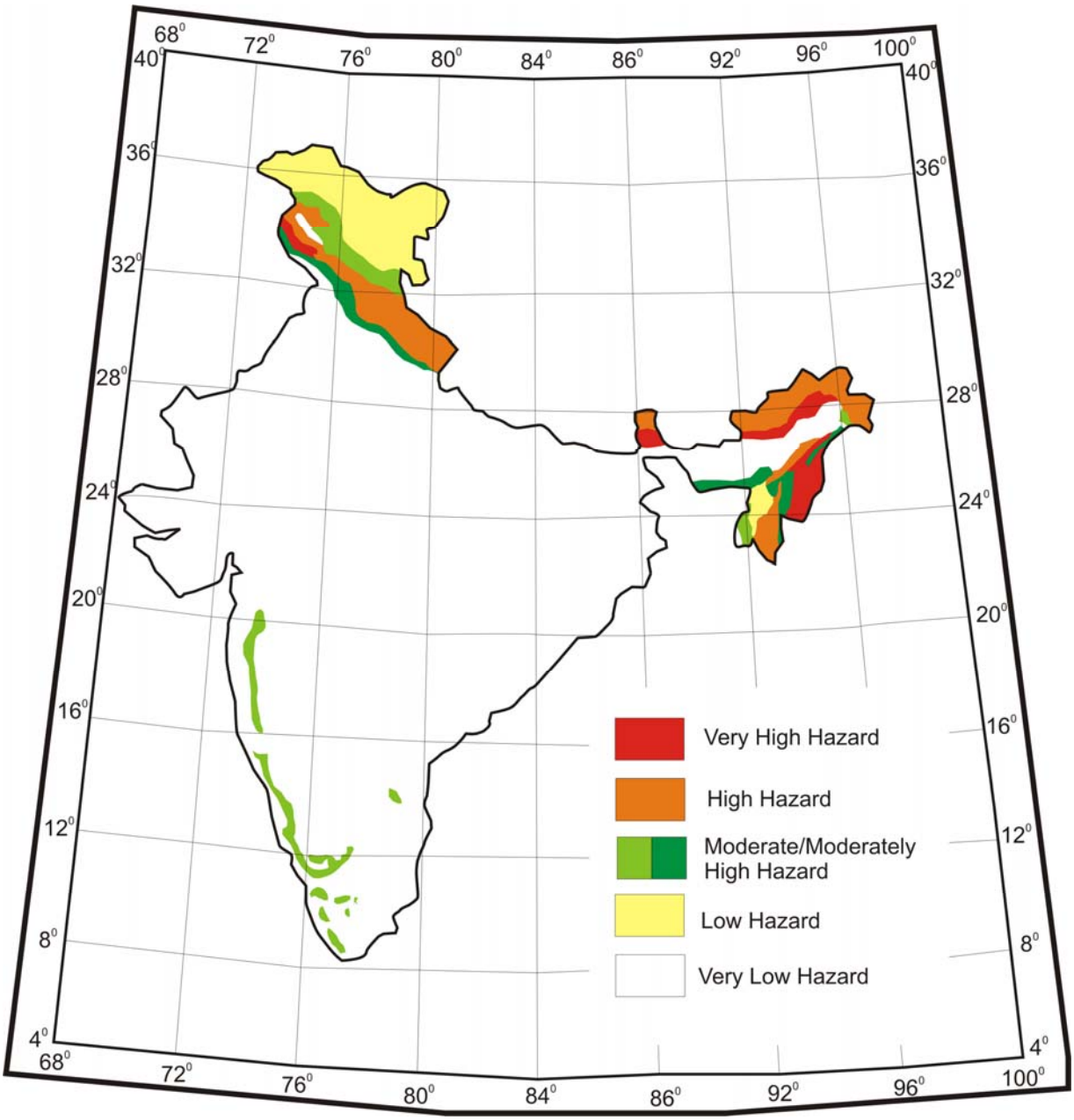
g). measures against woody debris- Slit type dams are built to effectively check the run off of fallen trees by wind or other causes.

h). Sabo for volcanoes- Protects people from pyroclastic flow, debris flow and lava flow accompanied with volcanic activities.

7.0 Overview of Landslide in India

About 12.60% (0.42million sq. km) of the total land area of the country excluding snow covered area is prone to landslide in India. Out of this 0.18 million sq. km falls in North East (Mizoram, Assam etc) and Himalayan region, 0.14million sq. km falls in the north west(Jamu & Kashmir, Himachal and uttarakhand) and 0.01million sq. km in Eastern ghat of the country. In India the risk to landslide is high due to the increasing population, infrastructural development and growth of hydropower in the hilly region. Apart from this the country's plan and action to have better connectivity like new roads, railway lines, tunneling are very much success. Despite the great achievements in such development, the growing constructional activities in these sectors do brings some unavoidable

imbalance in the country (Landslide/Debris Flow) which if not manage properly can cause serious damage and may results in loss of life and property. Some spectacular events of tragedies are reported as Varnavat landslide, Uttarkashi District, Malpha landslide Pithoragarh district, Okhimath landslide in Chamoli district, UK and Paglajhora in Darjeeling district as well as Sikkim, Aizawl sports complex, Mizoram. These are some of the more recent examples of landslides. Hence this challenging task of mitigation and preparedness from possible disaster now lies with the Administrator, Planners, Engineers and Scientists.



7.1 National Disaster Management Authority Guidelines on Landslide

In an effort to tackle the destructive potentials and reduce the consequence of losses due to landslide, The National Disaster Management of India(NDMA) felt necessary to have a national guideline. A series of consultation and workshop consisting of experts, stake holder, national and state officials was held during drafting of the guideline for mitigating a risk emanating from landslide. So a guideline named 'National Disaster Management Guidelines-**Management of Landslide and Snow Avalanches**' was finally published on June 2009. The main objectives of these guidelines are to institutionalize the landslide hazard mitigation effort, to make the society aware of the various aspects of landslide hazards in the country and to prepare the society to take suitable action to reduce both risk and cost associated with this hazard. The vision is that all the National and state disaster management Plan for landslide will be formulated and implemented under the overall framework of the Guidelines. It also envisioned an improved administrative response, bringing together the relevant scientific, engineering, construction, planning, and policy capabilities to eliminate losses from landslide. As per the plan for implementation of these guidelines, there will be Central policy statement and plan, State policy and plan, and District plan. Also it gives responsibility to the district administration for constituting village level disaster management committee.

The guidelines on Landslide suggested two main strategies, i.e. pre-disaster prevention strategies and post disaster management. Pre-disaster prevention strategies include assessment of the hazard, risk analysis, hazard zonation mapping and the application of modern techniques. Remediation practices includes slope geometry correction, retaining structure, nailing, bolting, anchoring, piling, geo-textile and afforestation etc.

7.2 Regulation and Enforcement

The following codes and Guidelines related to landslide has been finalized and published by the Bureau of Indian Standard (BIS):

a) Is:14496 part 2. Guidelines for the preparation of LHZ maps in mountain terrain.
b) IS:14458. Guidelines for retaining wall in hilly Areas.
c) IS: 14680. Guidelines for landslide control
d) IS: 14804. Guidelines for Siting, Design and selection of materials for residential buildings in hilly areas
e) National Building Code 2005

7.3 Landslide Nodal Agency

The Government of India has declared the Geological Survey of India (GSI) as the 'Nodal Agency' for landslide India on 29 January 2009 at the national level. This GSI has been responsible for undertaking and coordinating landslide investigation and formulation of mitigation measures. They undertake mapping and in the year 2013 they covered more than 50000sq.km area through landslide susceptibility mapping on 1:50000 scale. They updated the landslide data base of the country through landslide inventory work. They also undertake site specific landslide investigation for mitigation measures for roads work. The GSI at the national level is guided by the following action plan:

A). Finalization of uniform methodologies for landslide hazard Zonation on macro and meso scale.

b). Carrying out Landslide Hazard Zonation of vulnerable areas an macro scales.

c). Carrying out monitoring of landslide.

d). Evolving an Early warning system.

e). Preparing inventory/ database on hazard zone.

f). Carrying out landslide hazard zonation of identified areas on meso scales.

g). Take up awareness programmes in consultation with state government.

h). Do coordination works with any agency performing mitigation of landslide in the national as well as the state level.

7.4 Institutional Mechanism

The nodal agency for Landslide i.e. Geological Survey of India(GSI) has the responsibility to prepare Landslide management Plan(LMP) base on the guidelines laid down by NDMA. The development and implementation of this plan will be a coordinated programme of NDMA, GSI, and the national, state, district and local administrations.

In the same pattern with National Disaster management Act 2005, there is a National Executive Council (NEC) responsible for preparing the national plan on the basis of guidelines, approved by the NDMA which is for operation. The National Disaster Response Force(NDRF) has the responsibility of field and response action.

The State Disaster Management Authority (SDMA) Constituted by each state government under the chairmanship of their Chief Minister each laid downs their plan and policies for landslide DM in the state.

At the District level, The District Disaster management Authority (DDMA) headed by the District magistrate with the elected representative of the local

authority performed the planning, coordinating, implementation of DM in accordance with the guidelines laid down by the NDMA and SDMA.

Local bodies or Authority carry out relief, rehabilitation and reconstruction activities in the landslide affected areas and prepared the DM plan in consonance with the guidelines of NDMA, SDMAs and DDMAs.

7.5 Financial Arrangement for Landslide Management

The various measures for landslide management as per the plan is funded by the central ministries/departments and state government concerned by making provision in their five year plan and Annual plan. Sometimes depending on the cases special additional fund is made available through special mitigation projects which are formulated and implemented by the state government/ SDMA under the guidance and supervision of NDMA. Besides this, 10% of the Calamity Relief Fund (CRF) is sometimes utilized for purchase of equipment for landslide mitigation and preparedness and for rescue and relief operations.

7.6 Zonation and Cause

Landslide Zonation Mapping is a modern method to identify landslide prone areas and has been used in India since 1980's. The major parameters that calls for evaluation are as follows:

a). Slope- magnitude, length and direction.

b). Soil thickness.

c). Relative relief.
d). Drainage pattern and density.
e). Landslide affected population.

Landslide is usually caused in India by:
a). Poor ground condition.
b). Geomorphic Phenomena
c). Natural physical force.
d). Quite often due to heavy spells of rainfall coupled with impeded drainage.

7.7 Most worst landslide in India

The following are the most worst landslide in India:

a). Guwahaty landslide, Assam, 1948- Over 500 peoples died.

b). Darjeeling landslide, West Bengal,1968- Around 1000 peoples died.

c). Aizawl landside, Mizoram, 1992- 67 peoples died

d). Malpa landslide, Uttarakhand, 1998- Over 380 peoples died.

e). Mumbai landslide, Maharashtra, 2000- Around 67 peoples died.

f). Amboori landslide, Kerala, 2001- Around 40 peoples died.

g). Kedarnath Landslide due to flood, Uttarakhand, 2013- Over 4200 reported dead

h). Aizawl landslide, Mizoram,2013- 17 peoples died

i). Malin landslide, Maharashtra,2014- Around 150 peoples died.

7.8 Landslide remediation Practices in India

There can be many reasons affecting the stability of slopes. The most common that triggered landslide are- excessive rainfall, earthquake and human interference. To improve the stability of slope, geotechnical investigation is the foremost important thing. The following are the main remediation measures to improve the stability of slopes in India:

a). Drainage works: Surface drainage works to minimize the infiltration of water into the ground and sub- surface drainage works to remove the ground water from within the land mass is covered under this work. Surface drainage work may include drainage collection work and drainage channel work where as sub surface drainage work will include gravity drain, drainage well and tunnel.

b). Soil/Debris removal: This type of treatment which is very common in India is very effective for small to medium landslide. The soil mass is remove from the crown area downward under this method.

c). Check dams: Check dam is mainly used for prevention of scouring and erosion of the channel bank.

d). Restraining structures: These include pile works that act as a key to tie together the moving landslide and the stable ground to restrain movement, anchor and bolt works that utilize the tensile force of anchor bodies embedded through the slide mass and into a stable earth. The

construction of retaining wall and breast wall to check the movement of earth along the toe portion is included.

e). Slope Bio-engineering: The slopes covered with vegetation or afforestation not only provide effective covering to slope but also improve the shear strength of the material through root network.

f) Wire mesh: Sometime used of wire mesh is very effective in protecting slope with weathered rock.

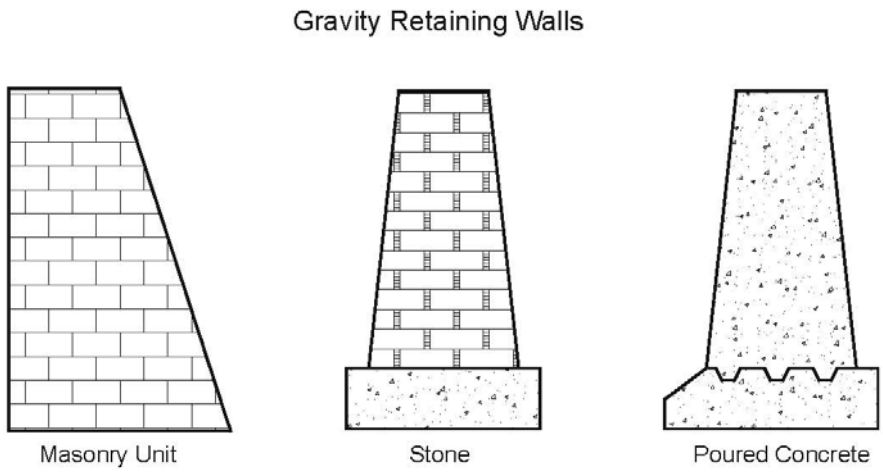
Also the stabilization of slope can be achieved by improving the mechanical characteristics by means of two approaches:

1). Through insertion of reinforced elements like nailing and grouting, networks of micro piles, column and anchors etc.

2). Also mechanical characteristic of the soil can be improved by thermal treatment or by electro-osmotic treatment.

7.9 Gravity Retaining wall in India

Retaining walls are structures designed to restrain soil to unnatural slope. Also it is constructed to resist the lateral pressure of soil when there is desired change in ground elevation that exceeds the angle of repose of the soil. In India retaining wall is commonly used to tackle the problems of landslide in hilly areas by stabilizing the fill slopes and cut slopes. For protection of slopes in the roads and residential purposes gravity retaining wall and breast walls are generally used. The material mainly use for construction of retaining walls are stone, cement, sand, gravels and sometimes steel. They are constructed in three types like stone masonry retaining wall, stone wall and concrete. For guiding purposes Bureau of Indian standard (BIS) has developed Indian Standard: Retaining wall for hill Area- Guidelines part 1, 2 and 3 and these guidelines are presently used for construction of retaining wall.



8.0 Major Sites Visited related to disaster During the Research

As the visiting research program is a kind of knowledge sharing and learning from experience, various sites had been visited and many interesting presentation were attended during the research. These sites includes The Great Hanshin Awaji earthquake memorial, fault line at Awaji island, Sendai (minamisanriku), Tokyo (Tokyo Rinkai Disaster prevention park, Honjo life safety learning Center etc.), Nagasaki Atomic bomb museum, Mt. Unzen Fugen active volcano,Kamenose landslide mitigation measures near Yamato River, JMA Osaka, Higashinada Sewerage treatment plant, Mt. Rokko Sabo works, Tsunami Disaster Observation Center Osaka, Kobe university, Kanso technos for slope reinforcing method, Hyogo prefecture Emergency Management and training center, Kobe city Fire control Room, Hyogo police Headquarter etc. The following are the major sites specially related to our research in brief:

8.1 **Nojima fault Museum in Awaji island:**

On 17th January 1995 there occurred a big earthquake causing serious damage to the Hyogo prefecture. This earthquake is named The Great Hanshin Awaji Earthquake and caused 6434 deaths and injured 43,793 peoples. The focus of the earthquake located 16kms beneath its epicenter on the northern end of awaji island. The tremors lasted for approximately 20 seconds and during this time the south side of the Nojima fault moved 1.5m to the right and1.2m downward. In other word the displacement at Nojima fault was 1 to 2 meter during the earthquake. This fault had been preserved within the museum and we can see the real fault having a length of around 140 meters. This earthquake has a magnitude of 7.3 as per JMA.

8.2 The great east Japan Earthquake and Tsunami:

The earthquake that triggered powerful tsunami waves that reached a height of up to 40.5metres in the eastern coast of Japan on 11.3.2011 is named the Great East Japan earthquake or Tohoku Earthquake. The tsunami waves reached 10kms in land and causing a total death of 15,894, missing 2562 and injured 6152 peoples. The affected areas around Sendai had been

visited during the research and some survivors were met and guided us during the tour and we found very informative and interesting to hear the real storyDisaster. The earthquake and Tsunami caused extensive and severe structural damage in north east Japan including heavy damage to roads and railways as well as fire in many areas. Also it is heard from the Tohoku University Asst. professor that the Tsunami is larger than they expect and Tsunami wall reduced the effect of waves.

8.3 Tokyo Rinkai Disaster Prevention Park:

The government of Japan developed The Tokyo Rinkai Disaster Prevention Park which will act as a central base of operation as well as institution that compile disaster related information and coordinate emergency disaster measures in the event of large scale disaster. We along with JICA trainees visited this Disaster Prevention Park which is in the Tokyo Bay Waterfront Area. The visit is so interesting and informative that National Government of Japan really prepared for future disaster. It is said that the park would accommodate around 150 numbers of top officials and experts that in the case of major disaster the area would serve as National control room. The reasons of development of the area, the aims, the objectives and the plan are very much interesting. The facilities like stockpiling, operation room, medical facilities, power back up, communication provisions, helicopters and earthquake reducers etc. are very interesting.

8.4 Atomic bomb museum at Nagasaki

The Atomic bomb Museum which was visited during the research gives us the idea of damaged that can be led by war disaster. It is evident from the museum that the radiation and rays produced has a very large disastrous affect for long years. At the same time the effort and action started from the incident for disarmament of nuclear is very much praiseworthy and supportive for a better tomorrow.

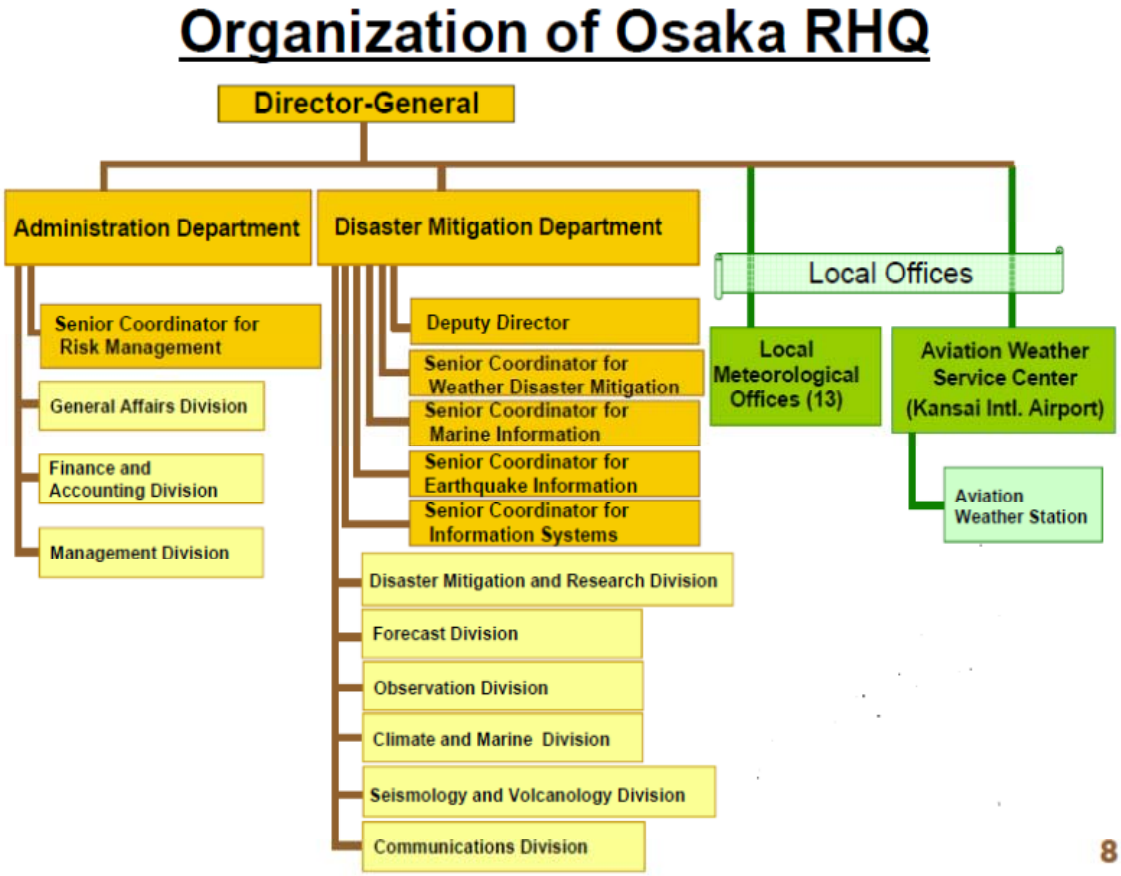
8.5 Mt. Unzen Fugen Active Volcanic:

The active volcano of Mt. Unzen is located at Shimabara of Nagasaki Prefecture. From the presentation done by the staff and guide of Unzen Recovery Office we can get a clear picture of the last eruption. The effect of pyroclastic flow, the debris and lava flow, the accumulation of lava in the creator called lava dome are very informative. The 24 hours monitoring and unmanned vehicles working are very impressive.

8.6 Japan Meteorological Agency (JMA),Osaka:

JMA, Osaka is one of the six regional Headquarters of Japan meteorological agency which served as regional meteorological center for Kinki region that consist of six prefecture. Its responsibility is to direct 13

local meteorological offices, one aviation weather service center located in Kinki, chugoku and shikoku region each. Also it serve as local meteorological office for Osaka prefecture.It is designed to provide backup operation for the JMA headquarter, Tokyo in case of its loss of functions that may arise due to disasters.



8.7 Miki Disaster prevention park, Hyogo:

The prefectural government of Hyogo developed a park for multipurpose facility to apply in case of disaster. This park is a nucleus facility which covers all areas of the Prefecture and would serve as a central base for rescuing the people at the time of disaster. Presently or not in the time of disaster this area is functioned as a normal disaster prevention center, sport activities and a kind of recreational space. The prefectural government developed this area to have various facilities like athletic stadium and gymnasium to responsible for supply base, tennis court to serve as assembly and accommodation relief workers and base ball stadium responsible for

temporary heliport etc.

8.8 Kamenose Landslide Mitigation Measures:

Recurrent large scale landslide movement always occurred in the area of Kamenose in Kashiwara City in Japan resulting in the clogging and flooding of the Yamato River, destruction of railway, closing of national highway and structures during 1900 to 1967. The last large scale landslide in the area occurred in 1967 which triggered sliding in the ridge area. As per the geotechnical investigation done in the area the depth of the slide mass on average is 30 to 40 m with the deepest part of the slide exceeding 80 m. The total landslide area is 87.2 ha and consist of two areas the ridge area and Shimizutoni area.

The comprehensive mitigation of landslide works started in 1962 under the management of National government though some efforts have been done earlier by local authority. Almost all the mitigation measures or technique has been applied in this area for making the area stable. This measures include tunneling, drainage well, surface drainage, horizontal gravity and vertical drainage works, steel piling and even soil removal. Also the mitigation works was continued with the installation of caissons piles with a maximum diameter of 6.5 m and length

100 m. The major mitigation works was completed in the year 1986 and found very successful and now the area appeared to be in stable condition.

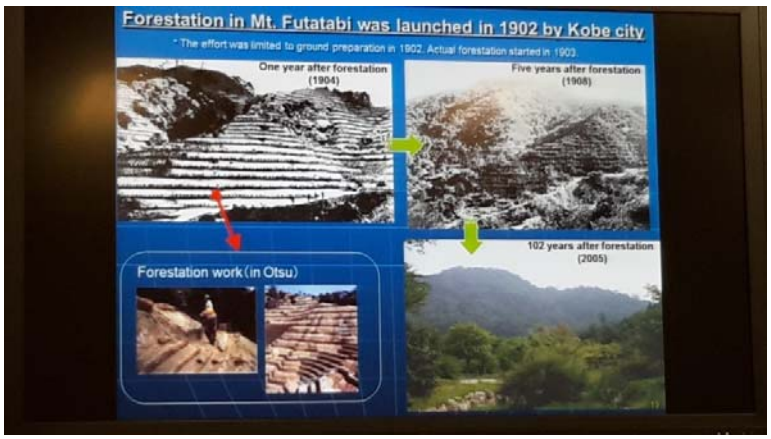
As the Kamenose landslide control measure is felt very important by the Japanese Government because of social and economic importance, the mitigation works also included software type measures consisting of an automated monitoring system which was started in 1986. The system consist of instruments to obtain real time data such as tiltmeter, rain gauge and extensometer etc. which are place on the ground for watching the behavior of the slide.

8.9 Sabo Works for Rokko Mountain

Rokko mountain which is within the Hyogo prefecture plays an important role in the peoples of the surrounding cities especially for Kobe city. The mountain which is originally fragile had been heavily weathered and devastated hundred years back but had now been protected and green because of the effort of the people and government. On the other hand urban area is spreading upward on to the Rokko mountain as the people of Kobe concentrates in a very narrow area along the coast line and the foot of Mt. Rokko. This has led to the high risk of landslide and the requirement of maintaining the area in a systematic manner that will avoid sediment related disasters.

As such being the condition the Sabo Office under the Ministry of Land and Infrastructure, Japan had under taken development of Sabo facilities, Rokko mountain Greenbelt and warning and evacuation system. These activities had led to the stability of the mountain slopes and reduction of sediment run off and avoid disasters. The Sabo dam constructions are mainly for protection of houses at the downstream from sediment run off and woody debris and usually consist of concrete dam work and steel frame work. The slope protection measures consist of wire mesh work/ netting, anchoring and soil nailing. Also the hillsides facing directly the residential areas or urban areas with a very high risk of collapse are reinforced with steel. The green belt activities are done with the goals and concept of prevention of sediment related disaster, prevention of urban sprawl, healthy urban environment and healthy recreational area. For this greenbelt project community as well as some institution also participated for awareness and plantation. Also the Sabo office install debris flow sensors and debris flow monitoring cameras at 56 locations and shared the information to Municipalities for early warning and evacuation purposes.

The various works implemented are very successful and bears a good fruit that the mountain is now green and became sound forest, the sediment run off are now checked and debris flow reduces with the construction of around 300 nos. of Sabo dam and the slope is now stabilized. This could be known through the



comparison of damaged led by the sediment related disasters and visual seeing of the new green forest in the area.

8.10 Various Functions and Presentation attended

During the research so many interesting and important functions and presentations are attended. These are very useful and impressive that it can gives us thorough knowledge and understanding on the subjects. The main subjects are; DM in Japan, drills, GHAE, GEJE, Community volunteer group (Bokomi), International Recovery Forum by IRP, DRA forum 2016,evacuation drill for handicap, reconstruction and recovery from disaster by IRP, Sewerage treatment plant design for earthquake resistant, building regulation in Japan by DRI, Mt. Rokko Sabo works by MLIT, on-site visualization by prof. Kobe university and natural slope prevention method by Kanso Technos Engineer etc.

9.0 Broad Observations and Findings through the Research

As stated earlier many sites have been visited and various lectures/ presentation have been received during the research program which gives us information, ideas, lessons, knowledge and even impressions. The following are the main observations and findings:

9.1 Brief comparison of Landslide in India and Japan

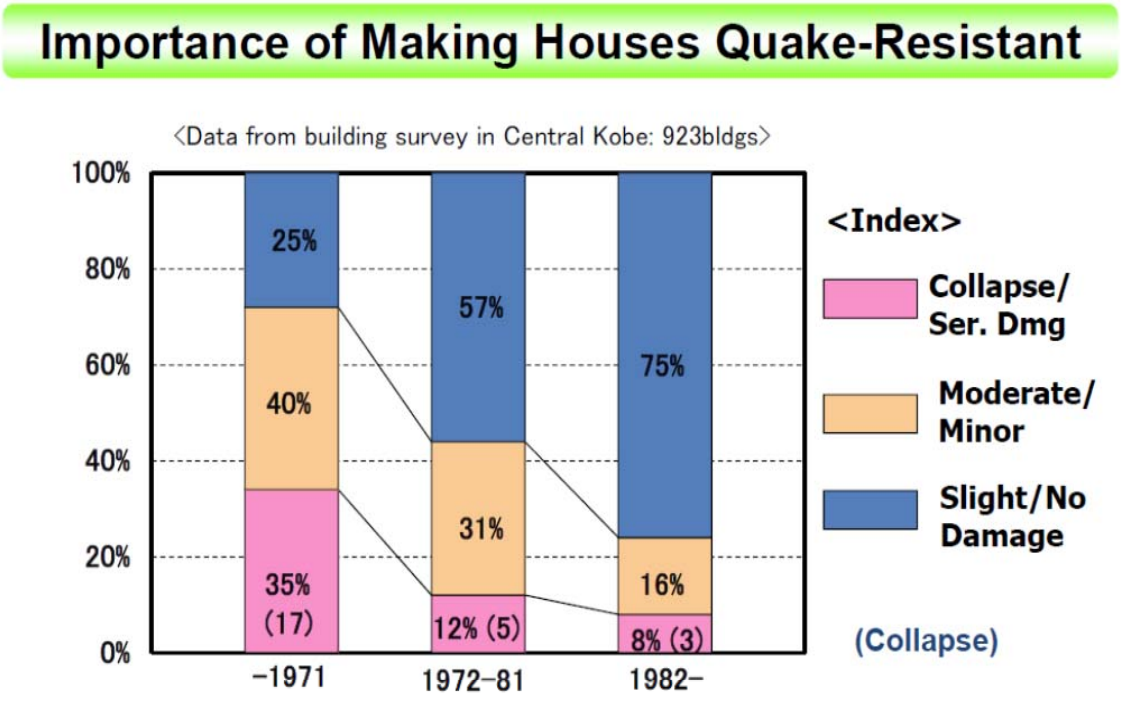
In India especially in the North East the terminology used for landslide and its meaning is not far from slope failure and both are usually mixed up and there seems to be no clear cut differentiation unless technical. The sediment related disaster at the same time is also not so common though it occurs at some places. The existing problem which is very much popular in the urban areas is the landslide due to human action like cutting of slope for residential, roads and for some activities (cut slopes). This happens due to unregulated cutting of the side or base of the mountain for leveling the ground for either road or residential purposes. The slope protection after cutting is usually by stone masonry retaining wall or sometimes reinforced

and by gabions wall. This retaining wall is not intended to stabilize the slope failure but to support the active or passive earth pressure from the possible failure wedge. In urban area the regulation and control lies in the hands of Town planning Authority or Municipal concern as per the building code or Master plan of a city. In Japan the slope cutting regulation had been restricted right from the ancient time and it goes along with the protection of mountains. In modern days there is a separate law for controlling the slope protection other than landslide and sediment disaster. In short the slope protection strategy is better equipped with law in Japan than India. Further the regulation of city is also done in such a way that the urban growth towards hillside is controlled and not promoted which results in lesser cutting of slopes. Therefore the main problems in Japan is not the landslide but the sediment run off where as in India landslide due to cut slopes is the larger problem than sediment run off in Urban areas.

Regarding remedial measures the method or technology adopted is very much similar in both the countries. The most commons are soil removal, retaining wall, gabion wall, wire mesh, piling or anchoring, underground and surface drainage, and some kind of green belt project.

9.2 Effectiveness of Seismic design

It has been said and learnt that the major incident in Japan has led to the enactment and amendment of disaster related laws and regulations in the history of Japan. The most notable in the case of building regulation and safety is that the Miyagi Off-shore Earthquake 1978 has led to the amendment of Building Standard Law by introducing new seismic codes in the year1981. It can be seen in the housing collapse data of the Great Hanshin Awaji Earthquake 1995 that more than 80% of the fatalities are due to collapse building. As many buildings that are built before 1981 do not comply with the seismic code there is a lot of damage during that earthquake and the building after the inclusion of seismic code suffer very less. Therefore it is evident and clear the effectiveness of seismic code in the building standard law for earthquake. ‘This gives me a great faith in Japan’s building Codes’ said Hong kong University’s Charles schencking, a historian who studies earthquake in Japan. Further the Great Hanshin Awaji earthquake 1995 has led to the establishment of the Promotion of seismic Retrofitting of building 1995 and enforced in the same year.



As far as it is known that in India even a place or region lying in the zone –v also do not insist design of earthquake resistant in building regulations and seeing the effectiveness of it, it is suggested to look the matter and take necessary action by the authority in this regards.

9.3 Landslide/ Sediment related Disaster mitigation measures works

The landslide or the sediment related disaster measures have been very successful in Japan. It has been learnt from the Sabo engineer that out of the construction of around 500 nos. of Sabo dam, they never experience structural failure. This clearly shows the reliability of the technology and workmanship. At the same time the landslide mitigation measures adopted at Kamenose like the control work and restraint works makes the area stable. The control works like soil removal, surface drainage and underground drainage improved the stability of upper slopes and the restraint works like steel and concrete piles stops the movement at the lower slopes.

The Green belt activities and the soil stability project at the Rokko mountain is really challenging and impressive. The plantation of deep rooted trees with the participation of the community works very well in the area. The mountain which has been devastated is now green with the proper approach of forestation. This green belt project improves the stability of slopes through the root network and reduces the debris flow. Also the application of anchoring and wire mesh netting protect the slopes very well and reduces slide.

9.4 Disasters can be larger than the expected

Though the Japanese has a culture of disaster preparedness with systematic training and evacuation drill at school and community etc., the Great east Japan Earthquake and Tsunami 2011 is disastrous and beyond the expectations. As per the post disaster analysis it is said that it was a high impact with a low probability of occurrence. It was the first ever recorded that include earthquake, tsunami and nuclear power plant accident. The GEJE is said to be the costliest earthquake in the history of the world and the estimated economic damaged is 16.9 trillion Yen.

It has been known from the site visit and from interaction with survivors that the probability of occurrence and size is small but comes with larger forces and impact. The real tsunami at that time is far greater than that is indicated in the hazard map. This underestimate of the size of earthquake and tsunami makes the people delay in evacuation and prolong in their exposure to danger which finally leads to larger impact. Hence the awareness of probable happenings of disaster larger than the prediction or forecast is really important.

9.5 Preparedness for Disaster

During the research various places relating to disasters and its preparedness have been visited. Among this The Tokyo Rinkai Disaster Prevention Park, Mikki Disaster Memorial Park, Hyogo and Japan Meteorological Agency (JMA) are worth mentioning in term of preparedness. The facilities available in the above stated two parks like stockpiling, control room, evacuation center, medical equipments, power backup and so many others are really praiseworthy. The national level preparedness and the prefectural level preparedness to safeguard the citizens from disaster are an interesting things to watch and learn. Also the local level preparedness for disaster like drill, consultation with handicap and awareness to the children are impressive.

The role of JMA to provide information on weather and monitoring of earthquake, tsunami and volcano is very much interesting. The forecasting service of JMA covers a wide range of information such as forecast, warnings and advisories. This really served as preparedness in disaster such as wind disaster, sediment related disaster and flood disaster. Apart from the weather forecast, the forecasting and analysis for typhoon is very useful for prevention from disaster. The information provided by JMA on hypocenter, magnitude and seismic intensity plays a vital role as a trigger for initiation of rescue and relief activities. Also the early warning system done through local TV and mobile handset is learnt to be very useful in the past experienced.

9.6 Enactment and framing of relevant laws

After focusing in to the landslide or sediment related disaster during the research the important findings is that there should be relevant laws for the regulatory activities. Apart from Basic Disaster counter measures Act 1961, there are four numbers of laws and regulation concerning sediment and landslide. The Sabo law 1897, The Landslide Prevention and Control 1958, Steep slope Law 1969 and Sediment related Disaster Prevention Law 2000 are presently enforce within Japan which is found to be very effective in dealing Landslide and sediment related disasters in the country.

10. Conclusion

Because of the reason that the Country is prone to almost all the disasters due to geo- physical condition and climatic condition India is advancing in Disaster Management. Even though the prevention, Mitigation, preparedness, response, recovery and reconstruction activities in disasters are now in good pace at some levels, in some areas there are many shortfalls, deficiency and the ways that needs to improve in the management of disasters. At the same time what is practical to some country may not be effective in the country also. The remedial measures especially technology adopted for landslide and sediment related disasters in India and Japan are almost all same but the urgency, types, nature and even soil are of bit different. Through this research one thing which is clear in general is that the preparedness is to be improved. From the prevention side the existence of relevant rules especially for landslide is also a doubt besides the improvement required in technology. Being large parts of the country's area lies in fault zone, the consideration of seismic code in the building regulation is a challenging task. Let us learn from the past by assessing our self knowing the others practices and experience, reduce the vulnerability of all types of hazards and create a safer world for tomorrow.

11. References

1. www.ndma.gov.in, National Disaster Management Authority (NDMA) Guidelines, India
2. Guidelines on protection of landslide and Avalanches, NDMA
3. www.portal.gsi.gov.in, Geological Survey of India (GSI)
4. https://en.wikipedia.org/wiki/Landslide
5. https://www.unisdr.org/we/inform/terminology, UNISDR
6. https://en.wikipedia.org/wiki/Disaster
7. www.adrc.asia/, (ADRC)
8. Presentation on Disaster management in Japan, Cabinet Office, Japan
9. Presentation on Orientation of Visiting Researcher by Shiomi Yumi
10. Introduction to Building standard Law in Japan by Mr. Hagesawa Tomohiro, MLIT
11. Presentation on Rokko Sabo Office, MLIT, Kobe
12. Presentation on Yamato River Work Office, MLIT, Kamenose
13. Presentation from Disaster Management Division, Hyogo Prefectural Government
14. Presentation from Japan Meteorological Agency (JMA), Regional Headquarter, Osaka
15. Publication of Japan Sabo Association.
16. Report done by C. Rana, Government of Himachal Pradesh, India
17. Report done by Dr.Lalrokima Chenkual, ATI, Government of Mizoram.
18. Indian Standard, IS14458 (Part 1):1998, R/Wall for hill Area, part 1,2 and 3