Total Disaster Risk Management (TDRM)

Best Practices

December 2003

Asian Disaster Reduction Center
Foreword

Natural disasters have been increasing every year due to various factors such as urbanization, population growth, destruction of natural environment and climate change. Further, Asian region accounts nearly 90% of the totally affected people in the world.

This human suffering is happening more in developing countries, especially poverty-stricken countries, and catastrophic natural disasters cause enormous amount of economic losses, which sometimes exceed the GDP of these countries.

Natural disasters imply a negative factor to inhibit the promotion of sustainable development and therefore it is essential to conduct comprehensive disaster reduction activities in Asian region.

The Asian Disaster Reduction Center (ADRC) and United Nations Office for the Coordination of Humanitarian Affairs (UN-OCHA), Kobe, in consultation with stakeholders in Asia, formulated the Total Disaster Risk Management (TDRM) Approach.

This book is a draft edition of the concept and best practices of TDRM approach for pragmatic application and understanding. To mark the event of World Conference on Disaster Reduction in 2005, to be held in Hyogo, Japan, ADRC plans to publish this book as a user-friendly handbook on TDRM approach to be applied in Asian region for effective disaster reduction.

We wish, this handbook can stimulate a process of learning from best practices of TDRM approach and applying it to the future disaster reduction activities in the region.

December 2003

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Asian Disaster Reduction Center
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1-1. Impact of Natural Disasters

In Asia, natural disasters can be the biggest obstacle to sustainable development. Due to its geographical and geological conditions, Asia is prone to various types of natural disasters. The region accounted for 89% of all the affected populations of the world during the period 1975-2002, and almost 50% of all the economic damages reported in the world for the same period.

**Summary of Natural Disasters (1975-2002)**

<table>
<thead>
<tr>
<th></th>
<th>Number of Disasters</th>
<th>Number of Killed</th>
<th>Number of Totally Affected People</th>
<th>Amount of Damage (1,000 US$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>World</td>
<td>7,104</td>
<td>2,063,633</td>
<td>4,797,950,112</td>
<td>982,894,232</td>
</tr>
<tr>
<td>Asia</td>
<td>2,676 (38%)</td>
<td>1,182,637 (57%)</td>
<td>4,269,422,754 (89%)</td>
<td>480,536,348 (49%)</td>
</tr>
</tbody>
</table>

Source: ADRC, Japan and CRED-EMDAT, Universite Catholique de Louvain, Brussels, Belgium, 2002

**Totally Affected People by Natural Disaster in the World (1975-2002)**

(Source: ADRC, Japan and CRED-EMDAT, Universite Catholique de Louvain, Brussels, Belgium, 2002)
We have seen many countries, losing considerable amount of their gross domestic product or GDP by one single disaster event. Statistics show that the earthquake in Armenia in 1988 deprived the country of more than its annual GDP. The following Table shows a few countries where disasters caused severe economic damages.

<table>
<thead>
<tr>
<th>Country Name</th>
<th>Disaster Year</th>
<th>Disaster Type</th>
<th>Amount of Damage (Billion US$)</th>
<th>GDP (Disaster Year) (Billion US$)</th>
<th>Damage GDP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Armenia</td>
<td>1988</td>
<td>Earthquake</td>
<td>20.50</td>
<td>11.65</td>
<td>176%</td>
</tr>
<tr>
<td>Mongolia</td>
<td>1996</td>
<td>Wild Fire</td>
<td>1.71</td>
<td>3.68</td>
<td>47%</td>
</tr>
<tr>
<td>Yemen</td>
<td>1982</td>
<td>Flood</td>
<td>0.98</td>
<td>8.92</td>
<td>11%</td>
</tr>
<tr>
<td>Nepal</td>
<td>1987</td>
<td>Flood</td>
<td>0.73</td>
<td>12.79</td>
<td>6%</td>
</tr>
<tr>
<td>Lao, PDR</td>
<td>1993</td>
<td>Wind Storm</td>
<td>0.30</td>
<td>5.95</td>
<td>5%</td>
</tr>
</tbody>
</table>

These natural disasters can also be the biggest obstacle to social security of the affected population in these countries. Unfortunately, in recent years, we are seeing the increasing trend of numbers of natural disaster events and people affected by these disasters worldwide.
1-2. Defining Disasters

Natural hazard events themselves do not necessarily mean disasters. A strong typhoon over an uninhabited island, or a strong earthquake in a no-man’s land are just natural phenomena and not a disaster. Unusual heavy rainfall in a river-basin with good flood management system may result in increase of water in reservoirs and not in loss of life or property. We must bear in mind that only when natural hazards strike vulnerable societies or communities that they turn into disasters.

\[ \text{Disasters} = \text{function (hazard, vulnerability)} \]

This gives us great hope that if we can properly assess the disaster risk of a community and take necessary disaster prevention/reduction measures and reduce the vulnerability of the community, we would be able to lessen disasters or reduce their impact. This concept could be diagrammatically represented as follows.
1-3. The Concept of Total Disaster Risk Management Approach

1-3-1. Background

What do we have to do to reduce disasters? Experience has taught us that there are different measures to be taken according to the four different phases of disasters, namely the pre-disaster phase, the preparedness phase, the response and immediate relief phase, and the post-disaster phase. In any country, immediate disaster response to a major disaster is the first step taken. After several experiences of disaster response, the disaster responders would notice that there are ways, such as the designation of evacuation routes from dangerous areas or the preparation of emergency stocks, to be better prepared for a sudden event. These proper preparedness measures can help save people’s lives. Then, the people would notice that there are also ways to prevent or mitigate disasters and they would start to take these measures. Furthermore, the people would notice that in rehabilitation and reconstruction, prevention or mitigation measures could be incorporated to reduce future disasters. Thus, the disaster reduction cycle is envisioned in the country.

However, do we have to wait for every disaster-prone country to experience this process? The answer is obvious. The United Nations designated the 1990s as the International Decade for Natural Disaster Reduction and called for concerted international action to reduce the impact of natural disasters. The idea of the disaster reduction cycle was discussed and the dictum “prevention is better than cure” was widely recognized. The exchange of experience in disaster reduction activities among countries was encouraged. Japan, having experienced so many natural disasters and also having confidence in the importance to address disaster reduction cycle holistically, was one of the promoters of the IDNDR.
1-3-2. Total Disaster Risk Management: Lessons Learnt ~
Japan’s Experience ~

Japan is affected by heavy rains and storms twice a year: First in late-June to mid-July (the bai-u rainy season), and second in mid-August to September (the typhoon season). Consequently, the country suffers from floods and landslides. Flood control has always been a major task for both the national and local governments since medieval ages. There is an old proverb in Japan, which says: “The person who controls the river controls the country”. There are traditional river dike construction methods and river control works, which were developed around 1500 to 1700 A.D. Some of them are named after the local feudal lord who made innovative river control works. The average number of typhoons, which directly hit mainland Japan, is 2.7 per year. Even if the typhoons do not directly hit the mainland, they sometimes stimulate the active rain-fronts and bring torrential rains.

In the 1940s and 1950s, Japan had suffered from the heavy damage caused by storms and floods almost every year. Death toll numbered more than 1,000 in several typhoons. In 1954, a powerful typhoon swept through the main islands of Honshu and Hokkaido, and just when the typhoon was above the Tsugaru Channel between these two islands a large ferry ship sailed out and shipwrecked, resulting in tragic deaths of 1,761. This alarmed the authorities of the fact that the typhoon warning was not duly transmitted or understood by the ship operator. In 1959, the powerful Ise-Wan Typhoon hit Nagoya Metropolitan Area, which is the third largest metropolis in Japan, and coincided with the high tide of the sea and resulted in 5,098 deaths. These tragedies forced the Government to drastically reinforce disaster countermeasures. The need for change from response-oriented approach to preventive approach was recognized. Comprehensive multi-sectoral approach was needed. Policy makers recognized the need to invest in disaster reduction measures.

The Disaster Countermeasures Basic Act was passed in the parliament in 1961, and the Central Disaster Prevention Council was formulated, as the national coordinating body comprised of all the relevant ministries and agencies with the Prime Minister as the chairman. Also the national government was tasked to compile the annual official report on disaster countermeasures, which must include the comprehensive list of action to be
taken by individual ministries and agencies, agreed upon as Cabinet Decision (which is the highest level of policy decision in the Japanese Government), and reported to the parliament. The National Basic Disaster Management Plan was formulated as Cabinet Decision and all the ministries and agencies were tasked to formulate the sectoral Disaster Management Operation Plan. Local governments were also given the duty to formulate the Local Disaster Management Plan. September 1st, the day the Great Kanto Earthquake devastated Tokyo in 1923, was designated as “Disaster Prevention Day” to raise public awareness and prepare the people for the typhoon season. “Act concerning Special Financial Support to deal with the Designated Disaster of Extreme Severity” was passed in 1962, which enabled special subsidies to local governments for reconstruction of public works. Also, early weather forecast and warning was seen as essential, and a huge meteorological radar was constructed on the top of Mt. Fuji, which is the highest mountain in Japan and the symbol of Japan’s landscape. This radar enabled the monitoring of typhoons far out in the Pacific.

These organizational arrangements, together with large governmental investments in river control, sabo, dam construction and also emergency telecommunication systems etc., gradually decreased the death toll by typhoons and floods. Although it is still impossible to prevent all the damage by typhoons, the annual death toll by floods and storms has been kept under a hundred since 1994. This is a clear indication of the success achieved by the holistic approach to disaster reduction. And, it also proves that it is worthwhile to invest in disaster reduction. Since the average number of typhoons hitting Japan has not changed in the past 40 years, the decrease in casualties can be attributed to the improvement of the societal conditions.
Ise-wan Typhoon

Hanshin-Awaji (Kobe) Earthquake
1-3-3. Elements of Total Disaster Risk Management Approach

Based on this emerging need in Asia to reduce the vulnerability against disasters, this holistic approach known as the Total Disaster Risk Management Approach or TDRM Approach has been developed by the Asian Disaster Reduction Center (ADRC) and the Asian Disaster Response Unit of United Nations Office for the Coordination of Humanitarian Affairs Kobe office (ADRU/UN-OCHA Kobe). This concept has three basic elements, which are given below.

(1) Addressing Risks - Risk Management Flow

(2) Four Phases of Disaster Reduction – The Disaster Reduction Cycle
- Prevention/Mitigation
- Preparedness
- Response
- Rehabilitation and Reconstruction.

(3) Strategies for Disaster Reduction
- Coordination Mechanism
- Information
- Investment for Disaster Reduction
- Public Awareness and Support
- Collaboration among Stakeholders.
2-1. Addressing Risks—The Disaster Risk Management

Risk Management entails four steps as identified above. This can be broadly categorized as below.

(1) **Formulation of Policies at National and Local levels to cope with risk.**

First, risk management policy is determined. Risk management policy means criteria and purposes of risk management. In the case of disaster risk, the following properties can be included in risk management policy.

- The types of disasters to cope with (flood, earthquake, slope failure etc.)
- The scale of the objective disasters
- The area to be protected
(2) Risk Identification

The next phase of risk management is risk identification, which specifies identifying possible events (disasters) that could occur due to hazard and vulnerability. While risk management policy reflects the value of a society or an organization, risk identification is carried out in relatively objective ways.

(3) Risk Assessment (Analysis and Evaluation)

The third phase is risk assessment. Probability of occurrence of an event (disaster) is estimated, and possible loss likely to be caused by the event is calculated. Multiplying them, risk is quantified. During that process, model is sometimes constructed under certain assumptions determined by local conditions. In case of flood risk, frequency of heavy rainfall is calculated using past rainfall data and the loss can be estimated by inundation model. In some cases, vulnerable spots are also specified.

In risk assessment phase, alternatives are evaluated. Decision maker has to choose an appropriate action from alternatives. Alternatives for risk management are often classified into four types: “avoid,” “reduce” “transfer” and “retain.”

(4) Implementation of Countermeasures.

(a) Risk Avoidance

The first countermeasure is risk avoidance. An example in this regard is not locating the residences in frequent flooding areas. However, due to the socio-economic, geographical and political reasons not all types of conditions can be avoided.

(b) Risk Reduction

The second-stage countermeasure is risk reduction. It includes both structural measures such as levies and dams, and non-structural measures such as early warning systems, raising public awareness, and disaster response drills.
(c) Risk Transfer
Another useful measure to address the economic damage is **risk transfer**. An example is obtaining insurance to cover anticipated economic losses.

(d) Risk Retention
It is difficult to adopt measures that completely deal with all types of risks. As a result, there is always some amount of risk retained and this is called as **risk retention**.

This is expressed diagrammatically as below.
3-1. The Four Phases

Disaster Reduction Cycle consists of four phases as explained below:

(1) **Prevention/Mitigation**

**Prevention/Mitigation** is defined as structural and non-structural measures undertaken to prevent or limit the adverse impact of natural hazards, environmental degradation and technological hazards.
Practice:

In 1995, a total of 6,400 people lost their lives in Japan's Great Hanshin-Awaji Earthquake (Kobe Earthquake); medical investigation in Kobe City showed that 92% of those who died within 2 weeks of the quake were killed in the first 15 minutes as a result of being crushed or suffocated beneath collapsing buildings or hit by furnitures.

Most of the buildings that collapsed were constructed prior to 1981, when earthquake standards were still inadequate.

In Kobe City, Japan, buildings in the same location, those that were constructed with adequate anti-earthquake measures suffered far less damage. Thus, through proper mitigation, such loss of life could have been greatly reduced.
3-Dimensional fragility curves

1950: Construction Standard Act
1981: Revision of the Seismic Design Standard

Ground Motion (PGV, cm/s)
Heavily Damaged Ratio

Construction Year

Source: Dr. Kimiro Meguro, Tokyo Univ.

Structural Mitigation Worked

-1971 1972-1981 1982-

Wooden-Frame Buildings
(2) Preparedness

Preparedness is defined as activities and measures taken in advance to ensure effective response to the impact of disasters, including the issuance of timely and accurate forecasts along with effective early warnings and the temporary removal of people and property from a threatened location.

Practice:

In 1985, the eruption of the Nevado del Ruiz Volcano in Colombia caused mudslides that killed more than 20,000 people.
Although experts had prepared an accurate hazard map one month prior to the eruption, local residents had not been informed.

The areas inundated by mudslides were precisely as predicted by the hazard map. This means that the human loss caused by the disaster could have been prevented if the information about the potential danger had been communicated to the public (Source: World Disaster report, 2002, IFRC).

In contrast, when the Mayon Volcano in the Philippines erupted continually in 2000 and 2001, residents were swiftly evacuated based on seismic monitoring, hazard maps, and other preparatory measures such as evacuation drills.
As a result, in spite of the great force of the eruption, no deaths occurred.

In this way, results can greatly differ depending upon the level and quality of preparation.
A variety of information channels must be established to ensure suitable communication of hazard map information and early warning to communities at risk.
Volcanic Eruption of Nevado del Ruiz Volcano in Colombia

Hazard Map of Nevado del Ruiz Volcano in Colombia
(3) Response

**Disaster Response** is defined as combined action of coordination and quick & appropriate relief with local participation in assessment through strengthening the local level disaster response ability in order to ensure disaster relief as the platform for disaster recovery.

**Practice:**

In the Marmara Earthquake that struck Turkey in 1999, 50,000 people were rescued from beneath fallen debris; 98% were rescued by local residents. In times of catastrophic disaster, the community plays a vital role. To ensure quick response in the event of a disaster, disaster drills are very important.

In the case of a disaster so severe that the country is in need of international assistance, the international community can provide support for emergency relief and recovery, such as through the United Nations Disaster Assessment Team.
(4) Rehabilitation/Reconstruction

During Disaster Rehabilitation and Reconstruction phase, the reconstruction work has to be well planned for the next such events. It should not be reconstructed as it was in past in order to prevent similar disasters in future. Furthermore, structural and non-structural rehabilitation/reconstruction process should be ensured. Reconstruction process could be a good opportunity to improve quality of life as well as ensure sustainable development of the affected areas.

**Practice:**

The earthquake that struck Gujarat, India in 2001 claimed about 14,000 lives. Most of the victims were killed by the collapse of poorly constructed masonry buildings. Today, those houses are being rebuilt with greater earthquake resistance, while still employing traditional methods. This type of recovery also helps to reduce future losses by preparing for the next disaster.

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**Shaking Table Test**

![Retrofitted Housing](image1.png) ![Non-Retrofitted Housing](image2.png)

(Retrofitted Housing) (Non-Retrofitted Housing)

(Source: UNCRD, Hyogo Office, Japan)
Thus, it is necessary to implement Total Disaster Risk Management (TDRM) throughout all four phases of Prevention/Mitigation, Preparedness, Response, and Rehabilitation/Reconstruction.
4-1. Strategies for Disaster Reduction—Application of TDRM Approach

Let us take a look at the five main strategies of Total Disaster Risk Management (TDRM). They are Coordination Mechanism, Information, Investment for Disaster Reduction, Public Awareness and Support, and Collaboration among Stakeholders. This can be explained as given below.

(1) Coordination Mechanism

To implement disaster management effectively, national and local level coordination mechanism is necessary. Through IDNDR (1990-1999) activity, national coordinating bodies such as National Disaster Management Council were set up in many countries. This mechanism effectively addresses various disaster management issues and improves coordination among disaster related organizations and stakeholders with clear definitions of each stakeholders’ roles based on government legislation such as Disaster Countermeasures act.
(2) Information

Proper disaster information management and dissemination are the key elements to plan and implement any disaster management activity. Proper disaster data analysis, dissemination and information sharing among stakeholders and risk communication at community level are critical here. Especially, risk communication to the residents is of vital importance. In prevention/mitigation phase, the proper understanding of the image of the anticipated disaster is important for legislation and finance sector to invest for disaster reduction. For citizens, without accurate hazard information no one will invest for retrofitting the buildings for earthquake disasters.

For preparedness phase accurate early warning information is crucial for timely evacuation, which can prevent human losses.

Response activity such as mobilizing rescue or supporting supply management always needs proper information of disasters.

Even in Rehabilitation/Reconstruction phase, to prevent a future loss or for sustainable socio-economic development and environmental sustainability in the affected area, information plays a vital role.

Example:

During the 1990s, Bangladesh was lashed by five enormous cyclones. Up to 140,000 people died, most of them during one storm in 1991. But over 2.5 million people were evacuated – and their lives almost certainly saved – before the cyclones struck (see figure below). This was largely thanks to the cyclone preparedness programme (CPP) initiated in the early 1970s by the International Federation, the Bangladesh Red Crescent Society (BDRCS) and the government of Bangladesh.

The CPP can now alert around 8 million people across the whole coastal region, of whom it can assist around 4 million to evacuate. The warning system uses Asia’s largest radio network, linking the CPP’s Dhaka headquarters with 143 radio stations. Radio warnings are then relayed by 33,000 village-based volunteers using megaphones and hand-operated sirens.
The volunteers are also trained to rescue people and evacuate them to shelters, administer first aid and assist in post-cyclone damage assessment and relief. Between disasters, volunteers organize simulation exercises and disaster-awareness rallies. This vast network of volunteers helps the CPP to solve two problems which challenge other disaster mitigation and preparedness initiatives: the transformation from a “project-based” approach into a long-term, ongoing operation; and scaling-up from a community-based initiative to a system large enough to protect all those living in area at risk (Source: World Disaster report, 2002, IFRC).

(3) Investment for Disaster Reduction

Since one disaster could wipe out country’s annual GDP and cause considerable social, economic and environmental damages, suitable investment in disaster impact reduction is a MUST to ensure sustainable development. Both “Soft and Hard” investments for structural and non-structural are needed in this aspect. Investments for disaster reduction can directly and indirectly contribute to socio-economic development of the localities at risk.

(4) Public Awareness and Support

Public are the first respondents to the disasters as well as main victims. Creating awareness among general public is one of the most important strategies to reduce disaster impacts. For example, if early warnings to be effective, the recipients of this early warning information must know beforehand the risks they are facing. Also these awareness programmes should include action programmes related to community based disaster drills and evacuation demonstrations.
(5) Collaboration among Stakeholders

**The multi-disciplinary and multi-sectoral coordination**

In order to address the entire Disaster Reduction Cycle, many players must be involved. Civil protection and relief teams are always needed for the Preparedness, and the immediate Response and Relief phase. But they are not the only major players. Expert knowledge of various disciplines are also needed. For the Pre-Disaster Phase and Post Disaster Phase, even more variety of players needs to be involved. Here are some examples: To cope with typhoon disaster, scientific research on meteorology, development of meteorological observation instruments, communication system to accumulate information and to disseminate forecasts, civil engineering for flood control works, forestry and agriculture for land conservation, regional planning for proper land use,......are important and so many players are necessary. To cope with earthquakes important are scientific research on geophysics, structural engineering for buildings and social infrastructures, forestry to prevent secondary landslides, city planning for securing of safe evacuation areas, lawmakers to draw regulations for building codes, administrators to enforce these codes,......are indispensable and so many players are likewise needed. What is more important is there has to be a national coordinating body to involve and mobilize various sectors concerned, to encourage individual efforts, as well as to enable the various players to cooperate among themselves. This coordinating body must also develop a “checklist” to draw the entire picture of what is being done and to identify what needs to be done.

**The important link to people**

For multi-disciplinary and multi-sectoral efforts to be effective, the most important factor is the link to the people. Typhoon forecasts by meteorologists must reach the people at risk to urge their evacuation if necessary. Local houses must be properly built with affordable technology by local architects to be earthquake resistant. In any country, this link to the people is the most difficult part. Various players can be this critical link. Local governments, community organizations, mass media, and non-governmental organizations may be the link. In Japan, for typhoon warnings, the public TV and radio broadcasts were quite effective in transmitting the critical
information. In some cases, the local school system can also play a big role in dissemination of knowledge to communities. Pupils can learn about disasters in the classrooms, and when they go home they can tell their mother and father what they learned in school. Many countries are trying various methods to convey the important message across more effectively.

5-1. Policies for Linking Disasters to Development
Disasters dominate three dimensions of the development such as economic, social and environment.

In economic viewpoint, development resources are lost when a disaster wipes out the product of investment and it shortens the life of development investments. Disasters have negative impact on the incentive for further investment.

Policy makers and development planners should consider that disaster management is not only for saving people’s life and property but it is directly linked to socio-economic development and maintaining sustainability of the environment. Therefore, we need to develop a “Culture of Disaster Risk Management” and the word “Total” means not only three elements which are “Risk Management Flow”, “Disaster Reduction Phases”, and “Application Strategies” but link to national and local policy as well as socio-economic, environment, urban and regional development plan. For that purpose, we have to learn from the precious past lessons not to repeat the same tragic disaster history in the region. Hence TDRM approach, as described above, transforms disaster reduction as an important tool for sustainable development.

6-1-1. Effect of Improving Building Standard on the Earthquake Damage - Case of Tokachi-oki Earthquake -
1. Introduction
On September 26, 2003 at 4:50 a.m., a large earthquake struck the northern island of Japan, Hokkaido. Basic information of the earthquake is shown in Figure 1. The epicenter was located in the offshore of southeastern Hokkaido with the 42 km focal depth. It was named the 2003 Tokachi-oki earthquake. Japanese local magnitude of the earthquake was 8.0 on the Richter scale and the maximum JMA (Japan Meteorological Agency) seismic intensity was 6 lower. This earthquake caused tsunami that recorded the highest of 1.3 m at a tidal observatory and 4.0 m of its trace was identified in the later survey.

Japanese Government has prepared an evaluation of long-term probability of large earthquake occurrence within 30 years from the stipulated reference date. Until now, 11 earthquakes along the plate boundaries have been examined and declared. The occurrence of Tokachi-oki earthquake with magnitude 8.1 was estimated as 60 %. The earthquake occurred on September 26 is considered as this estimated earthquake.

2. Effect of Revision of Building Code on Earthquake Damage
Iterative earthquake damage helped to revise the building code. The summary of the 2003 earthquake’s damage compiled by the Cabinet Office of Japan is shown in Table 1. Fortunately, the earthquake caused only a small number of victims, and a few residences were collapsed except some very old houses. One of the reasons is that the vulnerable buildings in the affected area have been already destroyed by several large earthquakes occurred in the past and aseismic buildings have been constructed instead. Comparison of the earthquake damage with previous one, occurred in the same region, is listed in the table.

Table 1 Summary of the damage in Tokachi-oki earthquake

<table>
<thead>
<tr>
<th>Event</th>
<th>Casualties</th>
<th>Damage to Residences</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Year</td>
<td>Mj</td>
</tr>
<tr>
<td>-------</td>
<td>------</td>
<td>----</td>
</tr>
<tr>
<td>2003</td>
<td>8.0</td>
<td>0</td>
</tr>
<tr>
<td>1952</td>
<td>8.2</td>
<td>28</td>
</tr>
<tr>
<td>1968</td>
<td>7.9</td>
<td>49</td>
</tr>
</tbody>
</table>

*) Mj means JMA earthquake magnitude on Richter scale.

The 1968 Tokachi-oki earthquake caused heavy damage to reinforced concrete buildings. Consequently, the reinforced concrete code changed significantly in 1971. This required closer spacing of column transverse reinforcement.
After 1972, the Ministry of Construction launched discussions on the new seismic design method. The 1978 Miyagiken-Oki earthquake, which stroked urban area heavily, accelerated it. In 1981, Japanese Government implemented the Building Standard Law Enforcement Order. This included a seismic coefficient that varies with structural vibration period, and introduced a two-level design procedure. The first level is that buildings should have capacity to resist for frequent and moderate events. The second level, which is the new idea, is that structures should have capacity to keep off the collapse under the assumed maximum event. Table 1 shows that the improved building code contributed effectively to reduce the physical damage in the latest earthquake damage.

6-2-1. Early Warning
6-2-1-1. Cyclone Prediction, Forecasting, Weather Warning System and Dissemination Methods: Bangladesh Perspective

1. Introduction

Bangladesh is a deltaic land of area about 144,000 sq.kms. the Himalayas is on the north and the Bay of Bengal is on the south. Due to the concave shape of the Bangladesh coast and peculiar geographic location, the weather system has become complicated over country. Bangladesh is the most disaster prone area of the world of course, most of the disasters are meteorological. Sometimes, it occupies new headlines in terms of the extreme weather events e.g. the great Backerganj cyclone of 1876, the killer of November cyclone, 1970, The Urirchar cyclone 1985; tornadoes of 1969 (Demra, Dhaka) 1974 (Manikganj), 1977 (Madaripur), 1989 (Saturia of Manikganj), 1995 (Laohajong), and 1996 (Tangail).

2. Tropical Cyclone

A tropical cyclone is a warm-core low-pressure system around which the air circulates in an anti-clockwise direction in the Northern Hemisphere. A tropical cyclone consists of a rotating mass of warm and humid air, normally between 300 and 1500 kms is diameter. The strongest winds, which may approach 200 knots, blow around the eye of a tropical cyclone, a central region of light winds and lightly clouded sky ranging from a few kilometer to over 100 kilometer in diameter.

The life span of tropical cyclones with full hurricane intensity averages at about six days from the time they form until the time of landfall. Some storms last only a few hours and a few as long as two weeks or even a month.
2.1 Nomenclature:

The nomenclature of cyclones are different in different parts of ocean/seas. It is called “cyclone” in the Bay of Bengal and the Arabian Sea, “hurricane” in the Atlantic Ocean, “typhoon” in the northern and southwestern Pacific Ocean, “baggio” in the Philippines Sea “willie wille” in the Pacific near Australia.

2.2 Formation of Cyclones:

The following conditions are essential for the formation of the tropical cyclone (cyclogenesis).

i) Sea Surface Temperature (SST) should not be below 27º C
ii) There should be little or no vertical wind shear for vertical growth
iii) There should be baroclinic zone i.e. inter-section of pressure surface and density surface
iv) The sea-surface region should be beyond 6º latitude (for more Coriolis force and hence for more spinning)

The cyclones have tendency to move initially in west or northwesterly direction. Then they move northeasterwards and sometimes they may recurve northwards. In the Bay of Bengal, cyclonic storms generally form in the months of April – May and mid September to mid December periods.

2.3 Different stages of tropical cyclones

The evolution of the average storm from birth to death has been divided into four stages (Chessman, 1951):

a. Baby or formative stage: This stage when the circulation develops along the equatorial front, in easterly wave. In this stage, the cyclone shows a falling pressure tendency. Winds remain below hurricane force in the formative stage and the surface pressure drops to about 1000 hPa.

b. The developing or immature stage: This stage lasts up to the time when it reaches into cyclonic storm. In this stage, the cyclone attains lower central pressure below 1000 hPa. Winds are well organized in a narrow band and spiral inward the centre. Only a small area is as yet involved, though there may be a large outer envelope.

c. The mature stage: This stage lasts from the time of attaining maximum intensity up to the time it weakens below 64 knots. It attains lowest central pressure, maximum intensity up to hurricane wind, maximum wind around centre and formed eye, which attain maximum temperature. In this stage, the surface pressure is no longer falling at the centre and maximum wind speed is no longer increasing. Instead the circulation expands during the mature stage, which may lasts a full week.

d. The decaying stage: Decay stage of cyclones appear when the cyclone makes landfall or sometime, cyclone has been observed to die over sea, for instance when moving over cold ocean currents.

Characteristics of Tropical Disturbances in the Bay of Bengal:

<table>
<thead>
<tr>
<th>Stages of Disturbances</th>
<th>Radius of Disturbances</th>
<th>Maximum sustained wind</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low pressure are or low</td>
<td>-</td>
<td>Less than or equal to 31 Kph (17 kts)</td>
</tr>
<tr>
<td>Well marked low</td>
<td>-</td>
<td>32 Kph - 39 Kph (18 kts - 21 kts)</td>
</tr>
<tr>
<td>Depression</td>
<td>44 Kms (24 NM)</td>
<td>40 Kph - 50 Kph (22 Kts - 27 Kts)</td>
</tr>
<tr>
<td>Deep Depression</td>
<td>48 Kms (26 NM)</td>
<td>51 Kph - 60 Kph (28 Kts - 33 Kts)</td>
</tr>
</tbody>
</table>
Cyclonic Storm | 54 Kms (30 NM) | 61 Kph - 88 Khp (34 Kts - 47 Kts)
Severe Cyclonic Storm | 64 Kms (35 NM) | 89 Kph - 117 Kph (48 Kts – 63 Kts)
Severe Cyclonic Storm with a Core of Hurricane wind | 74 Kms (40 NM) | 118 Kph-219 Kph (64 Kts–118 Kts)
Super Cyclone | 84 Kms (45 NM) | 220 Kph or more (119 Kts or more)

2.4. **Cyclone season of Bangladesh.**

<table>
<thead>
<tr>
<th>Seasons</th>
<th>Period</th>
<th>Weather events</th>
<th>Rainfall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Summer season</td>
<td>March – May</td>
<td>Nor’ wester, tornado Hail, Cyclone</td>
<td>370 mm</td>
</tr>
<tr>
<td>Pre-Monsoon</td>
<td></td>
<td></td>
<td>17%</td>
</tr>
<tr>
<td>Rainy season</td>
<td>June-September</td>
<td>Heavy Precipitation Monsoon Depression, Flood</td>
<td>1625 mm</td>
</tr>
<tr>
<td>(Monsoon)</td>
<td></td>
<td></td>
<td>72.5%</td>
</tr>
<tr>
<td>Autumn season</td>
<td>October-November</td>
<td>Cyclone, Tornado</td>
<td>208 mm</td>
</tr>
<tr>
<td>(Post-Monsoon)</td>
<td></td>
<td></td>
<td>90%</td>
</tr>
<tr>
<td>Winter season</td>
<td>December-February</td>
<td>Abnormal dryness, Cold</td>
<td>33 mm</td>
</tr>
<tr>
<td>(NE-Monsoon)</td>
<td></td>
<td></td>
<td>15%</td>
</tr>
</tbody>
</table>
3. Cyclone Warning System in Bangladesh

3.1. Prediction of cyclone and issue of warning:

Prediction of cyclonic storm in the Bay of Bengal and issuance of timely warning is the task of Storm Warning Centre (National Weather Forecasting Centre) Dhaka. The cyclone information issued by the storm Warning Centre requires detection and monitoring of cyclone from the formation till its landfall and forecast the cyclone’s future track. Modern technology has provided the means of early detection and constant tracking.

3.2. Data and weather charts used for cyclone forecasting:

Data from all sources, ground based and space based are utilized in weather forecasting. The following types of weather data are utilized:

i) Surface observations at different synoptic hours.
ii) Upper air observations at 6 or 12 hours intervals (pilot balloon and Rawinsonde)
iii) Ships observations and observations available from automatic platforms (if any).
iv) Aircraft report (if any).
v) Satellite observations of various types, such as clouds, wind sea surface temperature, etc.
vi) Radar observations.
vii) NWP products.

3.3. Cyclone warning system of Bangladesh

Cyclone warning system Is the well-known warning system in Bangladesh. This warning includes the following information:

a) Position of storm centre.
b) Direction and rate of movement.
c) Area likely to be affected specifying upazillas of the district if possible.
d) Approximate time of commencement of gale winds (speed more than 32 mph or 52 kms/hrs).
e) Maximum wind speed expected.
f) Storm surge/ tide of approximate height and the areas likely to be affected.

3.4. Cyclone prediction methods

In order to fulfill the tropical cyclone warning, predictions of the following are required:

• Tropical cyclone location motion.
• Tropical cyclone wind field.
• Storm surge.

Now-a-days, forecasting offices all over the world are equipped with a large number of track prediction techniques. These techniques can broadly be divided under the following categories:

a) Climatological techniques.
b) Persistence techniques.
c) Climatological-cum-persistence technique (CLIPER)
d) Synoptic techniques:
   (i) Surface geostrophic steering technique,
   (ii) Upper air steering technique.
e) Satellite techniques using climatology, Persistence, synoptic data (actual or forecast) as predictors.
f) Analogue techniques.
g) Dynamical techniques.

Besides these, Debsarma (STP Modelk 1994 & STEEPER Model 1998) developed one regression model and one steering-cum-persistence model for the track prediction of cyclones, which operates well in the Storm Warning Centre of BMD. It has been found that the upper air steering method plays an important role in the track prediction cyclones in the Bay of Bengal. For this purpose, 200 hPa or 150 hPa level chart is carefully analyzed to obtain the circulation pattern and the movement of a cyclone is guided by the anticyclonic flow pattern at 200 hPa ar 150 hPa level.

3.5. **Warning signals:**

Warning signal is classified in two: i) For Maritime Port and ii) River Ports.

i) **Warning signal for Maritime Ports:**

<table>
<thead>
<tr>
<th>Signals</th>
<th>Meanings</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Distant cautionary signal No I</td>
<td>There is region of squally weather in which a storm may form (well Marked low or depression with wind speed up to 61 Kph)</td>
<td>These signals indicate that ships may be exposed to danger after leaving/coming to the harbour.</td>
</tr>
<tr>
<td>2. Distant Warning Signal No II</td>
<td>A storm has formed (cyclonic storm) with winds speed 62-88 kph.</td>
<td></td>
</tr>
<tr>
<td>3. Local Cautionary Signal No III</td>
<td>III) The port is likely to be threatened by squally weather. It may experience severe weather from a squally wind of 40-50 kph.</td>
<td>These signals indicate that the port itself and the ships in it are in danger. All fishing boats and trawlers over North Bay and deep Sea are advised to take shelter immediately.</td>
</tr>
<tr>
<td>4. Local Warning Signal No.IV</td>
<td>IV) The port is likely to be threatened by the storm but it doesn’t appear that the danger is as yet sufficiently great to justify extreme precautionary measures of precaution (Cyclonic circulation with surface wind 51-61 kph).</td>
<td></td>
</tr>
<tr>
<td>5. Danger Signal No. V</td>
<td>V) The port will experience sever weather from a storm of moderate intensity that is expected to cross the coast to the south of the port (Cyclonic circulation with wind speed 62-88 kph).</td>
<td></td>
</tr>
<tr>
<td>6. Danger Signal No.VI</td>
<td>VI) the port will experience severe weather from a storm of moderate intensity that is expected to cross the coast to the north of the port (Cyclonic circulation with wind speed 62-88 kph).</td>
<td>These signals indicate that the port itself and the ships in it are in danger. All bay are advised to remain in shelter till further notice.</td>
</tr>
<tr>
<td>7. Danger Signal No.VII</td>
<td>VII) The port will experience severe weather from a storm of moderate intensity that is</td>
<td></td>
</tr>
</tbody>
</table>
expected to cross over or near the port (Cyclonic circulation with wind speed 62-88 kph).

8. Danger Signal No. VIII VIII) The port will experience severe weather from a storm of great intensity that is expected to cross the coast to the south of the port (Sever cyclonic storm with wind speed 89-117 kph or more).

9. Great danger signal No. IX IX) The port will experience severe weather from a storm of great intensity that is expected to cross the coast to the north of the port (Severe cyclonic storm with wind speed 89-117 kph or more). These signals indicate that the port itself and the ships in it are in great danger. All fishing boats and trawlers over North Bay are advised to remain in shelter till further notice.

10. Great Danger signal No. X X) The port will experience severe weather from a storm of great intensity that is expected to cross over or near the port (Severe cyclonic storm with wind speed 89-117 kph or more).

11. Great Danger signal No. XI XI) Communications with the meteorological Warning Centre have broken down and local officers consider that a devastating is following. Since the storm Warning Centre (SWC) is now in Dhaka, this Signal has become ineffective.

ii) Signals for Inland River Ports:

<table>
<thead>
<tr>
<th>Signals</th>
<th>Meanings</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Cautionary Signal No. I</td>
<td>I) The area is threatened by squally winds of transient nature with the kalbaishakhi wind of about 60 kph.</td>
<td>This signal is hoisted in case of gusty wind. The river crafts are advised to proceed with caution.</td>
</tr>
<tr>
<td>2. Warning Signal No. II</td>
<td>II) A storm is likely to strike the area (Vessels of 65 feet and under in length are to seek shelter immediately). The area is threatened by squally winds of transient nature with the kalbaishakhi wind of about 61 kph or more.</td>
<td>This signal is hoisted in case of squally weather expected from nor’ westers. The river crafts of length more than 65 feet may proceed with caution but small river crafts are advised to remain in shelter.</td>
</tr>
<tr>
<td>3. Danger Signal No. III</td>
<td>III) A storm will strike the area (all vessels will seek shelter immediately). The area is threatened by squally winds of transient nature with the wind of about 62-88 kph.</td>
<td>This signal is hoisted in case of weak/ moderate cyclones. When there are danger Signals for Maritime Ports. The river crafts are advised to remain in shelter till further notice.</td>
</tr>
<tr>
<td>4. Great Danger Signal No. IV</td>
<td>IV) A violent storm will soon strike the area (all vessels will take shelter immediately). The area is threatened by squally winds of transient nature with the wind speed of about 89 kph or more.</td>
<td>This signal is hoisted in case of strong cyclones. When there are Great danger Signals for Maritime Ports. The river crafts are advised to remain in shelter till further notice.</td>
</tr>
</tbody>
</table>
3.6. **Standing orders for cyclone warning**

As per the Standing Order of the Govt, Cyclone Warning messages are issued as follows:

a) **Warning Stage:** 24 hours in advance.

b) **Danger Stage:** Minimum 18 hours in advance.

C) **Great Danger Stage:** Minimum 10 hours in advance.

There are standing orders for cyclones to be disseminated to all concerned Ministries/Divisions/Department/Non-govt. agencies and also to press for public to enable to discharge their duties in a speedy and systematic manner to handle the situation efficiently. More frequent contact is maintained between Bangladesh Meteorological Department (BMD) and Betar (radio), Television for extension of transmission hour beyond normal hours as and when Danger Signal and great Danger Signal are hoisted.

Only 5% cyclone forms in the Bay of Bengal but loss of lives and property is about 85% of the Global total. Cyclone of 1970 took lives of 3,00,000 people but the cyclone of the same intensity of 1991 took lives of 1,38,000 people, cyclones of 1997 and 1998 took lives of only 127 and 6-7 respectively. This is surely a development for saving the lives of people and properties. A short table in this regard is shown here:
<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Cyclone Time</th>
<th>Land fall</th>
<th>Wind speed (max)</th>
<th>Storm surge</th>
<th>People killed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>8 – 13 November</td>
<td>Between Noakhali &amp;</td>
<td>a) Chittagong= 224 kph</td>
<td>3.0-10.0m (10-33ft)</td>
<td>People killed=3,00,000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Chittagong</td>
<td>b) Sandwip=139 kph</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>c) Cox’s Bazar=104kph</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>22-25 May, 1985</td>
<td>Near Chittagong</td>
<td>a) Chittagong=154kph b) Sandwip=139 kph c) Cox’s Bazar=104kph</td>
<td>55m (15 ft)</td>
<td>People killed=4,264, Affected population=13,10,935</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>24-30 November, 1988</td>
<td>Khulna coast near Raimangal river</td>
<td>a) Khulna &amp; Satkhira=157 kph b) Pathargata=161 kph</td>
<td>4.4 m (14.5 ft)</td>
<td>In Bangladesh people killed=5,683, people missing=6,000. In India people killed=532</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>25-30 April, 1991</td>
<td>A little North of Chittagong</td>
<td>a) Sandwip -225 kph b) Chittagong-218 kph c) Cox’s Bazar=185kph</td>
<td>6-7.6 m (20-25 ft)</td>
<td>Affected Population=1,0 7,98257, No. of people killed=1,38,882</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>24-27 September, 1997</td>
<td>Near Sitakunda</td>
<td>a) Sandwip=150 kph b)Char Tazumuddin=150 kph c) Barguna=90-135 kph d) Bhola=120-140 kph e) Hatiya=120 kph</td>
<td>4.55 m (15 ft)</td>
<td>People killed=67</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>17-20 May, 1998</td>
<td>Between Chittagong and</td>
<td>a) Chittagong=174 kph b) Rangamati=101 kph</td>
<td>3m (10 ft)</td>
<td>There was no report of death but believe 6 or 7 people were killed</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sitakunda</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

This was due to timely and correct weather forecast and effective preparedness programme. We have a long coastal belt of 710 kms at any point of which cyclonic landfall may occur. Cyclone Preparedness Programme (CPP) has about 35,000 volunteers of which 3,000 are female. They are plying a tremendous role to combat disasters arising out from cyclonic landfall over coastal and island areas. these efforts have been appreciated and the International Award “Smith tumsaroch” was jointly given to Bangladesh Meteorological Department and Cyclone Preparedness Programme in 1998. Despite this development in terms of disaster mitigation, we are not satisfied. We are still trying to reduce the loss of lives and properties.

3.7. **Warning message dissemination system of SWC, the national weather forecasting centre is as follows:**

- Storm Warning Centre (SWC)
- Prime Minister’s Secretariat
- Bangladesh Betar (Radio)
4. Conclusion

Weather forecasting was challenging and will remain as challenging jobs. The BMD has proposed a new unified (maritime and riverine): warning signals system based on wind speed is still awaiting for approval from the highest authority. With the inception of new equipment and modern technologies and the new warning system in Bangladesh, The BMD in collaboration with the CPP and other organizations related to disaster management will hopefully be in a position to handle the natural disasters more efficiently and easily in near future. That is our great expectation.

(Source; Md. Akram Hossain, Director, Bangladesh Meteorological Department, Dhaka)

6-2-2. Hazard Map
6-2-2-1. Applications and Advantages of Hazard Maps for Sabo in Japan

1. Outline of Sediment-related Disasters in Japan
Various natural disasters occur every year in Japan and claim people’s lives and properties. In fact, 5,890 lives were lost due to natural disasters between 1967 and 2000, 54% of which were due to sediment-related disasters, excluding the Hanshin Awaji Great Earthquake in 1995. It is therefore very important to mitigate sediment-related disasters in order to reduce total disaster damages in Japan.

In Japan, sediment-related disasters are categorized into three groups, according to the characteristics of the sediment movement:
1) Debris flows
2) Steep slope failures
3) Landslides

A debris flow is where soil, stones or rocks swiftly flow downstream with the water. A steep slope failure is where a slope collapses abruptly under the influence of rainfall or an earthquake. A landslide is where a soil mass slides slowly under the influence of ground water.
On average, around 1,000 sediment-related disasters occur annually, because there are geomorphological and geological vulnerabilities and harsh meteorological conditions in Japan. What are the geomorphological vulnerabilities? Hilly and mountainous areas cover 70% of the total land area of Japan, and many people must live on hillsides and foothills. Why does Japan have geological vulnerabilities? The Japanese archipelago is located where the Eurasian Plate, North American Plate, Pacific Plate and Philippine Sea Plate meet. The Pacific Plate and Philippine Sea Plate are actively subducting beneath the North American Plate and Eurasian Plate. The subductions cause earthquakes and volcanic eruptions. In fact, on average, more than 1,200 earthquakes occur every year, according to a calculation based on a search of earthquake databases. Furthermore, Japan has 108 active volcanoes, about 10% of the world’s total. On the other hand, what are the meteorological vulnerabilities? Japan has a monsoon climate with an annual rainfall of 1,700 mm, almost twice the world average, so there is heavy precipitation during the rainy season from June to July. Several typhoons hit the mainland of Japan every year. In recent years, several downpours in excess of 100 mm/hr have often been experienced. These cause many sediment-related disasters.

2. History of the development of hazard maps for sabo
To mitigate sediment-related disasters, the Japanese government and prefectural governments have conducted structural and non-structural measures. This paper introduces non-structural measures, particularly hazard maps for sabo.
“Sabo” is a Japanese term which means erosion and sediment control. Therefore, hazard maps for sabo means hazard maps for sediment-related disasters.

In the 1960s, Japan experienced several major sediment-related disasters in towns around Sai Lake (Yamanashi prefecture, 1966), Kobe-shi (Hyogo prefecture, 1967) and Kure-shi (Hiroshima prefecture, 1967), and 212 people were killed by debris flows and steep slope failures in just 2 years.
The Japanese government recognized the necessity of identifying sediment-related disaster-prone sites and notifying the sites to the public. Therefore, the Ministry of Construction (later reorganized into the Ministry of Land, Infrastructure and Transport) created criteria for identifying sediment-related disaster-prone sites, and then encouraged each prefectural government to identify those sites.
Each prefecture government surveyed disaster-prone sites and eventually identified:
1) Debris flow-prone streams in 1966,
2) Failure-prone slopes in 1967, and

At that time, sediment-related disaster-prone sites were abstracted using topographical maps on a scale from 1:10,000 to 1:25,000, and then were identified through field surveys. However, initially, the sites were identified as disaster-prone sites, such as debris flow-prone streams, failure-prone slopes and landslide-prone slopes.

After identification, sediment-related disaster-prone sites were made public as sediment-related disaster prone sites maps. However, the maps were not adequate, because it was hard to recognize actual hazard areas. Furthermore, the maps showed disaster-prone sites for existing residential areas, but not for future residential areas. Therefore, it was difficult for residents to avoid building their houses in sediment-related hazard areas.
In the 1960s, 1970s and 1980s, urban development progressed, and particularly residential areas were developed on the hills in the vicinity of major cities because of rapid economic growth, thus increasing the number of disaster-prone areas. In 1988, the Central Disaster Prevention Council of the Japanese government issued a report on the promotion of sediment-related disaster mitigation. In the report, the CDPC stated that hazard areas should be identified and used appropriately, rather than for building houses.

Figure 1 shows the increase of sediment-related disaster-prone sites between the late 1970s and late 1990s.

After issuing the report, the MOC encouraged prefectural governments to create hazard maps, which they are now doing. 44% of all municipalities which have sediment-related disaster-prone sites had made their hazard maps public as of 2002, according to a survey by the Headquarters of MLIT. Figure 2 shows an example of the hazard maps which are available on websites.

On June 29, 1999, a severe sediment-related disaster occurred in Hiroshima city and its vicinity (Hiroshima prefecture). 325 debris flows and steep slope failures occurred almost simultaneously. 24 people were killed and more than 150 houses were destroyed or damaged in newly developed residential areas on hillsides and foothills. The Japanese government was prompted by this disaster to establish a new act for designating hazard areas in order to:
1) Restrict new development for housing and other purposes,
2) Promote relocation of existing houses, and
3) Develop an early warning system.

3. The Sediment-related Disaster Prevention Act
3.1 Content of the Act
The Sediment-related Disaster Prevention Act was established in 2000, and took effect in 2001, in order to restrict new development for housing and other purposes, promote relocation of existing houses, and develop early warning systems for residents within hazard areas.

The Act specified the process of designating Sediment-related Disaster Hazard Areas (Yellow Zone) and Special Hazard Areas (Red Zone). Figure 3 shows the process of designating those areas.

Under the Act, an area prone to sediment-related disaster shall be designated as a Sediment-related Disaster Hazard Area (Yellow Zone). An area where there is a serious risk of damage to buildings and threat to residents shall be designated as a Special Sediment-related Disaster Hazard Area (Red Zone). If an area is designated as a Yellow Zone:
1) Early warning systems shall be established,
2) Steps to raise the awareness of local people about sediment-related disasters shall be taken.

If an area is designated as a Red Zone:
1) A license is required for land development for housing, etc.,
2) Building certification is required for buildings,
3) Relocation of buildings that are vulnerable to serious damage in case of a sediment-related disaster is recommended, and
4) Those who move their residence to a safe area under recommendation can receive grants.

3.2 How to determine hazard areas
Debris flow-prone streams are abstracted using detailed topological maps on a scale of 1:25,000 or more. The situation of a stream, such as spring water, landslide site, deposited sediment on the streambed and residential area on a slope of 2 degrees or more, etc., is surveyed. Figure 4 shows a diagram of a debris flow-prone stream.

How are Yellow Zones and Red Zones determined? In case of debris flows, an area located under a stream prone to debris flow and on a slope of 2 degrees or more below the crest of the alluvial cone is determined as a Yellow Zone. An area which satisfies the following equation is determined as a Red Zone (Figure 5).

\[ F_d > P_2 \]  \((F_d: \text{Fluid dynamic force}, P_2: \text{Structural strength})\)

In case of steep slope failures, areas which are:
1) On a slope of 30 degrees or more and a slope height of 5 m or more,
2) Within 10 m horizontal distance from the top end of the slope, and
3) Within twice the slope height or 50 m, whichever is less, are determined as a Yellow Zone.

An area which satisfies the following equations is determined as a Red Zone (Figure 6).

\[ F_{sm} > P_1 \]  \((F_{sm}: \text{Fluid dynamic force against } F_{sm}), \text{ or } F_{sa} > W_1 \)  \((F_{sa}: \text{Active earth pressure}, W_1: \text{Structural strength against } F_{sa})\)

In case of landslides, areas which are:
1) Currently prone to landslide or potentially vulnerable to landslide in the future,
2) Within a distance equivalent to the length of the landslide mass from the bottom end of the landslide area or 250 m, whichever is less, are determined as a Yellow Zone.

An area which satisfies the following equation is determined as a Red Zone (Figure 7).

\[ F1 > W2 \]  
(However, the length from the landslide mass should be 60 m at most.)

4. **How to use hazard maps**

Hazard maps have two functions. One is to increase people’s awareness about sediment-related disasters. The other is to improve co-operation among emergency responders (Figure 8).

Regarding the former, people should be kept informed about hazard maps by every possible means, such as the internet, mail, etc., because most people do not pay attention to hazard maps during non-disaster time, and sometimes lose their copy. Some prefectural governments put hazard maps on websites, and some municipalities send direct mail to each family living within hazard areas in order to inform them that they are living in a hazard area. One good way to increase people’s awareness is to fix signboards at the disaster-prone sites.

On the other hand, hazard maps are also very important for organizations responsible for emergency response, because a hazard map provides a common scenario when the organizations create emergency response plans. If there are no hazard maps, each organization must identify hazard areas by itself, and so 10 organizations might identify 10 different hazard areas, resulting in an uncoordinated disaster response. If there is a common hazard map, each organization can create its own disaster response plan based on a common scenario. Such coordinated disaster response plans lead to co-operative and more effective disaster response activities (Figure 9).

Furthermore, hazard maps should be revised when the situation of disaster-prone sites, such as the situation of vegetation, volcanic eruptions, big earthquakes, wildfires, etc., have changed and also disaster response plans should be revised in order to respond to the disaster quickly and effectively.

5. **Summary**

- Hazard maps should be created as early as possible for all sediment-related disaster-prone sites.
- If possible, the hazard maps should be created under the law in order to restrict the development of housing, etc. within hazard areas.
6-2-2-2. Effectiveness of Early Warning of Volcanic Eruption in Japan through Hazard Maps: Experience of Mt. Usu

1. Introduction
This section is to share the useful experience in early warning and effectiveness of hazard maps in relation to Japanese experience of volcanic eruption of Mt. Usu. The Japanese archipelago is part of the highly volcanic Circum-Pan-Pacific zone. Although the continental shelf where Japan is located makes up only roughly 0.1% of the entire world, the region has 86 active volcanoes. Roughly 10% of active volcanoes in the world are in Japan.

Many statistics show that Japan experiences several volcanic eruptions of different scale almost every year. The Government dedicates its efforts to mitigate the damage from volcanic eruptions. In this regard, early warning of eruption and accurate hazard mapping is essential. Let us now look into the recent volcanic eruption of Mt. Usu in March 2000 and the role of effective early warning and hazard maps.

2. Role of Hazard Maps and Early Warning in Mt. Usu Eruption
Mt. Usu is located in the northern part of Japan in the island of Hokkaido and erupted for the first time in 23 years in March 2000. This area is well known for the hot-springs. More than 1 million tourists, both local and foreigners, per year visit there to enjoy the beauty of nature. However, Mt. Usu has erupted 7 times in its history and devastated the villages surrounding the mountain.

After its last eruption in 1977, Japan Meteorological Agency (JMA), Universities and other research institutes have continuously observed this volcano. They have been conducting researches on volcanoes and monitoring on a real time basis by seismographs and surveillance cameras.

Also the Government has prepared the hazard-map and distributed to all residents so that people can be evacuated smoothly and timely. This is the good example of effective use of hazard maps. Even there are enough hazard maps, which are not known to the residents who are facing the risk, then those maps are really not useful in the event of a disaster. Hence distribution of hazard maps in understandable way to the residents who are at risk is the correct method to reduce disaster losses.

When the early warning of eruption of Mt. Usu is issued, immediately the national government dispatched officials to the site and set up a local headquarters. Local governments issued an “Evacuation Advisory” to the residents and tourists. The Evacuation Advisory was raised to the “Evacuation Order” which is the highest level of warning.

Since the residents know about the Mt. Usu hazard map, approximately 16,000 residents and all tourists were completely evacuated within one day.

The eruption occurred one and a half day after the evacuation was completed. 5 craters were formed by the eruption and the height of volcanic ash rose up to 3,200 meters high from the crater. This was a large-scale volcanic eruption in Japan that brought huge...
economic loss to this hot-spring resort. However, due to the effective use of hazard map and early warning, no one was killed or injured. 

made it possible to establish first response system quickly by the national government and related organizations. Further, the strong network among all the relevant ministries and organizations enabled to decide the most efficient mode of transportation for evacuation and to set up shelters immediately. Moreover, cooperation of the residents who know the hazard map of this eruption and media which contributed to disseminate the information among residents made the evacuation smoothly and led to no injured or killed. 

(Source: Masaaki Nakagawa, Cabinet Office, The Government of Japan, 2002)

The Japanese archipelago is part of the highly volcanic Circum-Pan-Pacific zone. Although the continental shelf where Japan is located makes up only rough

6-3-1. Response and Support: Effectiveness of Proper Emergency Supply Management System

1. Introduction

Effective and Coordinated Emergency Supply not only reduces the disaster impacts in terms of human sufferings but also contributes meaningfully to the Rehabilitation/Reconstruction phase. In this view, Emergency Supply Management
system called SUMA, began formal operations in 1992. It was developed in a cooperative fashion with the participation of experts from various Latin American countries, with the support of the Pan American Health Organization, Regional Office for the Americas of the World Health Organization (PAHO/WHO), the Colombian Red Cross, and financial support from the Government of the Netherlands. The system was designed for the administration of information regarding the entry of health and medical supplies into a country affected by a disaster. Later, SUMA was modified to serve as a management tool for all types of supplies, not only those related to disasters.

Over a period of several years, SUMA demonstrated its value as a technical tool for the coordination and management of information following disasters of both large and small scale in Latin America and the Caribbean. But SUMA is not merely a simple operational tool. Since its early days, it has evolved into both an indicator and a tool to assure transparency and encourage responsibility during the aftermath of disasters.

2. Functions of SUMA

- Identifies, selects, and classifies humanitarian aid as it arrives.
- Helps to establish priorities regarding supplies, based on the needs of the affected population.
- Provides a "snapshot" of the flow of donations and of remaining needs.
- Facilitates the preparation of reports and other types of news that can be exchanged among humanitarian groups.

3. Problems with the Arrival of Unsolicited Supplies

In the aftermath of a disaster, one of the main problems confronting national or authorities is identifying accurately what relief supplies have arrived, where they have been stored, and how useful they are. Often, well-meaning but misinformed donors send items that are not particularly useful, given the nature of the emergency as well as conditions on the ground.

Strictly speaking, this is a technical problem, but it has serious repercussions for policy implementation, given the following factors:
1. All too frequently, the storage space, transport, and human resources dedicated to relief supply management are scarce and must be allocated as efficiently as possible.

2. Technical information about arriving supplies is often lacking, making it harder to allocate them.

3. Because of these problems, the donors and the media get a negative impression of relief management efforts, through no fault of the disaster managers themselves.

4. **SUMA’s Objective**

SUMA’s objective is to prevent relief supply management inefficiencies by promoting a systematic approach involving trained staff, sound classification procedures, and a user-friendly, flexible information technology mechanism to ensure that incoming supplies are properly sorted, inventoried, and prioritized at their point of entry. The following steps are taken to maximize supply allocation effectiveness:

- Trained health staff sort and classify supplies as they arrive.
- Labels are attached to the incoming boxes and/or packages with the following information:
  - Distribution priority.
  - Whether the consignment contains health care items, including drugs and other medical supplies.
  - Whether items need refrigeration.
- An inventory is kept of the valuable items that arrive, based on technical and operational criteria.
- Donations are registered at the point of entry using a computerized system.
- National authorities receive daily reports detailing the name of the donors, the recipients, and the type of supplies provided, etc.
- The country’s efficiency is demonstrated by the use of advanced technology.
• Visitors obtain a favorable impression of emergency management efforts.
• Donors are sent an immediate confirmation via fax or e-mail as soon as the supplies have reached their intended recipient.

To attain this objective, all donations, regardless of their origin or ultimate recipient, are processed at the point of entry using the SUMA system before they are delivered. This requires that relief management organizations and institutions, whether governmental or non-governmental, cooperate closely to adopt operational policies and strategies before a disaster strikes.

As countries gain experience in the use of SUMA, they often start implementing it to meet goals that were not included in the original SUMA project. A case in point is the use of SUMA to keep track of supplies provided by local, rather than international, donors. Similarly, the system has been implemented at the local level to set up two field units, one to receive incoming donations and the other to distribute them on the ground. Regardless of how the system is adapted to local needs, it must be stressed that SUMA need not be used only for large-scale emergencies that require international support, but also can be used locally whenever the need arises to receive or mobilize supplies.

5. System Components

The system has three levels:

- SUMA CENTRAL
- The Field Unit
- Warehouse Management
SUMA CENTRAL is designed to operate at emergency management headquarters, i.e., the facilities where national authorities are managing a disaster or emergency.

At this level, the main tasks are to:

- Establish the criteria to be used by the Field Units, such as reception sites, consignment directories, definition of the main user, etc.
- Create Field Units.
- Consolidate the information sent by the Field Units.
- Respond to queries and prepare reports to support the decision-making process and promote inter-institutional coordination.
- Maintain the program tables (lists).

FIELD UNITS are designed to work at the points of entry (e.g., borders, ports), and at local collection centers where supplies arrive during an emergency, such as airports, collection sites, etc.

The main tasks at this level are to:

- Sort incoming supplies and label them URGENT – FOR IMMEDIATE DISTRIBUTION, FOR NON-URGENT DISTRIBUTION, and NON-PRIORITY ITEMS.
- Classify supplies by category and subcategory, and itemize them.
- Reply to selective queries about available items.
- Prepare reports on consignments that have arrived at that field unit.
- Provide receipts for recipients to fill as proof of delivery.
- Consolidate all relevant data on diskettes to be sent to SUMA CENTRAL

The SUMA Field Unit team also uses paper forms in case the computers fail, or whenever the logistics of data collection requires their use.
The WAREHOUSE MANAGEMENT Module is a tool that registers the arrival of supplies to storage centers or warehouses and their departure for distribution. These warehouses receive supplies as well as electronic tracking information sent by the Field Units or SUMA CENTRAL. In this way, institutions can coordinate the internal management of relief supplies or their distribution to other facilities or organizations involved in disaster relief efforts.

The main tasks carried out at this level are:

- Keeping track of the local inventory.
- Preparing reports on stocks and deliveries, according to several criteria and categories.
- Following up on the inventory in other warehouses, whether they are branches of the current warehouse or separate collection centers.

The following chart provides a functional vision of the system:

The Field Units produce information on diskettes to convey their data to SUMA CENTRAL and the Warehouse Management Module.
6. The Consignment

A consignment is a set of supplies that the same sender sends to the same recipient and that arrives at the same time by the same means of transport. It is the basic unit of reference for the system. The entire process of classifying and manipulating data on incoming supplies focuses on consignments.

The point of entry is the place where consignments arrive: sea and river ports, airports, customs offices, warehouses, etc.
The following examples may illustrate these concepts, assuming that the supplies arrive by the same means of transport:

- A ship arrives with a load of eight tons of wheat sent by the WFP to the Costa Rican Red Cross. It is a single item, sent by a single sender, and meant for a single recipient; therefore it will be registered as one consignment.

- A plane arrives with consignments for several recipients in Honduras. Three institutions or groups in Mexico have sent them:
  - Civil Defense sends various supplies to the Permanent Emergency Commission.
  - The Mexican Ministry of Health sends medical supplies to their Honduran counterparts.
  - The Honduran community in Mexico City sends food and clothing to the Red Cross for distribution in Honduras.

Facilities even though they all arrive on the same flight, from the same country, they come from different organizations and have different recipients, so they must be registered as three separate consignments.

Another case might be that one organization sends supplies to four different recipients within the same country. Alternatively, whether because of their bulk or due to transport limitations, relief supplies are sent to the same recipient by the same organization on four separate flights. In either case, we must record them as four consignments.

7. Activities in the Supply Reception

Before supplies can be delivered to their intended recipients, three steps must be taken:
- Sorting
- Classification
- Inventory

7.1 Sorting
Supply management and distribution priorities are determined by the guidelines set forth by the emergency management agency or the SUMA Team Coordinator. These priorities depend on the type of disaster and the national or local needs. For instance, in the event of an earthquake, medical supplies for the treatment of wounds and fractures would be crucial; in the case of floods, priority items would include food and water. All incoming boxes and packages must be sorted and then labeled and color-coded so as to show clearly their level of priority. Moreover, health supplies must be identified with an additional **green label**. SUMA’s priority levels and corresponding color codes are the following:

- **Priority 1:** **URGENT – FOR IMMEDIATE DISTRIBUTION.** These items must be distributed immediately at the site of the emergency. Label color: **Red**.

- **Priority 2:** **FOR NON-URGENT DISTRIBUTION.** These items are not urgently needed during the critical phase of the emergency, but may be useful later, during the reconstruction or development phases. Label color: **Blue**.

- **Priority 3:** **NON-PRIORITY ITEMS.** Some supplies may already have expired, or they have been damaged in transit. It may be impossible to identify them, or for any other reason they will be useless in the context of the current emergency. Alternatively, they may have been packed together in such haphazard fashion that it would be impossible to sort them efficiently during the critical stage of the emergency. In these cases, recipients may classify these items later, when human resources are not so pressed for time. Label color: **Black**.

For instance, in the disasters that took place in the Americas in the last decade, donations of pharmaceutical products broke down as follows:

- 15% were used immediately.
• 15% had no immediate use, but were used later after being stored safely.
• Approximately 70% had expired or were otherwise unusable.

Expired drugs may remain effective between three and six months after the expiration date. Depending on the importance of the drugs to the emergency, they might be classified as priority items for immediate distribution, indicating that they have expired and require a laboratory analysis to obtain a new certification. Health authorities should make such decision.

7.2 Classification

Within the SUMA system, relief supplies fall into one of the following ten technical categories:

<table>
<thead>
<tr>
<th>Pharmaceuticals</th>
<th>Shelter/Housing/Electricity/Construction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water and Environmental Sanitation</td>
<td>Logistics / Administration</td>
</tr>
<tr>
<td>Health (Non-Pharmaceutical)</td>
<td>Human Resources</td>
</tr>
<tr>
<td>Food and Drink</td>
<td>Agriculture (including Livestock supplies)</td>
</tr>
<tr>
<td>Personal Needs/Education</td>
<td>Unclassified Items</td>
</tr>
</tbody>
</table>

The basic recording unit in each consignment is the item. Examples include wheat, canned soups, aspirin and lidocaine. Each item can be identified by a series of characteristics such as its generic and brand names, its presentation and packaging unit (pills, kilograms, boxes or bags), and the total quantity received.

Each item falls within a category and a subcategory. For instance, an ambulance would be an item that would fall within the “Health” category and the “Transport of patients” subcategory.
In other words, every record must include the fields Category, Subcategory and Item. The only exception is the Unclassified category, where items are listed according to Category and General Type of Supply.

The Unclassified Items category enables the staff at the point of entry to deal with expired items, items that are unknown or unusable, or items that are too difficult to sort on the spot and must be classified eventually by the recipient when time and manpower allows, during or after the emergency.

7.3 Inventory

The inventory stage makes it possible for daily reports to be sent to the relevant national or local authorities on what supplies have been received and other relevant data, including the sender, the intended recipient, the categories of the supplies received, their quantity, and so on. Recipients can then make informed decisions on how to allocate these resources and otherwise manage the emergency. They can also notify donors directly of the arrival of their consignment.

During Hurricane Mitch

- Use of SUMA facilitated exchange of information among national institutions, international agencies and donors

- Appreciated especially in Honduras as a tool for transparency and accountability
8. Example

- SUMA is not only used for disaster supply management but also for routine operations:
  - warehouses,
  - hospitals
  - health districts

9. Conclusion
As we have seen above, the emergency supply management should be properly coordinated in order to avoid the secondary disasters and to ensure effective Rehabilitation/Reconstruction phase. Thus this Emergency Supply Management System is found to be effective due to following points. 
· Cost-effective 
· A simple system that makes sense if used by all parties, donors, local authorities 
· SUMA plays a major role in making humanitarian assistance more efficient 

(Source: FUNDESUMA, PAHO, 2002)
7-1-1. Coordination and Collaboration Between Government and NGOs for Strengthening Disaster Reduction and Response: The India (Orissa) Experience

1. Introduction

The World Disasters Report 1999 said during 1973-1997 the Asia region suffered about 106 major disasters every year (39% of the global figures). The annual average figures of losses due to disasters during the said period read as follows: 12, 675, 177 people affected (88% of global average), 36,914 people killed (41% of global figures), and 4,217,823 people rendered homeless (87% of global figures). These figures explain increasing vulnerability of the people of Asia to frequent disasters and call for serious thinking on disaster risk reduction and management, more so in view of their negative implications for growth and development in the Asia region. To strengthen disaster management in Asia, we need to consider constraints that affect and factors that positively contribute to risk reduction and management.

Our experience has shown that no single agency, whatever its capacity and resources, can adequately address all the problems brought by disasters. There is no substitute for synergy in thinking and action in reducing the risk and impact of frequent disasters. Successful initiatives in disaster reduction and management require careful efforts to combine knowledge, technology, expertise, institutional capacities, management skills, and practical experience for optimum results. The relationship between state and civil society, and more specifically, collaboration between Government and NGOs becomes important in this context. The state can act as a bridge between specialised knowledge & technology, skills, expertise in disaster management offered by individual experts, institutions, and agencies on the one hand, and grassroots experience, organisational capacity, participatory management skills, community based initiatives of NGOs on the other, in taking comprehensive measures for disaster reduction. NGOs can be innovative, rooted to
the ground, and participatory in their approach while government can replicate the best practices on a larger scale.

2. Important Role of NGOs in Development and Disaster Reduction

*Significance of NGO’s Role:* Of late, greater significance is being attached to the role of NGOs in the process of development as well as disaster management in view of their growing engagement in multifarious civic and development initiatives. However, it is not the magnitude of outputs delivered alone that justifies greater attention being paid to NGOs, who represent a significant part of the civil society. The disillusionment with too much centralisation, which over-burden the state machinery and adversely affects its performance, has led to growing emphasis on pluralism, expanded civic engagement, and collaboration amongst various actors as essential grounds for societal development. State alone can neither handle disasters nor ensure development without active participation of the people. The market, with its attention fixed on profit maximisation, hardly addresses social issues and concerns; hence, the importance of the Third Sector.

*Role in Development:* In the last few decades, NGOs have become important players in the development process all over the world. They are engaged in wide ranging activities starting from community level intervention for strengthening poverty reduction, women empowerment, rural livelihood stabilisation, health care, literacy, natural resource management, local governance, to training, research and policy advocacy at various levels. Their organisational flexibility, informal style of work, ability to work with communities in inaccessible areas have enabled them to deliver services to people with support from the government and from other resource providers at lower costs. At many places, they have supplemented government initiatives by acting as a conduit between development programmes and the beneficiaries, by informing and sensitising people about their rights and entitlements and by ensuring public accountability through greater participation of people in such programmes. Their long experience of working with poor and vulnerable communities, ability to mobilise people for micro-level development initiatives and understanding of people’s concerns and priorities enables them to better articulate problems encountered at the grassroots.
Role in Disaster Response: In addition to playing their part in the process of social development, NGOs are also playing an important role in disaster response and mitigation in different parts of the world. International NGOs such as OXFAM and REDCROSS have, since their inception, been active in providing humanitarian aid to the distressed. Local NGOs have played an active role in disaster response processes in South Asian countries, especially in Bangladesh, India, Nepal, and Sri Lanka. In India, the significant role of NGOs in emergency disaster response and long term mitigation came to the forefront after recent disasters: the 1993 earthquake at Latur which killed 7601 people, the 1999 Orissa super cyclone which killed 8931 people and the 2001 Gujarat earthquake which killed over 13,000 people.

3. Rationale for Stronger GO-NGO Partnership for Disaster Reduction

Replication of Micro-level Initiatives: The strength of NGO initiatives, whether it is post-disaster rehabilitation or development work during normal times, lies in community focus. However, this becomes a limitation in the absence of conscious efforts to facilitate the replication of such micro-level success stories at the macro-level and contribute to the overall process of disaster mitigation and development. Through constant interaction, dialogue, and engagement with the State, NGOs will not only be able to create grounds for greater understanding of their concerns but also be able to facilitate macro-level policy changes for replication of their experiments at the grassroots.

Optimal Use of Resources and Skills: GO-NGO partnership is a crucial factor in successful strategies for disaster reduction and response. Natural disasters may bring complex problems magnified at times by secondary technological and biological disasters. In countries like India, where limited resources and logistic and infrastructure facilities pose problems, optimal use of available financial and human resources, organisational energies and institutional support systems become very important in gearing up emergency response to disasters.

Check Overlapping, Duplication, & Confusion: The demographic factor poses an important challenge before disaster managers in South Asian countries, especially India, where the majority of people live in rural areas with poor communication facilities and limited support systems. Immediate response to disasters in such situations always proves difficult. Reaching marooned victims in interior areas before it is too late and providing necessary support for their survival, initiating primary restoration work prior to long-term mitigation remains a big
challenge, which would be difficult to ensure despite best efforts without a many hands approach. In recent natural disasters in India and other South Asian countries, NGOs have displayed their ability and commitment to reach as many victims-and in as short a time-as possible. While such quick response has reassured people in distress, experience has shown that without proper coordination these efforts could also lead to confusion. Proper GO-NGO coordination is, therefore, essential for emergency response to disasters, a point later we would discuss in the paper.

**Supplement Govt’s Response with Sectoral Initiatives**: We have learnt from experience in Orissa and in other parts of India that NGOs with their longstanding experience in community based development initiatives at the grassroots could positively contribute to the disaster mitigation process. The emphasis laid by NGOs on issues of livelihood, community organisation, community asset creation etc. has facilitated quick social and economic recovery after disasters. These initiatives meaningfully supplement reconstruction of civic infrastructure and other facilities. Adequate coordination of efforts between government and NGOs can accelerate rehabilitation initiatives and reinforce development.

**Special Attention to Problems Affecting the Most Vulnerable**: Disasters do not affect all people in a community equally. The relatively better equipped and better placed manage to cope with disasters better than those that are most vulnerable. In a recent expert group meeting of the UN division for advancement for women, Inter-Agency Secretariat for the International Strategy for Disaster Reduction held at Ankara (6-9 November 2001), Turkey, a study presented by Maureen Fordham showed that the disaster coping capacity of girl children in developing countries was limited by factors such as chronic malnutrition. Similarly, after the Orissa cyclone, as economic activities came to a standstill in the disaster hit areas, the worst hit were the landless wage labourers, left with few sources of income till reconstruction activities were initiated. In such a context, GO-NGO collaboration could ensure that while the state followed a universalistic approach in supporting victims, NGOs could adopt a more sector-focused approach in catering to needs of specific groups or address specific issues requiring special attention.

**Strengthen Community Based Disaster Preparedness**: In the Asian context, where poverty and low awareness levels account for higher human casualty and deeper adverse economic and social impact of disasters, it is difficult to visualise strategies for successful disaster
preparedness initiatives without active collaboration between government and NGOs. Techno-intensive solutions for disaster response and reduction are hard to adopt in view of higher economic costs and uncertainties surrounding their adaptability to local socio-cultural situations. Success of disaster preparedness in such situations depends more on effective community-based approaches to risk reduction and management. NGOs with grassroots experience and skill in community mobilisation could strengthen community-based disaster preparedness in collaboration with government. This aspect will be discussed in greater detail later in the presentation.

**Collaboration-Best Guarantee of Success:** In brief, without proper coordination and collaboration between Government and NGOs, initiatives in disaster response, mitigation, preparedness and reduction will not bear the desired fruit. On the other hand, effective partnership between government and NGOs would benefit both in terms of learning and greater understanding of each other’s problems and concerns. This would not only strengthen initiatives for disaster reduction but also positively contribute to the process of accelerating social development. Many studies have already shown a “stronger co-relationship between successful project implementation and effective GO-NGO collaboration” and have emphasised the fact that such “NGOs can achieve better impact through such collaboration” (Aga Khan Foundation, 1988; Asian NGO Coalition for agrarian reforms and rural development (ANGOC), 1988). Let me share my experience in GO-NGO collaboration for disaster reduction in Orissa, which will help in seeing the issue in proper perspective.
4. Learning From Experience: GO-NGO Collaboration for Disaster Reduction in Orissa

Poverty and Disasters: Before going into the dynamics of GO-NGO relationship in Orissa and its role in disaster reduction, which may not give an actual picture without the benefit of some discussion on the socio-economic and political context, I would briefly introduce the society and people of Orissa, the eastern Indian province, which in the past maintained close trade and cultural ties with the larger Asian fraternity. One of the poorer states of India, Orissa has predominantly agrarian economy with limited industrialisation and urbanisation. The majority (70%) of people (over 36 million) live in rural areas and earn their livelihood from agricultural activities. About 22% of people belong to Scheduled Tribes and 16% of people belong to Scheduled Castes. Spread along the eastern coast of India with a coastline of about 500 kilometres, Orissa is vulnerable to frequent natural disasters. While people in the coastal parts are exposed to floods from numerous rivers and cyclones from the Bay of Bengal at regular intervals, people in the western region suffer chronic drought conditions.

NGOs and Disaster Response: Till recently, except for a few INGOs such as REDCROSS, OXFAM and CARE, the role of NGOs in disaster response was limited in Orissa. The role that NGOs previously played was restricted to localised relief distribution. The State Relief Code, which paid little attention to the role of NGOs, could be seen as cause as well as effect of the limited role of NGOs in disaster response. NGOs emerged in large numbers in the 1980’s and mainly worked with the poor, especially scheduled castes and tribes in interior areas, with resource support from government and other donors. But the twin cyclones of 1999 radically changed the scenario.

The 1999 Cyclone: On 14th October 1999, the southern coastal districts of Orissa suffered a cyclone that killed over 50 people and inflicted heavy damage on housing and infrastructure. Hardly had the people heaved a sigh of relief when another cyclone struck on 29th October: this time, a super cyclone. The cyclone showed inadequacies in the state’s preparation for dealing with such a massive disaster. The devastating cyclone killed 8,931 people and 4,40,000 livestock as super heavy winds at speeds averaging 300 Km/Hr coupled with incessant rain over a 36 hour long duration destroyed houses, felled trees, and ravaged bridges, roads, telecom and power systems. Storm surges and flash floods in rivers submerged hundreds of coastal villages. Over 18.9 million people were affected by the disaster. More than 2 million houses collapsed; over 1,843,000 hectares of standing crops were destroyed.
5. NGO Response to 1999 Cyclone

At an hour of crisis, numerous NGOs in the state rose to join the emergency response process and supplemented efforts being made by the state government to deal with the unprecedented disaster. For the first time, about 40 local, national, and international NGOs joined hands to form an emergency response network called Orissa Disaster Mitigation Mission. They set up an emergency control room at the state capital, Bhubaneswar to coordinate relief and restoration work being carried out by ODMM member NGOs in various districts. In addition to coordinating relief and restoration work being carried out by NGOs, the ODMM control room also brought out daily bulletins and shared information with the state government’s emergency control room regarding various issues including problems faced in different locations at regular intervals. Another NGO network called Orissa Disaster Action Forum (ODAF) formed earlier was also active in emergency response. While most NGOs withdrew after the immediate cyclone response process was over, ODMM, ODAF members, INGOs and other NGOs continued their rehabilitation efforts in the cyclone-hit areas. The following gives a brief account of disaster response and rehabilitation initiatives taken by NGOs following the 1999 cyclone in Orissa.

Three Phases of NGO Response: The NGO response to the 1999 cyclone addressed different sets of problems and challenges in three phases: immediate, short-term, and long term. In the immediate phase, the NGO response focused on emergency food relief, disposal of human corpses, animal carcasses, supply of temporary shelter materials and utensils, emergency medical check up and distribution of medicine, sanitation and drinking water, trauma care and psychological counselling, awareness raising and rejuvenating community spirit for reconstruction. The second phase of disaster response, which was actually an extension of the initial relief phase, was focused on food security, restoration and creation of community assets, revival of learning process, social mobilisation and group formation. The third and final phase, which is still on, has sought to address challenges such as livelihood restoration, construction of multi-purpose schools cum cyclone shelters, and community based disaster preparedness.

Immediate Food Relief and Habitat Restoration: Disaster response NGO networks such as ODMM and ODAF, INGOs (Red Cross, CARE, Oxfam, Action-Aid, World Vision, etc) and UN Agencies (UNICEF, UNDP), philanthropic/faith organisations, and CBOs took part in the
immediate phase of cyclone response. They ran community kitchens in hundreds of villages to provide cyclone victims with cooked food. Such food relief was in course of time utilised, especially by professional NGOs, to initiate habitat restoration activities in partnership with local communities. In Erasama Block alone, over 5,000 people had lost their lives. The rotten corpses of men and animals floating on water and lying all around created a frightening scene accentuating trauma among people. Villages appeared smothered beneath the debris of broken houses and fallen trees. Immediate restoration activities which included clearing villages roads, schools, house backyards, cleaning and disinfecting ponds, renovating wells, disposing carcasses brought the affected villages to habitable condition.

**Emergency medical response:** Amidst acute scarcity of food and drinking water loomed the fear of an epidemic. Owing to the prolonged exposure to rain and wind and the lack of food, people fell victims to ailments such as severe cold, cough, diarrhoea, and gastronomic disorders. It was difficult for primary health centres to face the challenge of treating so many patients. Alongside the State Health Department and visiting medical teams from neighbouring states and the country, NGOs mobilised doctors and paramedical workers and sent their emergency health care teams to cyclone-hit areas. These medical teams ran mobile health camps in affected villages and treated hundreds of patients everyday. Preventive measures such as distributing medicine, and halogen tablets for purifying water, and giving health tips to people by organising community health awareness camps supplemented such curative health care initiatives.

**Rejuvenating Spirits and Raising Awareness:** Death and devastation filled the victims with a sense of gloom. Cases of severe depression, and psychological trauma were reported in the worst affected villages. With so many people killed, homes reduced to mud and property destroyed, in the minds of cyclone victims lurked the fears of an uncertain future, with which they now had to negotiate terms with little left in their hands. Even as the government provided immediate food relief for weeks and compensation for houses damaged and family members lost and NGOs came up with supplementary support, people showed little interest in restoration activities being initiated. Some NGOs adopted innovative means to raise people’s depressed spirits by organising street theatres and participatory cultural shows in the affected communities. These included Natya Chetna, Aaina, ODMM members, and volunteer groups. Many NGOs also organised cultural camps to raise awareness about challenges brought by the disaster and initiatives people needed to take. Andheri Hilfe trained ODMM member NGOs in
psychological counselling who ran Trauma Care Centres in worst affected villages. NGOs such as Adhikar and ODMM members ran Legal Aid Centres to sensitise people about their legal entitlements and helped them receive rightful compensation offered by the Govt.

*Volunteer Mobilisation:* NGOs played a crucial role in giving actual shape to citizenry concern for cyclone victims by facilitating their voluntary participation in disaster response. ODMM set up a Volunteers Hub at the state capital and ran a volunteers base camp in the worst hit area. The camp control room at Erasama coordinated volunteers’ engagement in relief activities in affected villages. These volunteers assisted in health care, food relief, and habitat restoration activities. Other volunteer groups that played an active role included NYK, Doctors sans Frontiers, etc. A youth camp organised at Erasama by National Youth Programme aimed to show solidarity with people and augment shelter reconstruction work in affected villages. The Assistant Relief Commissioner, who camped at Erasama to coordinate emergency response in worst hit areas, facilitated participation of volunteers in relief operations.

*Sort-Term Rehabilitation:* While faith based philanthropic organisations continued to offer food relief by running community kitchens and visiting teams from various civic associations, companies, educational institutions, and other organisations distributed one time relief and left, developmental NGOs concentrated on pressing issues of rehabilitation. These included food security, creation of community assets, revival of learning process, social mobilisation and group formation, etc.

*Food for Work:* NGOs including ODMM member organisations, CARE, Oxfam, Action Aid, and others initiated Food for Work programmes in different affected areas. The objective was to provide people, especially those without any source of income, with temporary food security and facilitate restoration and creation of community assets having economic significance. These included renovation of ponds, construction of irrigation facilities such as canals and earthen check-dams (CYSD and partner NGOs), village roads (CARE), restoration civic infrastructure, etc. Such initiatives were a prelude to livelihood restoration programmes. During this period, different NGOs including Action Aid carried out base line need assessment surveys using participatory research methods to prepare rehabilitation action plans. Vegetative regeneration through setting up backyard and community nurseries was carried out by many NGOs with seed support from CARE.
**Child Centred Initiatives:** Both during short-term and medium-term phases, an important aspect of NGO initiatives was to provide special support to children. Some NGOs took initiative to bring school going children back to the classroom by setting up temporary sheds and providing text books to students. The idea was to save children from disorientation in a post disaster situation of disorder. The concept of Mamata Griha (transit houses for orphan children) was introduced during this period, which initiated a debate between institution and community-based rehabilitation of children orphaned by the cyclone. Many NGOs set up community day care centres for orphan children where widows and single women worked as matrons. The aim was to facilitate community-based rehabilitation of orphaned children and check their adoption by outside agencies and individuals, ruling out any possible chances of trafficking in children. At Erasama, NGOs organised a one-day workshop in which the parents, teachers, and government officials participated to identify problems suffered by children in cyclone-hit areas. NGOs like Aaina took special care to facilitate cyclone-affected children’s participation in creative activities such as drawing and painting to relieve their trauma.

**Social Mobilisation and Group Formation:** The uniqueness of disaster response of developmental NGOs lay in their emphasis on community and group initiatives. Right from the start, NGOs used their community mobilisation skills to facilitate formation of village committees to decide future course of action and monitor all rehabilitation initiatives. They also formed functional groups such as women’s groups, farmers’ groups, water user groups, and youth groups to take specific developmental initiatives. These efforts strengthened a rights-based approach to disaster mitigation and helped divert people’s attention from “throw and leave” relief support extended by visiting groups for substantive reconstruction work in the community. Such partnership with people paved the way for long-term community-based initiatives for livelihood restoration, and disaster preparedness.

**Longer Term Rehabilitation:** NGOs that could mobilise resources went ahead with long-term rehabilitation initiatives even as those lacking resources were forced to withdraw. Restoration of livelihoods in rural farm and non-farm sectors, construction of multipurpose schools cum cyclone shelters, and initiatives to strengthen community based disaster preparedness are highlights of this process.

**Livelihood Restoration:** Major NGOs such as CYSD, Action Aid, CARE, Oxfam, Indian Red Cross, BGVS, CASA, CPSW, Agragamee, Gram Vikash, VHAI, and others played a lead role...
in the livelihood restoration process. CARE, CYSD, and others supported farmers with seeds, implements, tillage, irrigation facilities, and training to facilitate early revival of the agricultural cycle. CARE provided fishermen with boats and fishing nets, while Action Aid carried out a long drawn out process of food for work in affected areas. The Voluntary Health Association of India (VHAI) implemented a special project christened Aparajita (one who believes in “never say die”) to rehabilitate fishermen and artisans. Other NGOs facilitated income-generating activities by artisans, craftsmen, and the poor.

Micro-Credit and Women Self-Help Groups (SHGs): Studies have shown how micro-finance can be an important component of post-disaster rehabilitation process. To provide families with additional income sources as well as create local resource pools for dealing with future disasters, NGOs emphasised formation of women SHGs. These SHGs received skill training for taking up income generating activities such as setting up vegetable nurseries, making incense sticks, tailoring etc. SHGs that made quick progress received matching grants for financing small business activities by individual members.

Plantations: The devastation caused by the super cyclone was partly attributed to the destruction of mangrove forests that acted as a buffer between land and the sea in coastal Orissa in the last few decades. The 1999 cyclone fell an estimated 90 million trees, virtually wiping off the green cover in affected areas. NGOs who continued longer-term rehabilitation efforts, therefore, strongly emphasised plantation activities. The government and other resource providers supported NGOs in carrying out plantation by providing seedlings, and earmarking land for plantation. With facilitative support from NGOs, people undertook community, avenue, and backyard plantations.

Individual Dwelling Units: While the government ensured supply of temporary shelter building materials to each and every affected family, many NGOs distributed temporary shelter building materials among people after the cyclone. Some NGOs facilitated community construction of low cost temporary dwelling units for the destitute, women headed families, and the poor in the cyclone affected areas. NGOs such as CARE, Red Cross, Action Aid, Gram Vikas, AMG India International, and faith organisations such as Ramakrishna Mission, Bharata Sevasram Sangh, Orthodox Church Mission, LWS, etc constructed dwelling units for poor and vulnerable families. The major housing programme, however, was government
supported one. The Government provided resource support for constructing individual
dwelling units to about 200,000 cyclone-affected families.

**Community-Based Disaster Preparedness:** NGOs supplemented their rehabilitation efforts
with disaster preparedness initiatives. One aspect of this process has been the construction of
over 60 Schools-cum Cyclone Shelters by prominent NGOs like CARE, CYSD, CASA, Gram
Vikas, CPSW, Indian, Spanish, and German Red Cross, LWS, Tata Relief Committee, RK
Mission, etc in cyclone prone areas. These efforts supplement government initiatives to
facilitate construction of about 150 multi-purpose cyclone shelters with resource received from
various sources. These infrastructure building activities are backed by sustained efforts to
strengthen disaster preparedness through awareness raising, training, local volunteer
mobilisation, contingency planning and institution building at the community level.

**Highlights of GO-NGO Collaboration after 1999 Cyclone:** Even as the nature of coordination
between government and NGOs was marked by some initial confusion, it substantially
improved in due course of time. Growing recognition for the important role played by NGOs
in the disaster response process contributed to stronger collaboration between government and
NGOs. Highlights of such collaboration included regular coordination meetings at Block and
District levels to monitor rehabilitation process. UNDP took a significant initiative for
coordination of NGO initiatives by preparing a database on NGO initiatives in order to
strengthen information sharing and held regular meeting for problem sharing and future
planning. The state government, INGOs and local NGOs also carried out joint reconstruction
planning and vision building exercises. A participatory consultative workshop on disaster
impact and reconstruction challenges was organised by UNICEF and later another vision
building workshop was organised by ODMM-CYSD. Important stakeholders including
government, INGOs, local NGOs, UN Agencies, resource providers, and experts took part in
such exercises.

**Learning From Mistakes:** GO-NGO coordination during the cyclone response and
rehabilitation suffered a few drawbacks on account of several factors. Firstly, Orissa had not
faced a disaster of such magnitude in the recent past and was not prepared for such an
eventuality. In the face of a complete breakdown of the power and telecom systems,
destruction of communication facilities, Orissa was cut off from rest of the world for nearly
seventy-two hours. It was hard to reach emergency relief to marooned victims due to heavy
damage to communication facilities. The government had no previous experience of working with so many NGOs in a disaster situation as NGOs never before participated in disaster response on such a scale. The government was accountable to the people and had own priorities in catering to all victims whereas NGOs with their experience in micro-level development work were able to take community-based localised initiatives. Participation of so many NGOs in relief work and competition amongst them to impress their respective donors led to quite a bit of confusion. In the absence of a clear framework for information sharing and coordination of activities it was next to impossible for the government to initially find out who was doing what in the disaster affected areas. While bigger NGOs stole the lime light because of their superior documentation skills, smaller NGOs got neither the attention of the media nor that of resource providers. It was also difficult for many donors who landed up in the state capital to identify able partners for supporting rehabilitation work. Thus along with some highly credible and efficient NGOs many non-credible and even non-existent NGOs also managed to receive funds. Without a proper framework for coordination, the government was at a loss trying to find out whom to provide urgent facilitative support and whom not. As the rehabilitation process progressed, stronger, efficient and credible NGOs continued their efforts in the disaster affected areas, while the rest withdrew from the scene. NGOs on their part felt peeved at the government’s inability to provide them with adequate facilitative support and had some complaints to make. Increasing media attention being focused on NGOs partly explained indifference on the part of Block level officials towards NGOs. The major complaint made by NGOs was the absence of an institutional mechanism for information sharing and regular consultation with government. To address such problems, an NGO Coordination Cell was quickly set up with one Secretary in charge. The Secretary made an attempt to guide NGOs, researchers, and volunteers coming from outside the state, and facilitated interface between NGOs and government department. The process was essential and proved invaluable, and provided the basis for institutionalised GO-NGO coordination for emergency preparedness and response through OSDMA in due course of time.
6. OSDMA, NGOs, 2001 Floods, and After

The setting up of Orissa State Disaster Mitigation Authority (OSDMA) as an autonomous nodal agency for coordinating efforts relating to disaster response, preparedness, and reduction created space for stronger institutional coordination with NGOs. OSDMA developed and maintained own database on disaster response and preparedness initiatives of NGOs, held consultations with them for information, problems and experience sharing on a regular basis. Such close collaboration with NGOs not only made OSDMA’s task easier in carrying out need assessment, identifying problems and planning its future course of action but also helped NGOs in receiving adequate facilitative support in carrying out reconstruction and developmental activities in the cyclone affected areas. The 2001 floods were an acid test for such efforts, which the government and NGOs, it could be fairly said, successfully passed. Emergency coordination among government departments, between state headquarters and district administration, and with NGOs ensured quick and efficient response to the floods. NGOs worked hand in hand with government in carrying out rescue and relief operations. While the government played a lead role in making such efforts, NGOs participated in providing food relief by running community kitchens and in rescuing people from high-risk areas. Notable effort was made by INGOs such as CARE, which assisted the government in airdropping food packets in affected areas. This was possible due to several measures by government and NGOs. Important among these was sustained effort made by NGOs to strengthen community based disaster preparedness, which involved awareness raising, training, contingency planning, formation of village disaster task forces and disaster management committees. This in fact prepared the communities to better cope with floods.

Current Initiatives: OSDMA has initiated a number of activities including reconstruction of damaged infrastructure such as roads, schools, irrigation facilities, multi purpose cyclone shelters, and carrying on important tasks such as formulating disaster management policy and plans to deal with various kinds of disasters in future. It continues to collaborate with NGOs in addressing problems wherever necessary. For example, the community management of MCS is being ensured through partnership with NGOs such as BGVS. Different social impact assessment studies for reconstruction activities were carried out in partnership with NGOs. OSDMA has already formed a Grievance Redressal Committee representing both state and civil society to address public grievances regarding the rehabilitation process. Another such
broad-based committee is being formed to guide social capital restoration process in the disaster-affected areas.

*Vision Building through Collaboration:* OSDMA and NGOs joined hands to raise public awareness on challenges posed by frequent hazards to mark the Disaster Preparedness Day on 29th October 2001, the day on which the killer cyclone hit Orissa. The Voluntary Network of India held its annual convention in Orissa in November 2001 focussing on disaster preparedness and GO-NGO relationship, in which OSDMA actively participated. Later, a broad-based South-Asian Coalition for disaster management was formed at the workshop on disaster management organised jointly by South Asia Commonwealth Youth Programme, CYSD, CARE and OSDMA in the last week of November 2001. All such events have provided space for meaningful sharing of problems, challenges and vision building for collaborative initiatives for disaster reduction.

### 7. Removing Barriers to GO-NGO Collaboration

Before discussing ways in which GO-NGO collaboration can be strengthened for disaster reduction initiatives in Asia, it is apt to reflect on issues concerning GO-NGO relationship. These include the existing relationship between government and NGOs, problems and constraints experienced, and outstanding issues that need to be resolved to reduce strain between the two most important players in the process of development and disaster management.

*Misunderstanding and Mutual Suspicion.* Talking about challenges faced by India and role that all had to play in nation building, Jawaharlal Nehru once said “The common experience of suffering and common vision of progressive transformation should provide a common basis for our struggle for a better future.” Common objectives provide the best common ground for cooperation between government and NGOs. However, government and NGOs everywhere seem to have a set of perceptions about each other. NGOs see government as keen on authoritarian control restricting their freedom; unable to appreciate issues of development; insensitive to concerns of civil society; and opposed to transparency and accountability, and so on. Government on the other hand views NGOs as doing less and talking more; opposed to any move to ensure transparency and accountability, over critical of government policies without providing concrete suggestions, donor driven, obsessed with sectoral issues and blind to
macro-challenges of development, and so on. One general characteristic that such perceptions share is that they are generalisations based on limited observation.

Historical Legacy. Such confusions could partly be attributed to the painful historical legacy of colonial rule in India and other Asian countries, where laws and bureaucracy were seen as instruments of exploitation and underdevelopment and weapons to curb civic freedom. Following decolonisation, the post-colonial state began playing a central role in the process of development. In countries like India, over-arching structures of control were instituted, which are now being slowly dismantled following liberalisation. Too much expectation put enormous burden on state and rising social expectations on occasions erupted into violent movements, which Samuel P Huntington said was a major source of destabilisation of the institutional framework in developing countries. NGOs, which came up to play a crucial role in the development process in different countries, bridging resource and performance gaps, instead of collaborating with the state for accelerating development, sought to present themselves as an alternative to government, creating differences and conflict.

‘Holier than Thou’ Attitude. One factor that acts as a strong barrier to meaningful collaboration between government and NGOs is latter’s holier than attitude. Both government and NGOs have their respective strengths and weaknesses. However, at the slightest instance where the government is found lacking, NGOs tend to brag about their value addition and criticise the government. On the other hand, when government responds to a crisis in time, they underplay it saying it was after all government duty. The tendency of NGOs to overplay their role, and their “holier than thou” attitude could be a great obstacle to meaningful cooperation. Sometimes bigger NGOs use their superior media management skills to put themselves at the centre stage during emergency situations, which puts off smaller NGOs as well as government. There are shortcomings in the way both government and NGOs operate, which they should seek to minimise instead of trying to overplay their strengths and hide weaknesses.

Poor Information Sharing. Even as NGOs wax eloquent on various issues of development and the need for stronger collaboration, few NGOs make conscious efforts to share information regarding their activities and learning with other institutions of civil society and government. This of course does not apply to evolved NGOs, who regularly publish and circulate their annual reports, maintain websites, and regularly interact with relevant government departments.
Some NGOs prefer to practise isolationism and try to work away from the government orbit with an impression that otherwise it would affect their freedom. On the other hand, while some govt. departments and officers are better aware of activities and concerns of NGOs because of their regular interaction, other officials find it hard to interact with NGOs due to a lack of knowledge about latter’s activities and work style. The absence of proper institutional and regulative frameworks for information sharing puts both government and NGOs at a disadvantage. While NGOs fail to receive the kind of facilitative support they expect at the grassroots level, government fails to benefit from skills, expertise, and capacities of NGOs in planning and implementing its programmes.

Donor Driven Programmes Vs Actual Needs. The challenge of timely end to relief operations and early initiation of rehabilitation efforts after disasters is often given a go by some NGOs who continue relief work well past the emergency situation. This is well understood in the context of resource dependence of NGOs on donors. Until a proposal for emergency response is approved nothing moves, and after the proposal is approved some activities are carried out even without much relevance. However, prolonged relief support leads to confusion and affects reconstruction work. Similarly, another fact that deserves mention here is the differential approach of different NGOs to humanitarian aid. Some organisations provide more while some provide less, creating a situation where victims start bargaining with NGOs as to what they should provide to be able to work in a certain locality. This invariably puts developmental NGOs at a disadvantage who emphasise early initiation of rehabilitation activities and disapprove of relief delivery approach. On the other, philanthropic organisations, moved as they are purely by altruism, emphasise humanitarian aid.

Lack of Knowledge about NGO Skills, Capacities & Resources. Another problem that affects effective GO-NGO collaboration is a lack of adequate knowledge regarding skills and capacities of NGOs. Even as OSDMA in the course of continuous interaction with NGOs has come to a position to better appreciate skills and capacities of NGOs, further steps are needed to prepare stronger database on resources, skills and capacities of NGOs, so that optimal use of available expertise, skills, capacities, and resources can be ensured.

Adversarial Relationship Versus Partnership. Greater convergence of views on disaster response between government and NGOs was achieved after the super cyclone in Orissa. This was mostly because of greater recognition of ground realities by both government and NGOs
and sincerity of approach on their part. However, with regard to many issues areas of
difference still persist. The ADB Study on Asian NGOs (1999) says that collaboration and
advocacy action may not go together. However, a closer look at the issue will show that
adversarial relationship need not be a natural by-product of advocacy. In fact, experience
shows that in fact sincere advocacy could lead to greater understanding between government
and NGOs. For example, in Sri Lanka NGO advocacy led the government to initiate
consultations with NGOs, following which NGOs engaged in constructive engagement with
the government. In Bangladesh, following the government’s move to regulate NGOs, the latter
came up with Code of Ethics, which strengthened understanding between government and
NGOs. On the other hand, experience shows that cosy relationship between an NGO and a
govt. department could weaken accountability and breed corruption.

Inter-NGO Relationship. Studies on networking and collaboration among NGOs show that
activities of NGOs are poorly coordinated among themselves. In Orissa we saw that two NGO
networks emerged in response to the 1999 disaster, and neither of them was free from internal
bickering. Smaller NGOs felt coordination among NGOs was affected by dominance of bigger
NGOs, whereas the latter felt the lack of proper institutional frameworks in smaller NGOs
affected better interaction with them. Bigger NGOs have the resources to set proper
institutional structures in place, whereas smaller NGOs are mostly flexible groups of
individuals without the advantage of any proper office, assets and infrastructure to back
institutional growth, factors that poorly compare them with bigger NGOs. Bigger NGOs tend
to look down upon smaller NGOs and avoid sharing a common platform with the latter.

Competition is also a factor that affects relationship among comparable NGOs. At times,
leaders of two big NGOs do not see eye to eye. Initiatives by charismatic individuals
contribute to formation of networks and alliances, true, but such initiatives at times block
larger participation and give the network or group a partisan look, which affects its legitimacy.

In a study on feminist organisations, Carmen Sirianni (1995) showed that leader driven civil
society alliances could be affected by problems such as “leader trashing” and confusion among
members. These factors are being discussed here to explain that cooperation among NGOs is a
also factor, which determines the nature of collaboration between government and NGOs.

Inter-NGO conflict affects credibility of NGOs, limits their bargaining capacity, and works as
a barrier against meaningful collaborative initiatives for achieving larger goals.
Legitimacy and Issue of Regulation. Everything said and done, NGOs are still treated as outsiders in the present political-bureaucratic environment. This applies to Orissa as much as it does to other Asian countries, save some commendable exceptions. One reason why even in a democratic political set up, the government could be less enthusiastic about treating NGOs as equal partners is their weak representative character. Most NGOs operate more like private companies and, despite all their concern for social issues, have not taken clear steps to involve people as equal stakeholders in their programmes and initiatives. Therefore, a democratic government could always see itself the sole legitimate representative of people’s voices and see any talk of NGO role in policy making as preposterous. The fear of neo-colonial domination often leads governments in many developing countries to see foreign funded NGOs as agents of powerful global players and treat their criticism as moves to destabilise government. Secondly, NGOs stand opposed to any sort of government regulation on the grounds that this would invariably curtail their freedom, put a lid on advocacy and prevent them from playing their rightful watchdog role in a democracy. However, the absence of any regulation of NGO activities explains the presence of so many “fly by night” NGOs who tarnish the image of credible NGOs and the voluntary sector as a whole. We have to find out how mechanisms for regulation of NGOs could be set in place without affecting their freedom and pluralism.

8. Enabling Environment for GO-NGO Partnership

A few more issues need to be reflected on with regard to GO-NGO relationship. The nature of such relationship has been different in different countries. In countries with restrictive governments this has been adversarial (Zaire, Pinochet’s Chile, Kenya, Marcos’ Philippines, Lao PDR); in countries such as Tanzania and China NGOs have been over dependent on government for money, ideas, and resources. In countries like India, post-Marcos Philippines, and Brazil such relationship has largely been collaborative in nature. That democracies provide enabling institutional frameworks for collaboration with NGOs could not be ignored. However, within an inclusive institutional framework, there could be several ways in which GO-NGO relationship is established. It could vary from non-intervention, active encouragement, guidance, partnership, to co-option and control (John Clark, 1993). The areas of cooperation that needs further attention are: institutional and legal framework, required incentives, sectoral collaboration, NGO role in policy-making, and conflict management. A conducive policy environment will go a long way in strengthening GO-NGO partnership for better disaster
management and faster social development. The aim should be to create a “whole larger than the sum total of parts”.

Some crucial issues that need to be reflected upon by government and NGOs are:

− Nature of capacity building support needed by NGOs dealing with disaster management;
− Norms for partnership, continuous consultation and coordination
− Stage and type of collaboration with special attention to area of work
− Impact of GO-NGO partnership on institutional structure of government and NGOs
− Implications for engagement in various areas of disaster management


Overcome Historical Differences and Build Consensus: The 21st Century is emerging as the Century of collaborations, partnerships and consensus building. Both NGOs and government must bury their historical differences to be able to pursue goals of development through consensus. Old ideas and prejudices must die for GO-NGO partnership for progress to flourish. As John Clark (1993) points out the way to strengthen GO-NGO collaboration lies in seeing contributions of government and NGOs as mutually complementary and not as competing alternatives. The move should be towards greater consensus on goals and means of development and disaster management. The limited resources we have and the enormity of problems we encounter call for greater synergy, which could be achieved only through greater collaboration based on trust and mutual respect.

Information Sharing and Social Audit: The ground for strengthening GO-NGO collaboration lies in trust and mutual respect, which in turn depends on higher levels of credibility. Credibility is best guaranteed by suitable institutional mechanisms for ensuring transparency and accountability and steps to encourage healthy practice towards this goal. By treating each other as corrupt, government as well as NGOs not only fall in the public eye but also do great disservice to the process of development. Experience shows that both NGOs and government resist moves to hold themselves more accountable to people and must take exemplary steps to strengthen transparency and accountability. While the Government should participate in social audits organised by NGOs through public consultations, NGOs too should carry out such initiatives to hold themselves accountable to people. A notable initiative in Orissa has been Action Aid-India’s initiative to organise social audit in disaster hit areas. Similarly, CYSD in collaboration with government organised public hearings on rehabilitation efforts in cyclone-
hit areas to identify issues and problems. The minimum that needs to be achieved is institutional mechanisms for strengthening information sharing. This would help credible NGOs to distinguish themselves from “come and go suitcase NGOs” and also enable government to identify NGOs capable of adding value to the process of development and disaster management.

*Setting Minimum Parameters for Humanitarian Aid*: Keeping in view confusions that differential approach to humanitarian aid in post-disaster situations could create and affect rehabilitation, some common principles of providing humanitarian aid should be agreed upon. So far as minimum standards for providing humanitarian aid are concerned, the SPHERE framework remains a useful tool. However, to reduce the time lag between a disaster and humanitarian aid offered by NGOs, minimum parameters and time frames need be worked out. Steps should be taken to standardise people’s entitlements and norms of engagement in disaster response. This would reduce conflict of opinion among NGOs and also enable concerned stakeholders to initiate rehabilitation work early in disaster-affected areas.

*Database on NGO Skills, Capacities & Resources for Capacity Building*: To enable government to work in partnership with and cooperate with able NGOs in strengthening disaster management and social development, a stronger database on skills, capacities, and resources need to be created. Similar efforts should also be made to prepare manuals on available resources and support offered by government and other institutions for disaster management. Given that disaster management is an emerging field and not many NGOs have enough expertise in various aspects of disaster management. Therefore, a stronger database on NGO skills, capacities and resources would help government identify umbrella/support NGOs for strengthening capacity building initiatives for community based disaster management and other disaster reduction initiatives.

*Strengthening Learning*: After each disaster, the hard work done and difficulties encountered during emergencies are forgotten, creating a “learning gap”. As a result, when a fresh disaster strikes, there is little documented learning to guide emergency response. To strengthen disaster learning, OSDMA has started publishing a Newsletter called *The Response*. Further efforts are needed to document learning at different levels. Organising consultations for sharing experience would strengthen this process. NGOs, instead of just preparing activity reports and success stories, should come up with learning documents, which would benefit government as
well as other organisations. One way to strengthen GO-NGO partnership would be mutual sharing of experiences of interactions between government and NGOs.

**Issue Based Advocacy**: The existing adversarial relationship between government and NGOs, visible in many countries, could be transformed into a relationship marked by meaningful dialogue and debate on contentious issues for greater understanding. This would be possible if NGOs engage in issue-based advocacy in the stronger GO-NGO collaboration. Government on its part should encourage and appreciate such initiatives with an open mind. The common objective should be to identify and remove hurdles affecting collaborative initiatives for disaster management and social development.

**Institutional Mechanisms for GO-NGO Collaboration**: In the absence of proper institutional mechanisms, proper coordination between government and NGOs is hard to achieve. In Orissa, though no formal institutional framework is in place for GO-NGO coordination, the setting up of OSDMA has filled crucial gaps for institutional coordination of GO-NGO initiatives for disaster management. There should be conscious efforts to strengthen inter-institutional and inter-sectoral coordination of efforts at all levels for disaster management. For example, disaster management councils could be formed at local, district and state levels, which would strengthen disaster preparedness and response. Similarly, broad-based consultative committees with representatives from both Govt. and NGOs could be formed to guide GO-NGO collaboration for disaster reduction and response.

**Strengthening Networking and Collaboration Amongst NGOs**: To improve cooperation amongst NGOs they must take independent initiatives. At the same time resource providers including government should encourage networking and collaboration among NGOs. However, more than any incentives, it is commitment to strengthening collaboration for scaling up impact that would improve inter-NGO relationship. Respect for institutionalising relationship within NGO alliances and networks, and exemplary efforts by credible and leading NGOs in this direction could set the tone for other existing NGO networks. Tools developed for evaluating such networking initiatives could also be of great use.
**Strengthening NGO Governance**: NGOs could strengthen their credibility by taking steps to improve their representative character, and by ensuring better accountability to their stakeholders. This would be possible if they bring in changes in their governance process. The issues of regulation must be addressed by NGOs to curb “bogus NGOs” and strengthen credible and committed NGOs. Sincere efforts by NGOs to ensure self-regulation and strengthen their representative character by formally involving their community stakeholders remains the best option, as govt. steps to regulate NGOs, it is argued, may affect freedom and plurality in civil society. What mechanisms could be evolved for such regulation have to be identified through serious consultation between NGOs and government. Setting up a broad-based Ombudsman with credible representatives from academia, civil society, judiciary, and government could also be an answer.

(Source: Aurobindo Behera, Managing Director, Orissa State Disaster Management Authority, India)

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7-2-1. Lessons Learnt from The Great Hanshin-Awaji (Kobe) Earthquake: National Governments’ Countermeasures and Disaster Information Systems

1. **Introduction**:

An earthquake occurred on 17th January 1995 in Kobe, Japan. The magnitude was just 7.3 though, it happened directly underneath the Metropolitan area. It killed 6,400 people, injured 44,000 people and destroyed 518,000 houses. At peak time, 317,000 people evacuated at school and public places. Most of the damaged infrastructures were buildings. Even reinforced concrete buildings were collapsed. Estimated damage was about 10 trillion yen or about 85 billion dollar. Out of this, about 60% was building’s damage. Most heavily damaged area was capital of the Hyogo prefecture, Kobe that is the center of political and economic activities of the prefecture.

2. **Lessons Learnt**: 
Because the earthquake hit the capital of the prefecture directly, first response was very slow. Not only prefecture headquarters, but also almost all traffic system and telecommunication system including satellite telecommunication system were destroyed. So it took almost three days for the national government to understand the whole vision of the damage. Hence it delayed the first response.

As countermeasure for the delayed first response, the national government established the cabinet information collection center. At the same time, the national government established the minister of state for disaster management and chief cabinet secretary for crisis management. Also the government developed disaster information system, which is early estimation system and emergency measure support system.
3. Disaster Information Systems:

The Japan Meteorological Agency (JMA) and local governments developed seismic intensity observation points with seismographs. There are about 3,000 observation points nationwide. Based on the information from those observation points, the government developed Early Estimation System and Emergency Measure Support System. Following figure illustrates the Disaster Information System. After the earthquake, firstly the government estimate the damage such as number of death, injured, collapsed houses and so on. Then the government estimates the needs of support in terms of materials, manpower for rescue and rehabilitation, hospital beds, evacuation camps etc.

The estimation system is based on population, building structure information, ground conditions; time of occurrence and survey on persons enroute and normally
persons enroute is excluded in estimation. Further distribution of seismic intensity is obtained based on observatory’s data.

Following figure shows the flowchart of earthquake damage estimation. Through this system one can get the estimation of damaged building and casualties. Based on this damage estimation, needs of support level were calculated by computer.
4. Conclusion

Catastrophic disaster cannot always be predicted. However, in any disasters, if there are proper Information and Logistic System, we can start the prompt recovery response effectively, thus we can minimize the secondary disaster. Such system also helps the decision maker’s immediate action.

The accurate information is the very key factor for the response.

(Source: Satoru Nishikawa and Fumiaki Yoshimura, Asian Disaster Reduction Center, Japan)

7-3-1. Case Study: The Policies and Measures on Flood Disaster Reduction in China since 1998

Due to special geographical location and climate conditions, China is a country prone to frequent floods. In the Year of 2002, heavy rainfalls happened in Hunan Province. However, different from other years, there was no disaster but flood. The study financed by UNDP has reviewed the government practices including policies and measures in flood control in China after 1998 floods as well as those supported by the international donor community.

Since the devastating floods in the Yangtze River in 1998, flood defense and prevention have attracted nationwide attention. The central government attaches
great importance to flood defense. The State Council timely proposed several strategic decisions for flood prevention and control. These include a series of policies and measures, namely: enclosing mountains to plant trees, transforming land back into forests, demolishing polder fields to channel flood water, transforming farmland back into lake, supplying laid-off laborers for reconstruction, relocating people to form new townships, reinforcing key dikes and dredging river beds.

In response to the floods, the Chinese Government has adopted positive fiscal policies to increase investment in the water infrastructure development by issuing government bonds. In the past four years from 1998 to 2002, the total financial input from the central government in the water sector amounted to over 140 billion RMB Yuan and the annual investment was 3.4 times more than the average in the previous years. At the same time the Hunan Province gradually established a multi-level, multi-stakeholder and multi-channel water investment system, the total input was over 24 billion RMB Yuan, including 10 billion from the central government. In the past 5 years, US$ 18.73 million has been granted by
international agencies or foreign countries for disaster relief, disaster rehabilitation and management. US$440 million international loan is mainly used to strengthen the Yangtze River Dyke.

This case study discovered that the enhancement of the basic infrastructure and the improvement of flood defense capability have not only offered reliable flood prevention system and safety for the riparian people, but also strongly and directly improve the entire social-economic development of the areas that used to be under the threats of the flood disasters. The report concludes that there are five changes that have been brought to the people along the flood prone areas due to the above-mentioned flood control measures:

1) **The flood defense capability of lower and middle parts of the rivers is raised.** The polders used to block floods were removed and returned back to the lakes, and it then enhanced the storage and discharge capacity of the rivers and lakes. After large-scale construction of the dykes along the Yangtze River in the past 5 years, the ability to defend flood by the main dykes in the lower and middle reaches of the Yangtze River was improved greatly. The 5 years treatment of anti-seepage of reservoirs has increased the flood defense capacity due to the increased water storage capacity in the upper river basins.

2) **The benefits are far greater than the investment.** The pressure and difficulty of flood defense is relieved, the battle line of flood defense in dykes is shorten, therefore, less manpower is required during flood seasons, and materials and money needed by disaster response and relief have been substantially decreased by the governments at different level.

3) **It has effectively boomed the local economic and social development.** The flood control measures have quickened the urbanization and encouraged the adjustment of the regional economic structure. The large-scale flood control projects changed the local industrial structures and stimulated the backward economic and social development in the riparian areas.
The projects also improved the investment circumstance and have driven upgrading of the basic infrastructure of the cities.

4) **The income of the local people is increased.** The living conditions of the farmers within the lake areas have been improved substantially. The measures have not only prevented them from being back to poverty line each time after the flood disasters, but also ensured them security for investing for long-term business schemes. Under the government subsidy, many farmers built and moved into their new houses. The situation of being homeless in case of great floods disappeared.

5) **These flood control measures promoted the harmonious coexistence between the human being and the nature.** For many centuries, the human society has excessively explored the natural resources and the ecosystem of land, forest and water have changed their interdependence patterns and become more fragile. Floods and droughts become more frequent. The resettlement of the inhabitants and return of the farmlands back to wetlands and lakes reflected the resolution of the government and the people to live harmoniously with the ecosystem and to keep away from the threat of floods.
The study also discussed at the end some problems resulted from relocating people to form new townships, serious sand silting in the lakes or river channels, and inner-logging in the polders and which these can raise necessary attention of the government and research fellows in their works.

(Source: Wan Hongtao, Research Center on Flood and Drought Disaster Reduction China Institute of Water Resources and Hydropower Research, 1998)

7-4-1. Disasters and Education

1. Great Hanshin-Awaji Disaster (known as Kobe Earthquake)

1.1. The Lessons of the Great Hanshin-Awaji Disaster

It is said that more than 90% of the people killed by the Hanshin-Awaji Disaster lost their lives within 30 minutes. It is also said that more than 80% of the saved people were rescued by the neighboring citizens, not by the soldiers of Japan Self-Defense Army or the rescue teams of fire bureau. Fire fighters could not extinguish all the fires that morning because the city caught fires in too many places at the same time and that was beyond the capacity of fire fighters. The stop of the water supply also made it impossible to put out the fires. I believe from these facts that the most important lesson of the Great Hanshin-Awaji Disaster is that the citizens noticed for the first time that the lives of the citizens should be protected by the citizens themselves. For the citizens who had thought that the soldiers of the Japan Self-Defense Army or the rescue teams of the fire stations would manage to rescue them, the Great Hanshin-Awaji Disaster was the crucial event that made them realize how little they were aware and prepared.

1.2. Schools as the refuge during the Great Hanshin-Awaji Disaster

During the Great Hanshin-Awaji Disaster there were more than 1,100 refuges at the peak time and most of them were schools and kindergartens. There, those who took care of the refugees were the school teachers and staffs who had never received a special training on running the refuges. At an elementary school all the keys of the rooms were broken and the rooms were occupied by the evacuating people before one teacher got to the school in the morning. At a high school refugees had to sleep not only on the floors of the gym, the classrooms and in the
tents hoisted at the school ground, but also on the floors of the corridors and the steps of the stairs. At many schools the refugees used the toilet, where the supply of water stopped. Their feces formed a small tower and were got rid of by the teachers and the volunteering students. The teachers also had to take care of the sick old people, hear the sad stories by the some refugees who said they wanted to die, arrange their meals, and tackle many difficult affairs, until the volunteers functioned systematically. When more than 3,000 or 3,500 people evacuated in one school, the situation of the school became something like the mess that was mentioned above. School staffs who were also suffering from the disaster made great efforts to support the refugees by sacrificing themselves.

1.3. Disasters and the Functions of School

Not only during the earthquake, but also during the volcanic eruption, flood and so on, Japanese schools function as refuges. Schools are the places for those who lost their houses or in danger of losing their lives and houses by the disasters.

During the Great Hanshin-Awaji Disaster 310,000 people escaped from the collapsed and burning cities to the schools and the kindergartens nearby. Japanese people naturally regard school as the refuge during the disaster. Being a refuge is one function of school during the disaster.

Now, school has one more important function. School is the only place where the disaster mitigation education could be performed systematically. The idea of school = refuge is the idea during the disaster. On the other hand, the idea of school being the place for the disaster mitigation education ranges from “before the disaster”, through “during the disaster”, to “after the disaster”. Disaster mitigation education can function from the moment of the disaster taking place, through the emergency treatment and the recovery, to preparedness, as shown in the chart 1.

Schools thus have two functions: the place for “refuge” and the place for “disaster mitigation education.”
2. Disaster Mitigation Education

2.1. What is the Disaster Mitigation Education?

In the disaster mitigation education so far, we focused on the emergency management just after the disaster took place, such as the training of evacuation and distinguishing fires. In these trainings the children are not motivated very much. Everybody think he or she will never experience his or her house catching the fire. Nobody can image lively the influence of the earthquake on them because the cycle of the earthquake is much longer than the cycle of human lives. Many people think that typhoon and volcano have nothing to do with them. Thus, the less motivated training turns out to be fruitless and many people come to regard the disaster mitigation education as meaningless event.

See the chart 1. Roughly speaking, the disaster mitigation education can be done at every step of the disaster cycle in the chart. The emergency management is important just after the disaster took place. Besides, if we learn the mechanism of the earthquake, or the direction of the typhoon, for example, we will be more aware of the disaster and well prepared for it. To think of the factors causing vulnerability in a city is closely related to the disaster mitigation. Nobody will die by the earthquake of the Japanese seismic scale 5 in Japan, but many people may lose their lives in the developing countries by the earthquake of the same scale. It is easy to find the social problems there. The students will notice that to learn economy is related to learning disaster mitigation. During the process from emergency management to recovery, the students will come to notice that not only the hard aspects, such as the building code, the reconstruction of the railroads, super highways, the strong system of water supply, gas supply and so on, but also the soft aspects, such as the importance of the community, the neighboring help, the importance of human lives, the welfare and human rights, also have close relationship with the disaster mitigation. This shows that the disaster mitigation have closely related to every activity.
of the study at school. Thus, it is possible for the teachers to do the disaster mitigation education in every subject, if he or she wants to.

2.2. Disaster Mitigation Education as Citizens’ Education

It seems to be impossible to let 100 specialists live in one town with the population of 10,000 in order to make the city to cope with the disaster more functionally. But if every citizen advances a little in the disaster mitigation, the capacity of the city to cope with the disaster increases drastically. What takes an important role to advance the citizens’ ability, skills and will to cope with the disaster is “the disaster mitigation education.”

The disaster mitigation education is the citizens’ education. I have mentioned that the most important lesson of the Great Hanshin-Awaji Disaster is that the citizens noticed for the first time that the lives of the citizens should be protected by the citizens themselves. The, how the citizens protect themselves? This is the point that the disaster mitigation education takes an important role. It is reported that the specialists indicated the possibility of the strong earthquake in Kobe area. Most of the citizens, however, didn’t know the fact. The fact was only known to the specialists and the insurance companies. Some say that the old houses must be replaced with the newly built houses but ordinary people don’t have enough money. Others say that the retrofit of the fragile houses is urgent but the language of the specialists is difficult for the ordinary citizens to understand. There were the distance between the specialists and the citizens before the great Hanshin-Awaji Disaster. There was a missing ring between the specialists and the citizens as shown in the chart 2. It is the disaster mitigation education that can connect the two rings.
2.3. Maiko High School Environment and Disaster Mitigation Course

The environment and disaster mitigation course started at Maiko High School in April, 2002, 7 years after the Great Hanshin-Awaji Disaster. It is meaningful to set the course at a school located in the disaster area as the center of the disaster mitigation education first in Japan. We learned a lot of lessons from the disasters so far but they were discussed only by the specialists in the 20th century. The citizens didn’t pay attention to the lessons and thus were not prepared for the coming disasters. This is why many disasters continue taking place in everywhere in the world. The 21st century must be the age to cope with the disaster and mitigate it. It depends on whether we send our lessons to the world or not. The purpose to start the environment and disaster mitigation course is to send the lessons we learned from the Great Hanshin-Awaji Disaster to the world and make the citizens aware and prepared to cope with the disasters.

2.3.1. Educational Goals

The main purpose of the environment and disaster mitigation course is to grow the citizens with the disaster mitigation literacy. The literacy consists of three factors: the fundamental knowledge and the fundamental skills to cope with the disasters, and the strong will to contribute to the society.

2.3.1.1. Purposes of the Course

The purpose of the course is to have the students think of how we live and exist in the symbiosis society by utilizing the lessons learned from the Great Hanshin-Awaji Disaster. The course gives the students the disaster mitigation education concerning both the natural environment and the social environment.

2.3.1.2. Fundamental Concept of the Education
(1) The disaster mitigation education is based on the lessons of the Great Hanshin-Awaji Disaster. It also makes the students think of the importance of life, cultivates the students’ power against disasters, and brings up the human beings who can contribute to the society.

(2) The students are expected to understand deeply about the various environments (the natural environment and the social environment) by learning the mechanism of the natural phenomenon and the relationship between disasters and human society.

(3) We cooperate with universities, research institutes and coherent organizations. Students’ understanding of the environment and disaster mitigation is deepened through the experience learning. To raise the students’ attitude to "Think Globally, Act Locally" is one of the main goals to attain. We aim to bring up the individuals who can take actions independently.
2.3.2. **Curriculum**

The curriculum is the following (chart 3). Now it is under the slight modification but the main concept is the same. Roughly speaking, about 1/3 of the units is the special subjects (the dark cells) and the rest are the general subjects such as Japanese, mathematics, English, and so on.

Chart 3: Curriculum

<table>
<thead>
<tr>
<th>1st Year</th>
<th>2nd Year</th>
<th>3rd Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Japanese 1</td>
<td>Japanese 2</td>
</tr>
<tr>
<td>2</td>
<td>Geography A</td>
<td>World History B</td>
</tr>
<tr>
<td>3</td>
<td>Mathematics 2</td>
<td>Choose two subjects</td>
</tr>
<tr>
<td>4</td>
<td>Contemporay Society</td>
<td>Mathematics 2</td>
</tr>
<tr>
<td>5</td>
<td>Geography A</td>
<td>Japanese Classics 1</td>
</tr>
<tr>
<td>6</td>
<td>Choice two subjects</td>
<td>World History A</td>
</tr>
<tr>
<td>7</td>
<td>Mathematics 2</td>
<td>World History B</td>
</tr>
<tr>
<td>8</td>
<td>Mathematics 2</td>
<td>World History B</td>
</tr>
<tr>
<td>9</td>
<td>Mathematics 2</td>
<td>World History B</td>
</tr>
<tr>
<td>10</td>
<td>Health Education</td>
<td>Mathematics B</td>
</tr>
<tr>
<td>11</td>
<td>Chemicals 1B</td>
<td>Chemicals 1A</td>
</tr>
<tr>
<td>12</td>
<td>Physical Education</td>
<td>Reading</td>
</tr>
<tr>
<td>13</td>
<td>Physics 1B</td>
<td>Biology 1B</td>
</tr>
<tr>
<td>14</td>
<td>Domestic Technology</td>
<td>Physics 1B</td>
</tr>
<tr>
<td>15</td>
<td>Physical Education</td>
<td>Biology 1B</td>
</tr>
<tr>
<td>16</td>
<td>English 1</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Music/Art/Japanese Calligraphy</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>English 2</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Computer A</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>English 2</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>1st Year</td>
<td>2nd Year</td>
</tr>
<tr>
<td>22</td>
<td>Environment and Science</td>
<td>Human Beings &amp; Society</td>
</tr>
<tr>
<td>23</td>
<td>Social Welfare, Volunteer, and Mental Health</td>
<td>Disasters &amp; Human Beings</td>
</tr>
<tr>
<td>24</td>
<td>Disasters &amp; Human Beings</td>
<td>Activity in Disaster Mitigat</td>
</tr>
<tr>
<td>25</td>
<td>Natural Environment</td>
<td>Social Environment</td>
</tr>
<tr>
<td>26</td>
<td>Natural Environment</td>
<td>Social Environment</td>
</tr>
</tbody>
</table>
2.3.3. Characteristics of Educational Activities

Practical experience is the key word of the environment and disaster mitigation course. The followings are the characteristic activities of the course.

2.3.3.1. Lessons by the Guest Teachers

Many teachers are invited to school to talk about their experiences during and after the disaster. Teachers are from universities, police station, fire station, life-line related companies, the city government, the prefecture government, the volunteer organization and so on. Through this activity we hear the stories of the disaster, preserve them, and put them on the Home Page. Their precious stories make the students realize the importance of human lives and help to each other, which is the energy to facilitate the citizen-centered disaster mitigation.

2.3.3.2. Studies Outside of the School

The students visit the Disaster Reduction and Human Renovation Institute, Museum of Nature and Human Activities, Hokudan Cho Earthquake Memorial Park. They walk around the disaster area to interview the citizens. They stay one night two days at Kobe Fire Academy to learn the fundamental skills of extinguishing fires, rescuing people, and collecting information. They take part in the disaster mitigation training held by the prefecture, the city and the regional ward. They go to the Rokko Mountains to investigate the faults, the dangerous streams of debris flow, and the raised bed rivers, which were the causes of the floods in Kobe.

2.3.3.3. Problem Solving Study
While studying the disaster mitigation, the students are not only given lectures to get the knowledge but also given the problems, or they set the tasks by themselves and they solve them by the students themselves or by the cooperation with the other students. For example, in the study of “the disaster management of a virtual community”, the students set the population, the industry and the geographic characters of the community, and made a “Disaster Management Manual”. In another activity, the students study the relationship between some typical disasters which took place in Japan and the lows which were adopted after the disasters. They made a newspaper of the heavy floods in Kobe area and used this newspaper to teach the pupils in an elementary school. The aim of these activities is to have the students master the attitude and the technique of life-long education. Once the students master the cycle of the life-long education (see the chart 5), they can continue learning in their long life.

Chart 5: Life-Long Education

2.3.3.4. Computer Study

The students use the computers to make a report, to give a presentation, and to get information by inter-net. Through this activity the students master the fundamental skills of computers and gain necessary knowledge of the information society.

2.3.3.5. Disaster Mitigation Education with the Pupils of the Elementary School
Maiko High School is in corporation with an elementary school to do the disaster mitigation education. The students make a regional map with the 3rd year pupils. We don’t call this map “Hazard Map” but we call it “Safety Map” because we believe that people don’t feel like living in the town full of dangerous information. On the other hand, they become serious to the disaster mitigation of the community if the map is full of the places they like and are proud of. The students talk about their experiences of the Great Hanshin-Awaji Disaster to the 4th and 6th year pupils. Miko High School students were 1st or 2nd year pupils those days. Their experiences were hard and tough and serious but they didn’t have good vocabulary to express their experiences. Now they use the high school students’ language to tell the experiences of the small children. To teach the mechanism of the earthquake and the importance of preparedness they use the “Wall Newspaper”. To the 5th year pupils the high school students show the experiment of the flood and teach the history of the heavy flood in Kobe by the newspaper they made.

The pupils learn something about the disaster mitigation and they are sure to talk about what they learned at school to their family members at home. While listening to the children’s story, the parents may be interested in the disaster mitigation and then, the regional disaster mitigation may start.

2.3.3.6. Events of Disaster Mitigation

Every January 17th a memorial event for the victims of the Great Hanshin-Awaji disaster is held at Maiko High School. It will be held annually as the main event of Maiko High School. The purposes of the event are the collection, the arrangement and the transmission of the experiences of the Great Hanshin-Awaji Disaster and the construction of the base center of the disaster mitigation education. "The record collection" is published. It will be used as the teaching materials of both Maiko High School and other schools. In addition, we would like to inform the world of the experiences of the Great Hanshin-Awaji Disaster. The students of the environment and disaster mitigation course work as the staffs. They will be engaged in planning workshops, requesting lecturers, coordinating workshops, publishing record collections, and so on.

Schools must do the training of evacuation twice a year. The ordinary training are that after the fire alarm rings, the students evacuate to the school ground. The students seem less motivated and so they are not so serious in this training. At Maiko High School the conventional training
of evacuation is changed into the new training with the disaster mitigation study at classroom or the lectures of disaster mitigation at school gym.

2.3.3.7. Presentation outside of the School

The teachers and the students are often invited to the seminars or the workshops outside of the school. We utilize these opportunity for both the advertisement of the course and the spread of the disaster mitigation education.
2.3.3.8. International Exchange with the Children in Nepal

Maiko High School started the international exchange with Nepal under the help of UNCRD Hyogo Office and NSET-Nepal. The purpose of the exchange is the international friendship and the exchange of the disaster experience. We also learn a lot from the activities of NSET-Nepal.

2.3.4. Tasks

The disaster mitigation education has just started and we don’t have enough amount of the materials, nor the concrete approach to the education. Many teachers seem to be at a loss to do the disaster mitigation education. We put our results and information on the homepage of Maiko High School to support the teachers who are interested in or must do the disaster mitigation education but don’t know how to or what to. Our task is to build this network of the disaster mitigation education among the schools.

(Source: Seiji Suwa, Maiko High School Environment and Disaster Mitigation Course)

7-5-1. Multi-disciplinary and Inter-sectoral Collaboration and Cooperation in Disaster Reduction in Philippines

1. Introduction

It is alarming and disturbing that natural hazards and disasters around the world have been on the rise. Disasters precipitated by natural hazards reportedly have been affecting an average of 211 million people each year since 1991, exceeding the average of 31 million people affected by conflicts.

Our region, Asia, has borne the brunt of disasters caused by natural hazards, with 88% share of the affected people since 1975.

As disaster reporting becomes more efficient, we continue to witness an increasing trend in the frequency and severity of disasters and in the resultant losses of countries.
Improving our registry of small-scale emergencies may even reveal a grimmer reality, where scores are killed, injured and disabled each day on the road and in the workplace, due to prevalent hazards and uncontrolled risks.

In many cases, especially in less developed and developing countries, disasters effectively set back socio-economic development and impede achievement of sustainable development goals. They cause substantial losses in proportion to gross domestic product. They also cause the channeling of limited resources to relief, recovery and reconstruction, which are more often inadequate.

In all indications, the vulnerability and risk to disasters, especially in Asia, will increase, and the impact of disasters will likely intensify, due to the prevalence of poverty, the increase in population growth and densities, the depletion of water resources, urbanization trends, global climate change and environmental degradation, among others.

ISDR reported in *Living With Risk* that the number of people at risk in the world has been growing by 70-80 million per year. And, more than 90 percent of population growth is in the developing world.

Moreover, rapid urbanization, increased mobility, and the inadequacy of coping systems and contingency measures have increased disaster potential and impact. The growing vulnerability and risk of communities have become evident also in the developed countries, as we have seen in the emergence of global terrorism and SARS.

Inevitably compounding the problem is the insufficiency of government action and foresight to address prevalent and emerging risks. For one, land use policy as a disaster reduction strategy still remain a critical issue in many developing countries, that requires priority attention and action.

Disasters can be a major obstacle to social and economic security, as well as political stability. If we are to pursue sustainable development, then, disaster
reduction must be integral to sustainable development efforts. It must be a fundamental element of any development programme. In this regard, the pursuit of TDRM in Asia is a relevant and responsive initiative.

The immensity and complexity of the problem on disasters and risks convey foremost the message that no one person, group or society can address the disaster problem alone. Collaboration, cooperation and coordination in disaster reduction are essential and critical. We need to pull together and network our strengths and capacities, share available resources, and complement existing expertise to reduce vulnerabilities and to prevent and mitigate disasters more effectively.

2. Best practices in the Philippines

The emphasis of TDRM on collaboration, cooperation and coordination can be exemplified in programs and activities that require active partnership of government agencies, NGOs, civic groups, and specialized sectors at all levels. They pull together their respective strengths and capacities, including resources and expertise, as a strategy in pursuing disaster reduction activities. I am pleased to cite some cases from the Philippine experience:
Disaster prevention and mitigation

- **Brigada Kontra Baha for La Nina Mitigation.** Through collaboration among government agencies, local government authorities, local NGOs, and the AFP Engineering Brigade, the National Disaster Coordinating Council (NDCC) coordinated the de-clogging of at least 11 critical waterways and chokepoints to mitigate flooding in Metro Manila in 1999-2000.

- **Earthquake vulnerability assessment of school buildings in Metro Manila.** Through collaboration among Department of Education, Philippine Institute of Volcanology and Seismology (Phivolcs), Association of Structural Engineers of the Philippines (ASEP), and the Office of Civil Defense, the NDCC initiated the earthquake vulnerability and risk assessment of school buildings in Metro Manila.

Disaster preparedness and response

- **Disaster drills and simulation exercises.** In collaboration with the private sector, the NDCC facilitated the conduct of disaster drills and simulation exercises in malls, banks, schools, hospitals, and communities at risk, among others. The NDCC, together with the Corporate Network for Disaster Response, also developed a training film on how to conduct drill: *7 Steps to Effective Disaster Simulation Exercise*.

- **Disaster reporting: Training for media professionals.** In collaboration with the Kapisanan ng mga Brodakaster sa Pilipinas (KBP) and the Emergency Management Institute of the Philippines (EMIP), the NDCC trained a core of media practitioners in effective and reliable disaster reporting.

- **The Broadcasters Manual on Emergency Preparedness.** This has allowed the media to serve as effective partners in public information and education.
- *Stop DEATH is an integrated health emergency preparedness and response program* that addresses altogether the problem of disasters, epidemics, accidents and trauma. Began in 1994, the program succeeded in human resource development through collaboration among Department of Health, Philippine College of Surgeons, Philippine Hospital Association, Philippine National Red Cross, and University of the Philippines College of Public Health, Boston University School of Public Health, and World Health Organization.

- *SAGIP 2000* exemplified the broadened collaboration and cooperation among 14 countries in disaster response and humanitarian assistance. The forum facilitated the sharing of information and country experience on early warning systems, decision and planning processes, mitigation and response mechanisms.

Disaster relief and recovery

- *Psychosocial services for disaster victims and responders.* The mental health program for disaster victims and response workers has been established formally in the health sector and in the AFP. Active providers of this service are the Department of Health, Department of Social Welfare and Development and the Armed Forces of the Philippines

- *Tabang Mindanaw, Bangun Mindanaw and Oplan Tulong Kapatid* exemplified multisectoral collaboration and cooperation in disaster relief and recovery. They facilitated the prompt provision of relief assistance and recovery projects by the private and government sectors to southern communities affected by humanitarian complex emergencies (1998-2000). They included relief assistance and recovery packages such livelihood generation and skills training.

- *International humanitarian mission to Taiwan.* The mission, comprised of 22 structural engineers and health professionals, extended technical expertise to the local architects and engineers in conducting a rapid assessment of the structural damage and vulnerability of public infrastructures and lifelines resulting from the destructive earthquake of September 1999. The results of
the assessment facilitated the return of victims to safe homes and the decongestion of evacuation centers.

Disaster reconstruction and rehabilitation

- *Rebuilding lifelines and infrastructures in Mindanao* required the collaboration and cooperation of government agencies, local government units concerned and the community leaders.

- *Mobilizing military support.* The AFP has played an important support role in building damaged lifelines and infrastructures, including schools and places of worship.

3. Conclusion

As I conclude, I recall the Chinese characters for disaster, which also convey both threat and opportunity. Truly, the challenge in any crisis is to recognize, beyond its detrimental consequences, the opportunities it presents for development.

Notwithstanding the enormous disaster problem we face today, and the threats it bears for our societies, we have come here in this forum, with the resolve to do more, to do better and to sustain the gains of our disaster reduction efforts.

This is the clear opportunity the prevailing problem presents: The opportunity to adopt a holistic and integrated approach to disaster reduction. The opportunity to involve all sectors of society and other disciplines. The opportunity to collaborate and cooperate on reducing disaster risk and vulnerability. Because our world today is much more interactive, the possible ways of exploring this opportunity are many.

There is wisdom in the old adage: “No man is an island entire of itself, each one is a piece of the continent, a part of the main.” And, with commitment to action and
political will, we can make that message work for us, for the greater benefit of human society.

(Source: Orlando S. Mercado, President, Philippine Institute for Investor Relations
Former Secretary of National Defense and Chairman of the National Disaster Coordinating Council, Philippines)

Response To Gujarat (India) 2001 Earthquake

Alvaro Antonyan

Armenian National Survey for Seismic Protection

Address: Davidashen Massiv IV, 375054, Yerevan, Republic of Armenia
Phone: (374 2) 151108, 286494
Fax: (374 2) 151108
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The earthquake M_w= 7.7 occurred at 8:50 local time on the morning of January 26, 2001, northwest corner of India. The first reports in Armenia on the event were from the Armenian National Survey for Seismic Protection under the Government of Armenia.

Getting warning from Armenian NSSP about Gujarat earthquake the Government of Armenian in coordination with Government of India, has rushed an 18 member strong fully equipped and very experienced Armenian NSSP Task Force multi-disciplinary team for relief operations in earthquake affected Gujarat state of India for period of two weeks. The team has included seismologists, structural and communication engineers, geotechnicians, physicians, psychologist and rescuers with sniffer dog. As it was requested by Government of India, Armenian NSSP Task Force was dislocated in Ahmedabad (5.74 million population) city.

The formal charge to the team was as follows:

1. To provide scientific and technical expertise and multidisciplinary assistance to the authorities of the Gujarat state of India with respect to immediate post-earthquake relief efforts including: establish a temporary array of accelerographs in the different parts of Ahmedabad city to record strong aftershocks; provide rapid engineering assessment in such areas as soil and structural performance; provide demolition of heavy damaged structures hazardous for public and built environment and provide rescue, medical and psychological assistance to demolition team and earthquake suffered people.
2. To gather data and information needed to assess the factors that contributed to the disaster, identifying knowledge gaps where focused efforts can contribute to seismic risk (loss) reduction in the India, Armenia and other earthquake-pron countries.

1. SEISMOLOGY

1.1 Tectonic Setting

The Gujarat earthquake occurred in the Indian shield region, which is marked by several rift and shear/trust zones (Figure 1.0).

![Figure 1.0 The Gujarat (India) earthquake epicentre on 26 January 2001 (by USGC)]

1.2 Historical Seismicity

The Gujarat region has experienced strong earthquakes throughout the past 200 years, and probably for many millennia (Figure 1.2, Table 1).

Table 1 shows that the recurrence time of strong events in this region has ranged from 1 to 10 years. It means that seismic hazard for Gujarat area is very high even for short time period.

a) b)
1.3 Main Shock Parameters

The Gujarat earthquake was recorded by Armenian NSSP national seismographical networks (Figure 1.3) and seismographs worldwide. The standard event parameters as reported by the National Earthquake Information Centre (NEIC) of the USGS are:

![Graph showing seismic activity](image)

Figure 1.3GUJARAT (INDIA) EARTHQUAKE OF 2001. 01. 26, Ms=7.8
As recorded at Garni (GNI) IRIS GSN station, Armenia

- Origin time: 03:16: 41 (UTC)
- Latitude (deg) 23.36 N
- Longitude (deg) 70.34 E
- Depth: 22 km
- Magnitude: 7.7Mw

1.4 The Earthquake Sequence and impact to geological environment

Aftershocks sequence consisted of the main shock and the aftershocks. Numerous aftershocks exceeding $M_s = 5$ have been reported and one aftershock...
approached $M_s=6$. A subset of these aftershocks is plotted on the Figure 1.6. Aftershocks currently outline an ENE trending south-dipping trend (45° - 50° dip) to great depths (20 - 30 km).

![Map of Gujarat earthquake aftershocks area](image)

*Figure 1.4 Gujarat earthquake aftershocks area*

1.5 Conclusion

1. It has been not unexpectable and unpredictable in the long-term sense the strong earthquake in Gujarat area, because this region has experienced strong earthquake through the past 200 years and probably for many millennia.

2. First time strong ground motion recordings have been obtained for Ahmedabad city by Armenian NSSP Task Force Mission which means that there is no any seismic microzonation done for cities and towns of Gujarat area. The seismic hazard for Gujarat area has been underestimated.

2. GROUND MOTION RECORDS IN AHMEDABAD CITY

As the local experts told, there were no any ground acceleration measurements in Ahmedabad city before the Gujarat earthquake. Taking into account this fact, the first time ground motion studs through Gujarat earthquake aftershocks recordings conducted by Armenian NSSP Task Force Mission were very important for building codes design, seismic microzonation for earthquake hazard assessment and seismic risk reduction strategy and program development for Ahmedabad city.
2.1 The Temporary Ground Motion Network Establishment and general soil conditions study

In a short time, the temporary ground motion network consisting of four portable strong SMACH (SM1 and SM2) instruments with three-component strong-motion seismometers were placed in Ahmedabad. The instruments were installed in different parts of the city with various geologic conditions, on ground floor of buildings mentioned below:

1. The CRAWN HOTEL (coordinates 23°02.11’N; 72°33.71E)
2. ENGINEER OFFICE (coordinates 23°02.91’N; 72°33.64E)
3. DWELLING HOUSE (Nirman complex, coordinates 23°04.87’N; 72°32.04E)
4. MUNICIPAL CORPORATION (coordinates 23°01.34’N; 72°32.16E)

The strong motion digital instruments have measured ground accelerations in the wide range from 6 sm/sec² to 500 sm/sec² (SMACH SM1) and from 0,2 sm/sec² to 1000 sm/sec² (SMACH SM2).

2.2. Ground acceleration recordings and analysis

From 5 to 14 of February the Gujarat earthquake aftershocks with magnitudes 3,7 to 5,3 were recorded by Armenian NSSP Task Force temporary network. The recordings have been obtained at two sites CRAWN HOTEL and ENGINEER OFFICE. At two other sites ground shaking were not recorded because of different sensitivity of SM1 and SM2 strong motion instruments. All acceleration recordings were processed and analyzed.

2.3. Conclusion

1. The aftershock peak horizontal accelerations recorded by strong motion instruments at various sites of Ahmedabad city are not the same. It means that the acceleration amplification has been observed due to local geologic site effect.
2. The expected main shock January 26, 2001 peak horizontal acceleration in Ahmedabad city, on the base of aftershock recordings analysis, would be as 50-70 sm/sec² (seismic intensity 7 by EMS-98 scale), and predominant periods of ground shaking are 0,3-0,5 sec. The comparison of the peak horizontal accelerations calculated by different attenuation models shows a good agreement between data set and calculated accelerations on the base of attenuation model for Europe.
3. It is very essential to establish a permanent ground motion network in Ahmedabad city for study of the peak ground accelerations and ground response spectra in different parts of
Ahmedabad city for the following purposes: determination of ground motions period band were
ground response amplified significantly by the local geologic conditions; further Gujarat
earthquake aftershocks recordings in respect to high quality seismic microzonation of
Ahmedabad (at list at 1:100000 scale), taking into account that aftershocks time period will last
for several years.

4. From earthquake hazard point of view Bhuj earthquake source is the most dangerous
for Ahmedabad city. Taking into consideration the 280km distance between city and Bhuj
source it is possible to develop early warning system for Ahmedabad. That long distance allows
to get warning 1min before the devastating seismic waves’ arrival from strong earthquake
source to Ahmedabad.

3. BUILDING INSPECTION AND PERFORMANCE OF ENGINEERED
STRUCTURES AND SOIL CONDITIONS

The building inspection and performance of engineered structures were carried out by
civil and earthquake engineers of the Armenian NSSP Task Force.

The following objectives were entrusted to the team by the Ahmedabad municipality:
- to inspect the earthquake damaged buildings noted by municipality for damage
  assessment in respect to drawing up conclusion, related to further usage, reinforcement or
demolishing of those buildings;
- to provide consultancy for local engineers and builders, practically in site, in respect to
  urgent, temporary reinforcement of damaged buildings in order to prevent their further
deformations and failures.

Following to the first point of this guidelines, 140 buildings (4-12 storied) were inspected
in total, and the summarized data are given for 125 low and medium raised multistoried
residential buildings.

The following were defined:

1. The analysis of the macro - seismic data shows, that in the territory of Ahmedabad city
the Bhuj earthquake intensity has reached VII by European Micro-Seismic Scale (EMS –
European 1993).

2. Taking into consideration the circumstance, that the local authorities predetermined the
choice of buildings to be inspected, our conclusions are limited by examples of 123 buildings
chosen by not systematized method. At that the significant number of the surveyed buildings,
which is 100 buildings (or 80%) were 4-6-story apartment houses. During the earthquake the
surveyed buildings received various degree of damage and the basic picture is the following:
5.3% of buildings were collapsed or are subject to demolition;

- The strengthening of 48.2% buildings along with immediate evacuation of inhabitants for 44% of them is required;

- 46.5% of buildings is subject to normal operation with cosmetic repairing required.

3. Despite that Ahmedabad city is situated in 270 km from the epicenter of main shock and intensity of earthquake here is estimated up to VII according to EMS numbers, the buildings have seriously suffered for the following reasons;

- The buildings were designed and constructed with serious deviations or without taking into consideration well known basic rules of Earthquake Engineering;
- Poor quality of used building materials;
- Drawbacks in designing and production of cast in place reinforced concrete constructions;
- The low level of mechanization and thus poor quality of construction itself;
- Damages caused to bearing elements of the structures during its exploitation due to inadmissible changes made by the inhabitants;
- Predominant period of ground motion 0.3-0.5 sec and thus high probability of the resonance phenomenon arisen mainly in 4-6-storey buildings.

Proceeding from the above-stated the following is proposed:

1. It is necessary to revise the Indian Seismic Building Codes based world experience in earthquake engineering and taking into consideration analysis of consequences of the Bhuj earthquake.

2. The structural design has to be carried out in complete compliance with requirements of the codes to be developed and in coordination with corresponding departments.

3. To carry out the regulated quality control and assurance at the construction.

4. The building materials to be used for mass construction should be subjected to appropriate examination and certification.

5. Prior to the restoration and strengthening works to be carrying out in Ahmedabad city it is essential to conduct complex investigations of buildings.

Conclusion

- There were no scientific and engineering solutions aimed to public and built environment vulnerability reduction adequate to existing seismic hazard in Gujarat.

This conclusion was made on the base of:
- Lack of building code, adequate to exiting seismic hazard;
- Poor quality of building materials;
- Errors in buildings design (did not taking into consideration building codes), in construction (in many cases buildings were not constructed as they were designed) and exploitation (poor public awareness) of buildings and structures;
- Lack of seismic risk assessment (loss estimation);
- Lack of solutions aimed to seismic risk reduction.

4. DEMOLITION OF HEAVILY DAMAGED STRUCTURES

The demolition has been done by Armenian NSSP Task Force rescue team.

![Image of dense city buildings](image)

Figure 3.1 The very dense building of city.

5. RESCUE, MEDICAL AND PSYCHOLOGICAL ASSISTANCE TO DEMOLITION TEAM AND EARTHQUAKE SUFFERED PEOPLE

Several aspects of societal response to this earthquake were investigated.

The Armenian NSSP Task Force rescuers, physicians, social scientist and psychologist were in charge for following:

- rescue assistance and participation in demolition operations as well as search and rescue in Ahmedabad city;
- medical assistance to demolition team and to earthquake suffered people;
- social impact and emergency response investigation through meetings and interviews with officials, victims, and emergency managers.
6. The main outcomes of Armenian NSSP Task Force Mission

During two weeks of relief operations in Ahmedabad, the following outcomes were achieved:

- 6 strong aftershocks of the Gujarat earthquake have been recorded in different parts of Ahmedabad city, as well as ground geotechnical conditions were studied for buildings and structures earthquake damage analysis, further building codes development for current seismic hazard assessment and seismic microzonation for re-assessment of seismic hazard;
- 140 (4-12 story) buildings were inspected and tested with conclusions made in respect to their suitability for their further use;
- the unique operations have been done jointly with Ahmedabad fire brigade for the decutting and demolition of the 14 multistory, heavily affected buildings, which were very dangerous for public and surrounding built environment;
- the rescue, medical and psychological assistance has been provided for demolition team and for earthquake suffered people;
- the sociological studies have been carried out to investigate the reasons of such consequences, through talks to local people to understand their awareness and preparedness to strong earthquake, as well as their performance in rescue and recovery efforts.

General References:


Disaster Mitigation
On-going Practices in Bangladesh

COUNTRY POSITION PAPER

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Introduction:

Bangladesh has unique geographical location in South Asia and geologically a part of the Bengal Basin, one of the largest geo-synclinals in the world. The country is well within the tropics, bounded between 20°34′ to 26°38′ N latitude and 88°01′ to 92°41′ E longitude having an area of 147,570 sq. km. approximately. It has 4,685 km. long boundary of which the coastline is 710 km. long, all are lying along the Bay of Bengal. The land is largest delta in the world. The delta is very active because of the process of its alluvial deposits, behaviour of the river system and the tectonic movements. In its unique location the delta is at the lower part of the basins of three mighty rivers, the Padma (known as the Ganges in India), the Brahmaputra and the Meghna. These mighty rivers converge and meet at a place within the country prior to their discharge into the Bay of Bengal. The country is characterized by the flat terrain of alluvial soil criss-crossed with an intricate system of over 230 rivers, canals and streams. It is also the very geographical location which places Bangladesh in such a way that the Himalayan range remains to its north and its southern coast is at the northern tip of the Bay of Bengal which converges near the coast like a funnel towards the Meghna estuary. Because of such location, Bangladesh is one of the most highly disaster prone countries of the world. The country, with its population of about 140 million and per capita GNP of US $ 370 is visited frequently by various natural disasters such as cyclones and associated storm-surges, floods, droughts, tornadoes, river-bank erosions and earthquakes. These disasters, as happened in the past, continue to impact seriously on the society in terms of grievous human casualties, economic and social losses, disruption of livelihoods and degradation to environment.

2. Evolving Disaster Mitigation Strategy in Bangladesh:

In the past, disasters in Bangladesh were largely considered to be the acts of God and thought to be beyond any human remedy. As such, necessity was not felt for undertaking coordinated activities to minimize risks and losses except temporary Government responses to distribute relief during post-disaster phase without taking into account the socio-economic implications of these events. Efforts had never been made to recognize dependence of development on proper handling of disasters. But over the years in the recent past, the Government of Bangladesh (GoB) has been giving increasingly more emphasis on ways and means to reduce human, economic and environmental costs of disasters in Bangladesh, through enhancing in particular the national capacity of disaster mitigation to address management of all related aspects in respect of planning for and responding to disasters. This changing concept for the whole process of risk minimization activities identifies crucially not only disaster mitigation, but also other elements of disaster management i.e. preparedness, response, recovery and development. This broad concept is relatively new in Bangladesh but now firmly rooted. GoB has perceived that disasters costing millions of dollars to the national economy can be alleviated on the basis of national and international experiences, modern technology and knowledge. The Government firmly believes that with some elementary preparedness and preventive measures such as hazard and risk analysis, land-use zoning, building codes, training and awareness build-up, basic institutional arrangements, field level action planning, etc. disaster mitigation can be highly cost effective.

3. Current Disaster Mitigation Programmes:

Based on the new concept of disaster management, GoB has given equal
importance to both structural as well as non-structural mitigation measures keeping in view the aspect of better coordination within overall disaster management system. It is rather strongly believed by the GoB that non-structural mitigation measures need to be complemented by structural mitigation measures in order to modify or reduce some disaster effects. The programmes on disaster management in Bangladesh focus equally on structural and non-structural practices meant for disaster mitigation:

a) **Structural Mitigation**: As part of structural measures, the GoB with its own and external resources has so far constructed 1,841 cyclone shelters and 200 flood shelters for evacuation of people exposed to impending cyclone as well as flooding. In addition, during the last four decades 482 small, medium and large water and flood control projects have been implemented. Of these, more than 400 projects were implemented after liberation war in 1971. Through these projects, about 8,200 km. long flood protection embankment, drainage channels of total length 3,400 km. and 9,000 sluice gates and regulators on different rivers and canals as safety measures against inundation by tidal waves, storm-surge and flooding have been constructed.

b) **Non-structural Mitigation**: Non-structural mitigation practices pursued by the GoB focus on i) preparedness and possibilities for action to reduce risks and losses, and ii) better coordination mechanisms between all actors involved (GO, NGO and community people at the grass-root level) during all phases of disaster. Such practicing measures under the just completed project: "Support to Disaster Management" involve:

i) Legislation, Policy and Plan
ii) Training and Public Awareness
iii) Warning Systems
iv) Local Disaster Action Plans

i) **Legislation, Policy and Plan**: The Disaster Management Legislation (Act) has already been drafted and is now under consideration by the GoB. The Act is aimed at establishing a machinery working through the State and Local Governments and public corporations and clarification of where responsibilities lie, and providing for the formulation of disaster management plan and policy relating to preparedness and emergency measures and rehabilitation programmes to deal with disaster and thus ensuring an effective and organized administration of comprehensive and systematic disaster management with view to the preservation of social order and the security of public welfare.

Clear and Comprehensive National Policy on Disaster Management and National Disaster Management Plan have been designed in draft form under the project completed in June, 2002. Both the drafts are also under consideration of the GoB at present. The policy involves accurate definition of disaster threat, organizational arrangements which are required to prepare for, responding to and recover from disaster events, assessment of resources available to deal with threat and how national disaster policy interlocks with other national policies of development. The aim of the draft disaster management plan has been spelt out to anticipate future situations and requirements, thus ensuring the application of effective and coordinated counter-disaster measures. The plan also covers both planning at normal times for aspects like prevention / mitigation, preparedness,
response and recovery, and also planning for operational activities concerning mobilization and deployment of national resources, requests for international assistance and so on immediately before, during and immediately after the disaster.

ii) **Training and Public Awareness**: Disaster Management Bureau (DMB) established in April, 1993 as a dynamic professional centre of excellence under the administrative control of the Ministry of Disaster Management & Relief (MDMR), Government of Bangladesh (GoB) has conducted 447 training courses / workshops / seminars. About 35,000 participants attended the programme covering government and semi-government officials of different levels, elected public representatives, NGO officials, representatives of mass media, teachers, religious leaders and members of fishermen community. Besides, DMB has developed and tested Disaster Management (DM) training modules and has been supporting holding of disaster management training workshops in the regular courses of 25 national training institutes like BPATC, BCS Admin Academy, BARD, NAEM, IUBAT, etc.

As part of public awareness activities booklets containing public information about cyclone, flood, earthquake, etc. calendar, poster depicting disaster points are regularly printed and distributed upto grass-root levels by DMB. The GoB has already declared last working day of March every year as National Disaster Preparedness Day (NDPD) as part of public awareness build-up programme and the country has been observing the Day from national down to the union levels since 1998. On the basis of acquired experiences in facing disasters, DMB at the guidance of MDMR has also published both in Bengali and English a guidebook entitled ‘Standing Orders on Disaster’ (SOD) for use by all actors involved in disaster mitigation. The SOD has been distributed upto all disaster prone unions, upazillas and districts, and it clearly defines the functions of different line ministries, departments and agencies at the time of disaster and post-disaster phases. To raise awareness among the students on various common hazards / disaster management issues, a chapter on disaster management and concept of disasters affecting Bangladesh have been included in National Curriculum for the children aged 08-17 years (classes V - XII).

iii) **Institutional Arrangements**: The GoB has taken a number of significant steps during the last few years for building up institutional arrangements from national to the union levels for effective and systematic disaster management facilitating mitigation to the sufferings of disaster victims in Bangladesh. These are :

1. Naming of the Ministry of Relief and Rehabilitation as the Ministry of Disaster Management & Relief (MDMR).
2. Establishment of a disaster management organization named Disaster Management Bureau (DMB) in 1993.
3. Establishment of Council and Committees at the national, district, upazilla and union levels.
4. Establishment of Emergency Operations Centre (EOC) at the MDMR for information exchange during emergency period related to impending disaster.
The Council and the Committees:

At National Level

i) National Disaster Management Council (NDMC): headed by the Prime Minister to formulate and review the disaster management policies and issue directives to all concerned.

ii) Inter-Ministerial Disaster Management Coordination Committee (IMDMCC): headed by the Minister in-charge of the Ministry of Disaster Management & Relief (MDMR) to implement disaster management policies and decisions of NDMC / Government.

iii) National Disaster Management Advisory Committee (NDMAC): to be headed by an experienced person having been nominated by the Prime Minister.

iv) Disaster Management Training and Public Awareness Building Task Force (DMTATF): headed by the Director General of Disaster Management Bureau (DMB) to coordinate the disaster related training and public awareness activities of the GO, NGO and other organizations.

v) Focal Point Operational Coordination Group on Disaster Management (FPOCG): headed by the Director General of DMB to review and coordinate the activities of various departments / agencies related to disaster management and also review the Contingency Plan prepared by concerned departments.

vi) NGO Coordination Committee on Disaster Management (NGOCC): headed by the Director General of DMB to review and coordinate the activities of concerned NGOs in the country.

vii) Committee for Speedy Dissemination of Disaster Related Warning Signals (CSDDWS): headed by the Director General of DMB to examine, ensure and find out the ways and means for speedy dissemination of warning / signals among the people.

At Field Level

i) District Disaster Management Committee (DDMC): headed by the Deputy Commissioner (DC) to coordinate and review the disaster management activities at the district level.

ii) Upazilla Disaster Management Committee (UZDMC): headed by the Upazilla Nirbahi Officer (UNO) to coordinate and review the disaster management activities at the upazilla level.

iii) Union Disaster Management Committee (UDMC): headed by the Chairman of the Union Parishad (UP) to coordinate, review and implement the disaster management activities of the union.

iv) Warning Systems: In Bangladesh there are two warning systems: one is the flood warning and other one is the cyclone warning system. Both these warning systems are of great concern to the decision makers as well as the general public.

a) Flood Warning System: Flood warning has been in the state of continuous development since 1972 when Flood Forecasting and Warning Centre (FFWC) was established under the Bangladesh Water Development Board (BWDB). The flood warning system in its evolution has passed through two stages and entered into the third stage in January, 2000 under a project which will continue till December, 2004. During second stage of evolution under a project ending December, 1998 there has been significant improvement in flood
Forecasting and Warning system (FFWS) with the introduction of hydrodynamic super model MIKE 11 and real time monitoring stations having been increased to 30. With such modernization, FFWS yielded a very productive and successful result during the devastating flood of 1998.

b) **Cyclone Warning System:** The existing cyclone warning in Bangladesh has signal numbers inherited from British India. The warning signals have two sets: one for sea-ports and the other is for river-ports. Experiences show that these two types of signal numbers are confusing to the common people. Moreover, the contents of the cyclone warning known as Special Weather Bulletin are not specific for easy understanding by elites, decision makers and general public. Because of these anomalies, growing need was felt from all sections of the society for simplification of the warning signals on the basis of cyclone intensity and less signal numbers, and improvements in the contents of the cyclone warning by making it precise, easy to understand and oriented as per people's requirements. Under the project completed in June, 2002 the cyclone warning signals have been simplified, made specific and easily understandable. The modified cyclone warning is under consideration by the GoB.

v) **Local Disaster Action Plan:** For coordinated and effective efforts to cope with disaster situation, a well thought, carefully designed and action oriented detailed disaster action plan is of paramount importance to Bangladesh, both at national and local levels. Guided by this realization the DMB under the project 'Support to Disaster Management' completed in June, 2002 made all out efforts to establish Disaster Action Plan at local levels. An elaborate procedure was strictly followed for the preparation of Disaster Action Plans. The draft model action plan was prepared by the DMB and put to debate at a workshop held in July, 1998 and attended by a good number of eminent experts of the country involved in disaster related activities. Based on the outcomes of the workshop, the draft model action plan was modified and finalized. On the basis of the final 'model', the DMB with the help of national consultants has been able, by the end of the project 'Support to Disaster Management' to prepare Local Disaster Action Plan (LDAP) for most disaster prone 29 districts, 84 upazillas, 776 unions and 24 pauroshavas.

The LDAP basically contains three parts. First part deals with union profile both narrative and simple sketch alongwith hazard and vulnerability maps. Second part contains formation of Disaster Management Committee (DMC) and its responsibilities. Final part has all the details of action plan including various volunteer groups (VG) and sub-committees for undertaking responsibilities like:

a) warning dissemination and precautionary response;
b) arrangements for evacuation;
c) arrangements for rescue and casualty care;
d) arrangements for burial;
e) control room;
f) restoration of essential services;
g) security and protection of property;
h) damage and needs assessment;
i) coordination of assistance;
j) management of relief supplies;
k) support to rehabilitation;
l) logistics;
m) training and awareness build-up; and
n) testing and updating the plan.

Final part of the LDAP also includes lists for all locally available resources with particulars of owners (if applicable) for use during emergency situation.

At the time of preparation, the LDAP has full participation of the local people and the communities. The main purpose of the LDAP is to mobilize local communities in the most disaster-prone areas to prepare and protect themselves, and to increase their own capacities to cope with and recover from disaster without waiting for outside assistance.

4. Co-ordination Mechanisms:

To maintain proper coordination amongst the concerned Ministries, departments, line agencies, Local Government Body (LGD) and community people, and also to ensure their proper functioning to mitigate sufferings of the people, the GoB has formulated a set of mechanisms for Council and Committees from national down to the grass-root levels. For the mechanisms to be best operative, the SOD acts as a guidebook.

The high powered NDMC and IMDMCC, developed as effective bodies to promote and coordinate risk-reduction, preparedness activities and mitigation measures, meet twice and four times a year respectively. While NDMC formulates and reviews disaster management policies and issues directives to all concerned, the IMDMCC plays key role in implementing the directives maintaining inter-Ministerial coordination, supervising the services of the Armed Forces as well as NGOs working in the field of disaster management in the country. Under the mechanism there exists a well established organization named Directorate of Relief and Rehabilitation (DRR) within the administrative control of the MDMR wherein EOC is located. The DRR acts during post-disaster emergency situation and operates relief activities for distribution to remote field levels under the supervision and guidance of the Ministry of Disaster Management & Relief (MDMR) / IMDMCC. The MDMR has a small dynamic professional unit known as DMB to perform specialist functions and ensure coordination with line departments/agencies and NGOs by convening meetings of DMTATF, FPOCG, NGOCC and CSDDWS every three months regularly.

The DMB also helps EOC by extending technical support services through MIS/GIS for information exchange. In addition, the Cyclone Preparedness Programme (CPP) also plays very important role during and immediately before
cyclone disaster by maintaining coordination with EOC, Bangladesh Meteorological Department (BMD), DMB, NGOs and others and extending direct help to the community people.

The entire mechanism thus meets the requirements of clear policies, provides scope for implementation of NDMC directives and decisions by the high-level IMDMCC on an inter-Ministerial basis, incorporates the role of the MDMR as the responsible line Ministry, provides for the integration of Armed Forces and reflects the crucial role of the DDMCs, UZDMCs and UDMCs.

5. **CDMP : A Vision in the future**

Based on the existing achievements and focuses on the 'gaps' in current disaster related project interventions, there has been a growing recognition in Bangladesh that renewed efforts should be directed toward more comprehensive programming that contextualises all elements of disaster handling within a broader risk management framework and in so doing creates a more coordinated programming environment. Accordingly, in mid 1999 the GoB together with UNDP and other development partners agreed to address the issue of risk reduction in a more comprehensive programmatic approach. Hence with the initiative taken in October, 1999 in the direction as agreed upon, Comprehensive Disaster Management Programme (CDMP) is at present nearly in its final stage through long painstaking processes to prepare concept paper, develop framework and formulate programme support document.

CDMP has been designed to adopt an umbrella programme approach that encompasses all aspects of risk management and in so doing facilitates to move from a single agency response and relief strategy to a whole of government holistic strategy that addresses the issue of community vulnerability. CDMP is thus a business strategy. It is a strategic institutional and programming framework that is meant to optimise the reduction of long-term risk and the operational capacities for responding to emergencies and disaster situations related to each of the major hazards or potential emergency situations and action to mitigate sufferings and improve recovery from these events. CDMP is, therefore, a realistic strategy consistent with the GoB’s vision for a more comprehensive approach to addressing the issues of risk and vulnerability. CDMP has then the main focus on capacity building, partnership development, community empowerment, research information management and response management.

6. **Conclusion**

Bangladesh has an elaborate, established and experienced disaster management system from national down to the union level to mitigate the effects of disaster. As comprehensive control on the natural hazards most frequent to Bangladesh is not possible, Bangladesh will have to live with natural disasters. Living in such condition, the GoB has been continuously making endeavour to make preparedness and mitigation measures under the total disaster management programme (like CDMP) as sufficient as possible so as to ensure sustainable development of the country as a whole. GoB recognises that building of greater self reliance, awareness and empowerment of the people must be a corner stone of policy and strategies related to mitigation measures within the generic term 'disaster management'. Based on this
realization, GoB strongly believes that it is now time, at the very beginning of this 21st century, to take pragmatic approach to the whole issue of coordination amongst training, research and management centres so as to reap maximum mutual benefit for the people in distress out of frequent sharing of expertise, experience, knowledge and information. We should put up our best in this logical approach to prepare ourselves for major growth and development in Asia with minimum risk involved from disasters, and make our communities and our nationals safer than ever before.

Disaster Emergency Management in China

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Natural disasters occurred frequently in China resulting in more than 200 million persons effected every years. The direct economic loss increased year after year, among which it has exceeded 100 RMB billion every year of the 1990s, exceeded 200 RMB billion in recent years, and exceeded 300 RMB billion in 1998. Natural disasters have become an important factor to restrict the economic and social development of China. Following the economic development and the increase of social wealth, the loss and harm caused by natural disasters will increase further. And the alternate and superimposed occurrence of various disasters increases the difficulty of disaster prevention and emergency. China government has paid more attention to disaster reduction and has great achievement through the efforts of 40 years.

Disaster management is an applied science to improve the measures of disaster prevention reduction, preparation, alarm, response and recovery by observation and analysis of disasters (Carter, 1993). “The cycle of disaster management” has been put forward (see figure 1). Disaster emergency response is the measures to be adopted. In the cycle of disaster management, the duration of emergency response is shorter than phases of disaster prepare and recovery, but the phase is the key phase. The object of the phase of disaster preparation is to reduce the loss caused by disasters and make full preparation for disaster emergency response. Moreover, the success of disaster emergency response decides the safety of the lives and property and the difficulty development of the phase of disaster recovery.

![Figure 1 The cycle of Disaster Management](image-url)
According to the practice of disaster relief work of many years, improving the ability of disaster emergency response is a necessary condition to enhance the ability of disaster control, reduction and recovery and an important symbol to weigh the ability and level of disaster relief work. So, perfect disaster emergency management is an important task of disaster reduction.

1. The study and practice in China

Since the medium and later period of last century, the problems on resource and environment have stood out and the frequency, intensity, scale and effect of disaster occurrence increased following the rapid economic development. Disaster reduction, as an important approach of sustainable development, has been paid more attention by academic, economic and social circles (Kates et al., 2001; Makowski et al., 1999). As the scientific base of disaster reduction practice, natural and social scientists and technological experts have shown concern over the study on disaster (Mileti, 1999). Represented by U. S. A., Japan, Australia and some countries of Europe, the study on disaster has turned into autumn from development period since the 1960s, representing the international advanced level. In China, the study on disaster has entered into rapid development period since the medium and later term of the 1980s and has obtained some important achievements in the fields including simple disaster type, regional disaster, disaster theory, disaster reduction policy as well as disaster insurance.

Lots of literatures have discussed the theory of disaster study in China. Disasters (D) are the results of the integrated action of hazard-formative environments (E), hazards (H) and hazard-affected bodies (S) on the earth surface (Shi, 1991). The expression is D=E∩H∩S (see figure 2). Regional disaster system is the variation system of earth surface composed of hazard-formative environments, hazards and hazard-affected bodies. The stabilization of hazard-formative environments, the risk of hazards and the vulnerability of hazard-affected bodies decided the magnitude of disasters and form the regional disasters through a feedback of hazard-formative environments, hazards and hazard-affected bodies (Shi, 1996). The regional disaster system provides a theory basis for the theory and practice of disaster emergency management.

In the fields of the theory and technology on disaster emergency management, some study has appeared in China. Chu Dajian (2003) brought forward emergency management mode based on system control including strategic ability, development ability and process ability (including prevention, preparation, emergency and prevention). The mode should heighten strategic consciousness, enhance the development to prevent risk, reduce the vulnerability of community to disaster events, heighten the adaptability of community to disaster risk, and establish the management mechanism of whole process combined crisis prevention with crisis reply. Some key elements in developing a fast and effective Computer Emergency Management System (CEMS) are discussed (Zhai et al., 1998) in the example of CEMS, including system structure, database system, inference method, communication network and graphic system which are useful for the future study and practice as they provide general theory, methods and scientific basis. Approaches for environmental emergency management are presented using GIS/ES (geographic information system/expert system technologies), based on the environmental emergency requirements for environmental management (Xu et al., 1999). It is pointed out that the integrative application of GIS/ES provides an effective tool for intelligent emergency response and management.
Following the experience accumulation of disaster reduction work, disaster emergency management has achieved great success in China. Now, the system of disaster emergency management has been established, namely that huge disasters is managed and disposed by national government uniformly, local government manage by stages, various sectors divide the work, and the army is active to join the disaster assistance. In China, the disaster emergency management system takes the local management as the dominant factor, the central management as the supplementary factor. For national and provincial governments, the response points that integrated correspond should be strengthened further while fulfill the disaster relief burden respectively. For local governments, the key of response is to carry out their own task of disaster prevention and relief.

![Figure 3 Disaster preparation mechanism (Wang, 1999)](image)

Ministry of Civil Affairs of China, as the general department of disaster relief and reduction management, assumes the work of organizing and coordinating disaster relief, supervising and promulgating the information of disasters, managing and distributing disaster relief fund and material of central government and monitoring their use. In the light of disaster emergency management, the formulation and implementation of emergency plan have been developed by the ministry of Civil Affairs of China. From 23 to 25, May, 2003, a conference on emergency plan of disaster relief of China was hold in Hefei City, Anhui Province, which indicating the beginning of the constitution of emergency plan in the whole country. To ensure emergency relief work after the occurrence of unexpected natural disasters and guarantee basic lives of people suffered from disasters, the Ministry of Civil Affairs of China divides the work to reply unexpected natural disasters into three grades of response based on the scene of disaster losses, and has enacted “the work rules of unexpected natural disasters response of the Ministry of Civil Affairs of China” in June, 2003. To normalize and instruct the constitution of local disaster emergency plan, the Ministry of Civil Affairs of China drafts the basic content of emergency plan of disaster relief. Emergency plan of disaster relief should be enacted in cities along main rivers and cities covered by earthquake monitoring net in 2003. The Ministry of Civil Affairs is organizing manpower and material resources to extend material warehouses and the net of reserving material in the whole county. By attracting nongovernmental capital to attend the establishment of professional serving enterprises of emergency relief, the serving market of emergency relief will be exploited in China. By training, volunteer group of community will be organized, which possess some knowledge and skill of self-saving and mutual aid.

As a professional section, the Ministry of Water Resources of China has been unfolding the work of flood control construction in countries and cities, and has organized community manpower to establish more than 370 groups to rush to deal with the emergency. In April, 2002, China Seismological Bureau established national troop of seismic emergency assistance which has had the ability to attend the seismic emergency relief in mainland and overseas. In recent years, China Meteorological Administration has strengthened the monitoring of the meteorological disasters to forecast and release disaster weather by using some equipment such as computer system, satellite and ladar.
In light of disaster emergency management, China has promulgated some laws such as “Law of Flood control of P. R. China” (performed since January 1, 1998) and “Law of Earthquake Control and Disaster Reduction of P. R. China” (performed since March 1, 1998). Specially, State Council of China has promulgated “the regulation of destructive earthquake emergency” (performed since April 1, 1995), which has particular regulations on the emergency work of destructive earthquake. Correlative laws and regulations have been enacted to systemize and legalize disaster emergency management gradually in China.

2. Problems on disaster emergency management in China

Following the deep study of natural disaster theory and the improvement of disaster emergency management practice, the ability of the government of various grades to deal with unexpected events has been enhanced and lots of achievements have been obtained. But, the theory study and practice have many problems and large gap with the level of disaster emergency management of developed countries.

1) The work of emergency management of governments is primitive, and disjoints with the study of theory and technology. The management level of various governments is not balanced. The ability to deal with unexpected disaster events reduces from central government, provincial governments to local governments. At the same time, the power of various sections cannot be conformed resulting in the disaster management mode of different disaster types and different sections.

2) Propaganda and education on disaster emergency are insufficient. Mass is short of the knowledge on disaster prevention and saving oneself, which restricting the heighten of the level of disaster emergency management.

3) The level of theory and practice of various disaster classes is different. Because of earthquake having obvious unexpected characteristic, the study and practice experiences on earthquake emergency are abundant. The study on flood is in the next place. To the other disaster classes, the study and practice on disaster emergency is weak.

4) The work of natural disaster emergency management is different in various regions. In a general way, the level of study and management in the regions with relative developed economy or frequent disaster occurrence is higher than that in the regions of relative undeveloped economy. On the other hand, the level of emergency management in urban areas is higher than that in rural areas.

5) For the legal construction on disaster management, some simple regulations have been enacted. But, there is not a compositive law to manage disaster reduction of the whole country resulting in that some important policies such as “synthetical disaster reduction” are short of law dependence.

3. Development of Disaster Emergency Management in China

Disaster emergency response is the measures to be adopted while disasters occurring. To ensure the effect of these measures, many aspects of disaster reduction work will be related. So, before the occurrence of disasters, the hazard-formative environments should be assessed and potential disaster condition should be forecasted, which will be as the basis of disaster emergency plan and the preparation, distribution and transportation of the resource for disaster relief. While disasters occurring, the content of emergency plan should be adjusted based on actual conditions, and it should be implemented effectively. The disaster emergency management should be ensured by acquiring and assessing exact disaster information rapidly. So, it is imperious for disaster reduction work of China to constitute disaster emergency management of the whole country.
3.1 The establishment of emergency management

Firstly, natural disaster emergency management need the establishment of perfect and effective management system including capable administration organized system, self-contained legal system, scientific and precise expert consultation system, developed technical equipment system and practical material sustaining system. To constitute perfect organizing and leading command system of disaster emergency management, the responsibility of leader should be divided well, the relation of governments of various grades and various sections should be clear. Effective administration organized system will help the reduction of the number of dead and injured persons, the losses and the destruction of ecological environment and establish good basis for disaster recovery. Moreover, the management depends on the legal system and the execution of the laws depends supervision and inspection.

3.2 The constitution of emergency plan

Disaster emergency plan is the emergency action scheme of governments to meet natural disasters, which is a key measure to normalize disaster emergency management and improve the ability of disaster emergency assistance and an important mode to constitute modern disaster relief mode. The emergency work must change from adopting passive remedial measures after disaster occurrence to establishing and adopting various measures to prevent disasters before their occurrence. Once disasters happen, governments and related sections can relief disasters according to preliminary plan. Firstly, Emergency plan must be a policy, and is scientific and operational. The establishment of emergency plan should institute work frame to indicate the guideline and policy of emergency work of governments. Secondly, emergency plan should accord with related laws and regulations. In the light of the regulations of disaster occurrence, the emergency task of related regions and sections and the emergency response and action measures should be scientific described based on actual resources, conditions and power of disaster prevention. Third, once disasters occur, emergency plan can be activated, and various terms of emergency preparation and safeguard measures can be carried out.

3.3 The acquirement and assessment of disaster information in emergency management

Acquiring disaster information is the first link of disaster emergency work, the basis to various actions and an important link of the whole emergency process. After the occurrence of disasters, there are lots of difficult in the exact acquirement of disaster information. So, establishing an effective system to obtain disaster information is a key problem in disaster emergency management. After the acquirement of disaster information, how to effectively assess the information is another part to adjust disaster emergency plan and establish particular assistant plan. At present, the level of disaster information assessment is low in China. Specially, while disaster occurring the assessment of disaster information is depend on the experience judgement by governments and disaster management sections. The level of disaster information assessment using high technology is very low.

To change the behindhand conditions, database and 3S technology (including GIS, RS and GPS) should be applied to heighten the ability of acquiring and assessing disaster information. In the study and management sections of simple disaster class of China, some disaster information management systems on simple disaster class (including flood, drought, forest fire, earthquake, snow disaster, sand disaster and so on) have been established, and the study on disaster emergency inspection and assessment has been expanded, which has constituted a compositive system of huge natural disaster inspection and assessment supported by GIS and RS technology. The system has good functions in inspecting and assessing some huge natural disasters occurred in recent years. However, these systems of disaster information, inspection
and assessment are in the phase of study and test. How to consummate these systems and use them in disaster emergency management should be settled as soon as possible.

3.4 The establishment of emergency management system

Based on the establishment of disaster emergency management system, the constitution of operational disaster emergency plan, the improvement of disaster information acquirement and assessment, the establishment of operational disaster emergency system will enhance the level and efficiency of disaster emergency management work.

At present, there is not a perfect modeling emergency relief management system in China. There are three disaster emergency management systems such as EMS of U. S. A., MEMbrain system of EUREKA of Europe and DRS of Japan. These systems use advanced GIS, RS, GPS and communication network systems to assistant decision-making, and have the characteristics of distributed structure, integration and operation capability, which helping heighten the speed of disaster reduction decision-making and develop system management of large scale. But, these systems have some disadvantages such as immoderate dependence on engineer hardwares and the simplification of complex and particular problems.

Conference

Theme: Mitigation

Development of Eco-Bio-Engineering Mitigation System;
An Eco-Geological Approach towards Community-based Rain-induced Landslide Prevention in Java.

Dwikorita Karnawati1, M.G. Anderson2, Wilkinson, P.L3, Sri Astuti Sudjoko4 and Kuncoro5

Mountains area which covers about 70% of the Java Island region, geological conditions and high rain precipitation bring about to high susceptibility of landslide in Java. Landslide occurrences however have dramatically increased within the last three years mainly as the results of urbanisation and deforestation. Since November 2000 up to now there have been 391 people lost their life, thousands of people lost their homes and more than 657 ha land destroyed due to rain-induced landslide disasters in Java. Therefore, Eco-geological management is proposed here to mitigate such disasters. This is such an integration of management on hydrological and social aspects controlling landslide by developing a community-based slope management system. Innovative numerical approach to analyse complex slope stability problems in hydrologically sensitive areas also applied to support the management.

I. Introduction.

Eco-geolgy is the inter-relationships between geological study and the ecological considerations (including socio-economical aspects) and the feedback effects of one on the other. This is an applied Geology which takes up a systematic study of the natural processes without which environmental problems can be neither understood nor solved. Such study considers on the balance management of natural resources and geological hazards towards sustainable environment, and dedicated to whole human being.

Landslide is one type of the geological hazards which commonly occur in Indonesia, especially during the rainy season. Chowdhurry, 1978 defined that landslide

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(slope failure) is a downslope movement of soil or rock masses as a result of shear failure at the boundary of moving. When the movement of the soil/rock mass is mainly induced by rainfall then it is defined as rain-induced landslide. Indeed, this geological hazard brings about to high socio-economical cost as illustrated in Table 1. The total cost was estimated about 104 billion rupiahs (which is about one million US dollars).

This paper highlights the importance of eco-geological considerations to support landslide mitigation in Java. Such considerations do not only include geological assessment but also bio-engineering as well as socio-economical aspects. Therefore the proposed mitigation system is so-called as eco-bioengineering mitigation system.

II. Controlling factors and inducement process.

Admittedly, by nature many slopes in the mountainous and volcanic areas in Java are susceptible for landslides. Such susceptibility is mainly driven by the integrated influence of geological conditions such as morphology, slope stratigraphy and structural geology, slope-soil cover, slope hydrology as well as by the rain intensity (Karnawati, 2003).

According to Sartono (1975), Heath and Sarosa (1988), Heath et al (1988), Tjojudo (1985) and Sarosa 1992, as well as Karnawati (1997 & 2000), landslide in Indonesia is controlled by several factors as follows:
1. Morphology, in particular the steep slope inclination
2. Characteristics of soil/rock material covering the slope, such as residual soil and colluvial.
3. Soil or rock structures within the slope, such as discontinuities (joints) and or contact planes. Such planes normally exhibit a contrast in soil permeability and shear strength. These could be the contact between weathered soil and the underlying more fresh bed rock, or contact between two different soil/rock types.
4. Climate (i.e. rainfall intensity and duration).

Some studies reported that landslides are strongly related to the high intensity of rainfall. However, Karnawati (1996 & 2000) argued that the relatively low intensity of rainfall, i.e. 25 mm/day could trigger the landslide in a slope with relatively low $2.51 \times 10^{-6}$ m/sec with a shallow (1 to 3 m depth) initial groundwater table. Thus it
is suggested that the triggering rainfall characteristics is strongly controlled by the permeability of soil / rock covering the slope and the initial groundwater table. In order to identify characteristics of triggering rainfall those conditions should be considered.

5. Slope hydrological conditions.

A shallow initial groundwater table and or perched groundwater aquifer contribute to the increment of pore water pressure due to rain infiltration, which leads to the landslide. However, in the slope with deep groundwater table loss of suction due to rain infiltration could be the mechanism of landslide occurrence.

Despite all of those controlling factors, the susceptible slopes may remain stable and landslide disasters will not occur, unless there are some inducements or triggers that proceed on slopes and surrounding area. These inducements or triggers are considered as the main factors should be managed to reduce the occurrence of landslide disasters.

Landuse changes especially those due to deforestation and land clearing, are the most effective inducement of landslide disasters. In December 11, 2002 debris flow occurred in Pacet Area which is located in the north-west part of Welirang Volcano slope (at the south of East Java). Prior this debris flow, there had been several days of rainstorm with the intensity exceeding 50 mm/day at the upper part of Welirang Volcano. Kartodihardjo, et al, 2003 reported that deforestation in this upper area had reached 50 % of 195.8 ha pine forest. Twenty six people were buried instantly by the debris flow and 14 others were still missing. Then, another debris flow occurred in the slope of Mandalawangi Volcano at Garut Regency, in the south of West Java during several days of heavy rainstorm (exceeding 100 mm/day) in February 2003. Twenty two other people lost their life and again, deforestation had seriously occurred in the upper slope of this volcano. Indeed, vegetation cover on slope seems to have an important role in controlling rain-induced landslide occurrences.

To avoid further substantial cost, landslide occurrence should be prevented or minimized by developing an appropriate strategic mitigation. Eco-hydrology, i.e. the inter-relationships between hydrologic regime and the ecological structure (including
socio-economical structure) and the feedback effects of one on the other, are accordingly crucial to support the appropriate landslide mitigation. This paper highlights the importance of a new approach for developing the strategic mitigation system and slope protection management in the rural areas, where the community has not very good access for education and social welfare. Roles of ecohydrology are discussed by considering the factors controlling rain-induced landslide occurrence, the mechanism of such occurrence as well as the role of vegetation in minimizing the occurrence.

III. Mechanism of rain-induced landslide

Gostelow (1991) suggested four consecutive steps leading to failure due to the rain infiltration. These are:

a. the storm or rainfall event
b. infiltration
c. groundwater table rise in the slope and reduction in shear strength
d. failure and displacement along a shear surface

Meanwhile Heath and Sarosa, 1988 and also Karnawati, 2001 reported that mechanism of landsliding in many slopes of colluvial or residual soils in Java is mainly induced by infiltrated rain water in the permeable soils (such as clay, sandy clay or sand – clay) which are underlain by more impermeable soils or rocks (andesitic breccia, andesite, claystone, tuff, or marl). This infiltrated rainwater cannot penetrate further-down through the more impermeable soils or rocks. The accumulation of infiltrated rainwater in the soil pores of the slopes causes the water table rise in the slope (which also results in pore water pressure increase within the soil), and it eventually reduces shear strength in the contact zone between residual/colluvial soils and the underlain more impermeable soils or rocks. This mechanism is also in confirm with the results of slope hydrological and stability analyses on colluvial and residual soils in Java investigated by Karnawati (1996, 2000) by applying numerical modelling. A part from this mechanism, water seepage through the bedding plane or fracture plane of rock slopes can also induce the rocksliding.
Loss of suction is also considered as one common mechanism of landslides on steep slope with thick soil cover and deep water table. In dry season many steep tropical slopes remain stable due to the suction held by surface tension at soil particles. Once the rain water infiltrated into the soil pores, these surface tension removed and suction reduced, then results in relatively shallow landslides (Karnawati, et all 2003).

However, there are several mechanism of rain-induced landslides in Java. These include:

a. soil unit weight variation as saturation changes
b. decreasing pore suction in the unsaturated zone
c. pore water pressure rise

Which one of those mechanism will proceed, depends on the slope hydrology and geology conditions. When the initial groundwater table is relatively shallow, landslide is most likely due to the pore water pressure rise, whilst such occurrence due to the soil unit weight variations is the most unlikely one.

IV. Landslide Classification.

Landslides in Indonesia can be classified based on the types of movements and slope conditions as illustrated in Table 2.

V. Integrated approach for landslide mitigation.

To avoid such substantial lost, landslide occurrence should be prevented or minimised by developing an appropriate management system. It is the evidence that most of the vulnerable area in Indonesia is located in the rural area. Consequently, regarding the socio-economical conditions of these landslide vulnerable areas, the low-cost and simple system is required. Thus, eco-geological approach with respect to community based-slope management system is the preference. This is such an integration of technical-biological-social considerations which is so called as socio-bio-engineering mitigation is proposed (Figure 1).

a. Role of vegetation.

The key factor controlling the management system here are the hydrological conditions. Indeed, some previous investigation by numerical simulation show that vegetation on slopes can be effectively control the slope hydrology and stability. The
vegetation cover on slope significantly affects the rate of rain infiltration and groundwater table rise as well as improvement of soil/rock shear strength on slope. Wilkinson et al, 1988 and Wilkinson, 2000 found that in hydrological terms, vegetation affects the slope hydrology and slope stability through three mechanisms, depends on the types of vegetation as illustrated in Figure 2 and Figure 3. Dense stand of trees can significantly reduce the effective rainfall infiltration due to the interception, evapotranspiration and root water uptake. Accordingly, the capacity of free water both as a run off at slope surface as well as infiltrated water in the soil pores can be reduced, and thus the occurrence of flood and landslides can be both minimised.

Meanwhile in mechanical term, both root reinforcement and vegetation surcharge are significantly affect slope stability (Wilkinson, 2000). Deep penetration of root stand into hard-rocks beneath the loose soil crucially provides additional support to the soil cohesion, and thus increases the soil shear strength against sliding.

b. Proposed bioengineering management.

Regarding the important role of vegetation to control hydrological conditions as well as to maintain slope stability, Sudjoko (2002) proposed the simple arrangement of vegetation for slope protection as below.

Vegetation types suggested are the local trees which are not too heavy but they have quite deep root. The trees with easily re-growth branches when they are harvested are the preference. Multi-functional trees are the most ideal, they are not only beneficial for controlling slope hydrological and stability conditions, but also economically useful for agriculture and farming. These suggested trees may include:

Trees with deep root and intensive root branch.

- *Aleurites moluccana* (kemiri) which can be plant up to the elevation of 1000 m above see level.
- *Vitex pubescens* (laban) (most suitable for the area with the elevation below 300 m above see level).
- *Homalium tomentosum* (dlingsem) (most suitable for the area with the elevation below 300 m above see level).
- *Lagerstroemia speciosa* (bungur) (most suitable for the area with the elevation below 300 m above see level).
- *Melia azedarach* (mindi) (most suitable for the area with the elevation up to 1000 m above see level).

- *Cassia seamea* (johar) (most suitable for the area with the elevation up to 700 m above see level).
- *Acacia villosa* (lamtoro merah) (most suitable for the area with the elevation below 300 m above see level).
- *Eucalyptus alba* (most suitable for the area with the elevation below 300 m above see level).
- *Leucaena leucocephala* (lamtoro) most suitable for the area with the elevation below 500 m above see level).

Vegetation with deep root but less intensive root branch.
- *Swietenia macrophylla* (for the area with elevation below 700 m dpl)
- *Gluta renghas* (for the area with elevation below 300 m dpl)
- *Tectona grandis* (for the area with elevation below 500 m dpl)
- *Schleicheria oleosa* (for the area with elevation below 500 m dpl)
- *Pterocarpus indicus* (for the area with elevation below 700 m dpl)
- *Dalbergia latifolia* (for the area with elevation below 700 m dpl)
- *Cassia fistula* (for the area with elevation below 700 m dpl)
- *Bauhinia purpurea/hirsula* (for the area with elevation below 1000 m dpl)
- *Tamarindus indica* (for the area with elevation below 1000 m dpl)
- *Acacia leucophloea* (for the area with elevation below 700 m dpl).

*Vegetation for area with high water content soil.*
- *Hisbiscus tiliaceus* for the area with elevation below 700 m above sea level
- *Hisbiscus seminis* for the area with elevation up to 1000 m above sea level
- *Calliandra calothyrsus* for the area with elevation up to 1000 m above sea level
• Calliandra tetragona for the area with elevation up to 1000 m above sea level
• Paraserianthes falcataria for the area with elevation up to 1000 m above sea level
• Bambusa sp. for the area with elevation up to 1100 m above sea level
• Artocarpus heterophylla for the area with elevation up to 1000 m above sea level
• Artocarpus communis for the area with elevation up to 700 m above sea level
• Durio zibethinus for the area with elevation up to 700 m above sea level
• Setaria spp (grass for cattle) for the area with elevation up to 1000 m above sea level

Pattern and space of the tree plantation should also be arranged to reduce the surcharge that may also drive soil movement. At least 10 m distance between tree stands is suggested. Therefore, grass or low vegetations can be planted in between trees.

The application of numerical approach is very useful to analyse complex slope stability problems in hydrologically sensitive areas with respect to any design of vegetation plantation. Such analysis by applying Combined Hydrological and Stability Model (CHASM) develop by Wilkinson et al (1998) is currently being undertaken to develop the most appropriate design for several models of slopes in Central Java.

c. Role of social management.

All of the bioengineering design proposed above may not be effectively implemented in the landslide area, unless there have been rigorous assessment on social conditions of the community at vulnerable area and it surrounding. This assessment is crucial to ensure that the community could be empowered to manage their own environment and slopes. Improving willingness of community to protect their-own susceptible area is necessary. Most of them are the farmers or communities living with agricultural environment. Thus, introducing the vegetative measure to maintain sustainability of hydrological regime in their environment is considerably appropriate.

Social mapping needs to be conducted to identify the characteristics of community, the key person can support empowerment program, as well as the existing traditional wisdom can be utilised. In-depth interview, participatory rural appraisal (PRA) as well as Achievement Motivation Training may also conducted.
VI. Conclusion.
Considering the socio-economical conditions of the landslide susceptible areas in Indonesia, the low-cost but effective and simple system is required for minimising the landslide occurrences. An integrated water resources management with respect to a community based-slope management is accordingly proposed. The communities’ understanding on the importance and the benefit of vegetation for environmental protection from landslide is crucial to indirectly reduce the rate of deforestation and thus to empower the community in minimising landslide disasters

References.


<table>
<thead>
<tr>
<th>No.</th>
<th>Location</th>
<th>Landslide event</th>
<th>Socio-economical cost</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Death</td>
</tr>
<tr>
<td>1</td>
<td>Kotagede, Yogyakarta</td>
<td>January 2001</td>
<td>32 people dead</td>
</tr>
<tr>
<td>2</td>
<td>Sangihe Island, Province of North Sulawesi</td>
<td>January 2001</td>
<td>1421 people and 389 houses threatened</td>
</tr>
<tr>
<td>3</td>
<td>Lebak Regency, Banten Province</td>
<td>February 8, 2001</td>
<td>94 people dead</td>
</tr>
<tr>
<td>4</td>
<td>Nias Island</td>
<td>July 30, 2001</td>
<td>50 people dead</td>
</tr>
<tr>
<td>7</td>
<td>Penusupan Village, Sruweng District, Kebumen Regency</td>
<td>October 4, 2001</td>
<td>9 people dead</td>
</tr>
<tr>
<td>8</td>
<td>Mangunweni Village, Ayah District, Kebumen Regency</td>
<td>October 23, 2001</td>
<td>35 houses burried</td>
</tr>
<tr>
<td>9</td>
<td>Ngelo and Purwodadi villages, Kajoran District, Magelang Regency</td>
<td>November 19, 2001</td>
<td>5 houses and 1 mosque damaged, tens house in Nglegok village down slope areas threatened.</td>
</tr>
<tr>
<td>10</td>
<td>Kedungrong, Purwoharjo Village, Samigaluh District, Kulon Progo Regency, Yogyakarta</td>
<td>November 20, 2001</td>
<td>7 people dead</td>
</tr>
<tr>
<td>11</td>
<td>Klepu, Banjararum Village, Kalibawang District, Kulon Progo District</td>
<td>November 20, 2001</td>
<td>2 people dead</td>
</tr>
<tr>
<td>12</td>
<td>Ciliwung Valley, Jakarta</td>
<td>January 2002</td>
<td>4 people dead</td>
</tr>
<tr>
<td>13</td>
<td>Pacet, Regency, Mojokerto Regency, East Java</td>
<td>December 11, 2002</td>
<td>26 people dead</td>
</tr>
<tr>
<td>14</td>
<td>Kalimatan mining sites</td>
<td>January 2003</td>
<td>5 people dead</td>
</tr>
<tr>
<td>15</td>
<td>Bandung, West Java (mining site)</td>
<td>January 2003</td>
<td>4 people dead</td>
</tr>
<tr>
<td>16</td>
<td>Kedungora District, Garut Regency, West Java</td>
<td>February 2003</td>
<td>21 people dead</td>
</tr>
<tr>
<td>17</td>
<td>Blambangan Village, Banjarnegara Regency, Central Java</td>
<td>February 2003</td>
<td>16 houses destroyed</td>
</tr>
<tr>
<td>18</td>
<td>Kokap District, Kulon Progo Regency, Yogyakarta</td>
<td>February 2003</td>
<td>4 houses burried</td>
</tr>
<tr>
<td>19</td>
<td>Bahorok, Langkat, North Sumatra</td>
<td>November 03, 2003</td>
<td>142 people found dead &amp; 134 people buried (missing)</td>
</tr>
<tr>
<td>18</td>
<td>Kokap District, Kulon Progo Regency, Yogyakarta</td>
<td>February 2003</td>
<td>4 houses burried</td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td></td>
<td><strong>391 people dead</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>269 people missing</strong></td>
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</tbody>
</table>
Table 2. Landslide Classification in Indonesia.

<table>
<thead>
<tr>
<th>No.</th>
<th>Types of movement</th>
<th>Slope conditions</th>
<th>Impact</th>
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<td></td>
<td></td>
<td>Slope inclination</td>
<td>Stratigraphic model</td>
</tr>
<tr>
<td>A</td>
<td>Initial movement</td>
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</table>
| 1.  | Deep and slow movement (creep). | Gentle hill-slope (being less than 20°) | Thick (more than 2 m) sandy clay, sandy silt, silty clay or clay of residual soils (commonly montmorillonite type) sometimes underlined by montmorillonite claystone or impermeable layer dipping towards slope inclination | • Damage the structures, but never caused in death.  
• Occurs over large area (larger than 1 ha), indicated by cracks in soil and structures, ground subsidence, and or inclined trees/ piles. |
|     | The lateral movement being less than 1 m per year | | |
| 2.  | Rapid movement (translational movement being more than 25 m/minute). | a. Steep hill-slope (steeper than 20°).  
b. Steep river bank slope (steeper than 20°) and related to river erosion. | Thick (more than 3 m) and loose sandy clay, sandy silt, silty clay or clay of residual soils underlined by denser soil or rock mass.  
• Soil or rock layers dipping towards slope inclination | • Frequently cause in death and or damaged of structures.  
• Occurs on relatively narrower or localised area (≤ 1 ha), but the moving material may flow downslope in a longer distance.  
• Sometimes the moving material blocks the river flow and cause in floods. |
|     | a. Shallow slumps or slides | c. Steep manmade embankment, including filled slope (steeper than 20°). | Filling material that sometimes not thoroughly compacted and without appropriate drainage system. | • Cause in death and or damaged of structures.  
• Commonly occurs in a localised area (≤ 1 ha) |
|     | b. Rock slide or rock fall | a. Steep hill-slope (steeper than 20°).  
b. Steep river bank slope (steeper than 20°) and may relate | Fractured or jointed rocks. | • May cause in death and or damaged of structures.  
• Commonly occurs in a localised area (≤ 1 ha) |
<table>
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<th></th>
<th>Developed -stage of movement</th>
<th>This is regarded as the continuation of the initial movement, when the deposit of initial movement at upper-slope or mid-slope re-moves downslope mostly due to rainfall inducement.</th>
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<tr>
<td>1.</td>
<td>Slow movement (continues creeping, especially during rainy season)</td>
<td>Gentle hill-slope (being less than 20°)</td>
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</table>
| |   |   | • Damage the structures, but never caused in death.  
| |   |   | • Occurs over large area (larger than 1 ha), indicated by cracks in soil and structures, ground subsidence, and or inclined trees/ piles. |
|   | Rapid movement | a. Middle part of steep hill-slope (steeper than 20°).  
|   |   | b. Middle part of steep river bank slope (steeper than 20°) and related to river erosion.  
|   |   | c. Middle part of steep manmade embankment, including filled slope (steeper than 20°). | Thick (more than 2 m) and loose deposits of landslide materials from upper slope. |
|   | a. Earth Flow | a. Middle part of steep hill-slope (steeper than 20°).  
|   |   | b. Middle part of steep river bank slope (steeper than 20°) and related to river erosion.  
|   |   | c. Middle part of steep manmade embankment, including filled slope (steeper than 20°). | Thick (more than 2 m) and loose deposit of soils produced by initial movement. |
|   | b. Rock Flow |   |   | • Such deposits can be romoved by heavy or long sustained rainfall that cause in earth, rock or debris flow. The flow may exceed 500 m to several kilo metres.  
|   |   |   | • Results in many deaths, and bury several to many houses (in central java it can bury 35 houses in instant).  
|   | c. Debris Flow | Mix of soils and rocks (thick and loose) deposited by initial |   | • Small flow of slurry or mud normally to be the symptom that
movement. larger flow will start.

Figure 1. Schematic of Socio-Bio- Engineering Approach for rain-induced landslide management.
Figure 3. Schematic model of slope hydrodynamic and slope stability simulation (Wilkinson et al, 2003)
Flooded and Drought Mitigation.
Community Best Disaster Management
Wat louang village Pakse District Champasak Province Lao P.D.R
P.o. Box : 830
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E-mail : Bounheng_Amphavanh@wvi.org

1. Outline of Champasak province.
   Location: Champasak Province, which borders Cambodia to the south and Thailand to the west. Geographic features dominate the province: the east is dominated by the Bolovens Plateau, an important coffee-producing highland area, while the west is dominated by the Mekong River, which borders Thailand in the north of the province before cutting inland. The Mekong floodplain spreads over two thirds of the province. Steep mountains rise up from the plain to the west of the Mekong, along the border with Thailand. Champasak Province, along with Khammouane and Savannakhet Provinces to the north are perennially the most flood prone provinces in Lao PDR.

Champasak District lies within Champasak Province and is located about 35 km south of the provincial capital Pakse. The district is located in the strip of land between the Mekong and the Thai border, covers 800 sq km and is home to over 53,250 people. Although some minority groups are present, the majority of the district population are lowland Lao, and depend almost exclusively on rice cultivation. Every few years the eastern half of the district is inundated with very destructive flooding along the Mekong as water levels break the emergency line of 12 meters (the major cause of flooded is heavy rain).

The western half of the district is just beyond the Mekong's normal flood range and is bordered by mountains in the north and east. Here, short periods of drought and flash flooding take an even higher toll on both the lives and the livelihoods of the people. Although the Khamuan River (and its 13 intermittent tributaries) flows through this area, it becomes very dry in between the months of January and April and is subject to flash flooding at other times as the heavy precipitation in the mountain areas drops down into the Mekong Valley.

Champasak map
Flooding is an important and normal part of life in Champasak. However, as environmental conditions, demographic and livelihood patterns have changed, the destructive effects of large floods has increased, although the frequency of floods has not changed much over 40 years.

The western part of Champasak District is typical of midland areas throughout Lao PDR’s Mekong valley, which also cycle through short periods of drought and flash floods nearly every year. These areas are not close enough to the Mekong to regularly benefit from annual inundations for rice cultivation. Instead they depend on rainfall which must occur frequently during the planting season to sustain rice yields. Also, these midlands have frequent flash floods. Precipitation in the mountains is normally twice the average rainfall in the valley. This creates numerous and dangerous flash floods along intermittent streams and rivers dropping off the mountain areas to the Mekong valley.

A new approach is needed whereby the people of Champasak District learn to live with and mitigate the effects of flooding while at the same time maximizing the benefits that annual flooding brings. Livelihood patterns, misguided development, world view and inadequate response mechanisms are the cause of disasters when risks, like flooding, outstrip the capacity of the community to cope. The flooding may not be controllable, but the way the community co-exists with the risk can be adapted.
Champasak province serious flooded over 12 m.

3. How to sold the problem.
The project has approach the flooding problem at two levels:
- The first is to developed a community based early warning mechanism through a process that also increases the awareness of the community of both new and traditional ways of coping with the risks while benefiting from the flooding. This requires both technical studies as well as participatory social and historical surveys to understand the specific impact of various levels of flooding on the lives of people. These processes also identify which traditional coping mechanisms are working or may no longer be valid, as well as introduce new approaches.
- The second approach is to deal with the drought- and flood-induced food security problems in the poorest areas of the district. This include efforts to mitigate the effects of flash flooding and drought through the construction of catchment weirs and diversification of agricultural practices into those more appropriate to the geography and disaster risk.

4. Major Objectives and activities.
The project was enable the peoples of Champasak District to better cope with the perennial hazards of drought and floods on their lives and livelihoods. The project has promoted community based and environmentally sensitive approaches to disaster risk management based on proven methodologies used in Lao PDR as well as other South East Asia countries.
* Develop and promote environmentally and socially appropriate early warning systems and community awareness of disaster risks and response options.
* Promote agricultural production practices that are more appropriate to the local environment and improved food security at the family and village level.

5-Activities was done.
1: Early warning and response capacity enhanced.
- Train and support a Meteorology Counterpart at the District Level. Flood forecasting requires good data at the local level combined with coordination at the central level. This activity was enable the DOM to function within the district and ensure regular contact with the official sources of Mekong River information and National disaster management office.
  - Trained for villages volunteer to daily recording and data collection of the Rainfall and river water level (mainly in rainy season) the weather forecasts were given through TV station and Radio station on a daily basis.
  - Established villages VDPU and trained them in CBDM.
- Complete flood and drought capacity and vulnerability mapping. This activity review technical and historical data on flooding and droughts in relation to traditional livelihood, land use and demographic data. At one meter increments - beginning with one meter below the
emergency level of 12 meters - maps will be created which outline inundation areas and identify the types and amount of damage normally caused.

( Hazard mapping of village )

- Community based early warning mechanism and social coping practices identified using PLA and technical resources. Through “Participative Learning and Appraisal” approaches villagers, identify how flood and drought impacts life from a village and family perspective as well as what traditional coping methods are the most effective.

PLA data collection at village

- District and sub-district “Rural Development Committees” trained in community based disaster management theory and practice. The non-traditional approach of community based disaster management was required the support and understanding of district and sub-district leaders. The project has provided training to all levels of the district’s RDCs and solicit their input in finalizing the early warning and response.

District and Sub district trained in CBDM
- **District level awareness campaign on disaster risks and early warning systems completed.**

An ongoing awareness campaign is needed to introduce the new early warning systems and promote appropriate coping responses. This was included the preparation of posters, teaching material and training for schools.

School trained in CBDM

“**Community Based First Aid**” Red Cross volunteers trained and equipped in each village.

The Red-Gross volunteer was established in the villages level
- Trained them in first aid and provided the equipment as well.

Trained Red-Gross volunteer of village
2. **System of small scale flash flood catchment weirs constructed.** Nongtae, is the poorest sub-district of Champasak largely due to the high dependency of rain fed rice cultivation in an area which often cycles from weeks of drought to flash floods a couple times per year. This Output aims to build catchment weirs to mitigate flash flooding and store water for periods of drought. In addition to mitigating the effects of drought and flash floods on rice cultivation, the weirs also support crop diversification and complement existing project initiatives in animal husbandry and fish farming.

![Weir constructed for villages in drought zone](image1)

Weir constructed for villages in drought zone

- **Establish, train and support a village based planning and oversight committee for the construction and water resource management of each weir.** The catchment weirs was constructed with community participation of villages, to ensured of weir management we have set up the weirs management committee and water user groups in each villages and trained them in technique of weirs management and land used planning.

3. **Diversified and flood / drought resilient agricultural practices established.** This Output was promoted more cultivation of legumes, both as primary and secondary crops, as well as fruit trees. The types of produce selected for promotion had to meet all of four criteria. First soil type, water resources and land topography needed to be ideal for the crop (that included flood and drought zone).

![Promoted dry season crops after flooded](image2)

Promoted dry season crops after flooded

- **Farmers Associations trained and supported in fruit tree cultivation through the Provincial Agriculture extension services.** Once a fruit tree reaches productive maturity in 3 to 5 years it is much more flood and drought resilient than rice crops. Also, harvests occur many different times a year depending on the fruit. Tamarind, pomelo, oranges and mangoes …was cultivated in flood and drought zone.

To provided seedling of fruit trees to farmers
Public Awareness in Primary School
(Developing Primary School Curriculum by integrating on Disaster Preparedness).
Prepared By: Bouasy Thammasack, Information Assistant, NDMO Lao PDR

Lao PDR, Known as a landlocked country, situated in the central of South East Asia, sharing borders with China 416 km to the North, and Myanmar 130 km to the Northwest, Vietnam to the East 1,957 km, Cambodia to the South 490 km, and Thailand to the West 1,730 km that largely follow the Mekong River with a total land area cover by forest. Lao PDR is classified as one of the least developed country in the World, In Laos climate Phenomenon is dominated a country seasons, for Lao people they are acknowledge only two seasons: Rainy (or wet) and Drought (or dry).

Lao PDR also has heavy rainfall, tropical storm, and typhoons originating in the Chinese sea. It’s vulnerable to a wide variety of natural hazards: flood, flash flood, storm, drought....and man made: accident, fire, Epidemic, Social conflict, pollution, drug protection....So it is indeed needed to do major role from very sector of the Govt, I-NGOs, Private Organizations, and Others else....from the Social, Economic and Environmental aspects of disaster what the local Government in Lao PDR can do is the main perspective of this assignment.

Disaster management organization in Lao PDR
- Prime Minister's Office (PMO).
- National Disaster Management Committee (NDMC)
- Ministry Focal Points (MFP)
- National Disaster Management Office (NDMO)
- Ministry Focal Points in Unit (FPU)
- Provincial Disaster Management Committee (PDMC)
- Provincial Focal Points in Unit (PFPU)
- District Disaster Management Committee (DDMC)
- District Focal Points in Unit (DFPU)
- Village Disaster Protection Unit (VDPU)
National Disaster Management Office (NDMO) received official status by the Prime Minister of Lao PDR in 1997. It acts as the secretariat for the Lao National Disaster Management Committee (NDMC). The committee is chaired by the Minister of Labour and Social Welfare, NDMO is also under of Ministry of Labour and Social Welfare and is responsible for disaster preparedness and management and acts as the national centre to coordinate disaster management in Lao PDR.

Responsibility of NDMO

- Responsible for disaster preparedness and management as a center of coordination in national disaster management.
- Study and plan policies on disaster management then process to Lao Government.
- Research and collect data and statistic on disaster victims and make requests for assistance.
- Mobilization from individuals, organizations, internal and external in kinds and money for disaster management.
- Public awareness about disaster in order to prevent disaster hazards and incidence that may occur. Consider to put disaster management, environment and natural conservation into school curriculums.
- Direct relief operation, disaster preparedness, response and rehabilitation by using government budget and the contribution of concerned agencies, International organizations and non-governmental organization. Regularly report to the government.
- Coordinate and enhance provincial governors to establish provincial and district disaster management committee. Improve capacity of this matter.

The Best practice in Lao PDR,

Public Awareness in Primary School

Based on responsibility of NDMO, The Director of The NDMO decided to use the small budget to develop and test ‘Additional training materials’ for disaster risk management for primary school children. This had been announced as a government priority in a decree three years previously by there had never been money available to pursue the initiative. The DRP CLV money provided an opportunity to conduct a trial, and develop materials. which if successful could be proposed for inclusion in national curriculum.

Thus This case carried out under the Disaster Reduction Program for Cambodia, Lao PDR and Vietnam (DRP-CLV) implement by Asian Disaster Preparedness Center (ADPC) Bangkok, with DANIDA funding and in collaboration with the National Disaster Management Office (NDMO and the Ministry of Education (MoE), Lao PDR.

The activity for Lao project was selected basic upon discussion between Director of NDMO-Laos and Representative from ADPC in following month.
ADPC respected NDMO decision to start drafting additional teaching material (ATM) for primary schools with context of DM and aimed for future adopting as curriculum for grades 3, 4 and 5.

**Objective of project of Lao PDR**

The project aims to strengthen institutional capacities of national disaster management systems in the area of public awareness through educating schoolchildren from Grade 3-5 in the themes of public safety, environment protection, health and sanitation.

In the implementation of project DRP CLV September 2002 to April 2003, NDMO sought the assistance of the Ministry of Education (MoE) to develop educational curriculum and teaching materials for grade 3-5 focusing on public safety, environmental protection, health and sanitation.

The MoE was doing pioneering work in the integration of disaster risk reduction in its primary school curriculum from grades 3-5. It had developed supplementary curriculum on road safety, population education, HIV Aids and Drugs prevention.

The concerted effort of the two organizations can contribute enormously in changing children’s behavior towards risks and in promoting the culture of safety in Lao PDR.

**Project Activities**

Large number of experts had been invited to First Partnership Meeting, They were curriculum developers, school principals and senior teachers, experts from agriculture, health, environment, fire brigades, traffic police all together selected topics and discussed on main contents, working procedure and time schedule to carry out activities.

It was agreed to work on 8 topics: flood, drought, human disease, fire accident, traffic accident, social conflict, pollution and HIV. Many good questions had been asked and numbers of value comments and advises had made. Seven topic drafted by curriculum developers (National Research Institute for Educational Science, MoE).

The training expert of NDMO was assigned to the curriculum development team (drafted on topic “drought”) to enable her to develop generic skills that could be used for a wide range of NDMO training curriculum on disaster management.

NDMO conducted training courses on Disaster Management for Curriculum developer, School directors and teachers. Those that participated found them useful. Although they had basic knowledge of hazards, this greatly enhanced their understanding of mitigation and preparedness measures, which the believe to extremely important.
Time for drafting materials planned for 3 months and one month needed for test in schools.

As National Research Institute for Educational Science (NRIES) developers were not specified on topic. An Editorial meeting organized at the NDMO office to comment on drafted materials. Final versions of ATM had been revised and duplicated in 300 copies. An orientation course for school’s teachers organized twice.

Before brought ATM to schools, a pre-test pupils understanding of disasters had been made by forwarded questionnaires drafted by curricular developers to children. They were very interested answering on quires.

ATM had been tested into three schools such: Nhapa, Hongkha, and Phonsaath School (not in eight as planned) due to time budget limited and the need for the curriculum developers and teacher to be able to meet regularly, the project should concentrate on 3 schools in Vientiane.

Improved Disaster Risk communication Strategies and Materials Aimed at Reducing Community level Disaster Risks

- The pilot project has been successful in communicating the importance of including the disaster management in national curriculum. This is an important step in the NDMO’s longer term strategy of communicating disaster risk through formal education.

- DRP CLV has facilitated the production of improved training materials and teachers guidelines for teaching in primary school that have stimulated children’s interest to learn about disaster management and teachers’ desires to teach. There is already evidence that 225 children between the ages 8-13, living in Vientiane, have increased awareness of disaster management issue. They were able to demonstrate some understanding and recall of causes, effects and methods to reduce risks of road accidents, social conflict, fire, flood and pollution. There is some evidence of them trying to encourage their families to change behaviour that would reduce community level disaster risk.

Learning from project: Laos is the first country in region working on integrated DM concepts into primary school curricular with emphasized on awareness for children from early ages.
All topics are very suited for different locations, event: country sides or cities. Up to singer school will choose which topic to teach in that school.

Special attention had paid on building strong coordination and collaboration among partners in all levels on implementing project.

Involving professional curriculum developers on producing ATM granted suitable contents of materials for benefit children as target group and could help to ease on officially adopting ATM as curricular.

Project activities, while implementing, involved big number of stakeholders and benefit target groups, which were not expected from starting. Project had strong participation of women; number of curricular developers and almost all school’s teachers involved are women.

As mentioned by Mr. Robin- ADPC consultant, Laos is the first country in region provided effort to integrate DM concept into school curriculum.

Looked back on implementation process, We have acknowledged that; some issues had not been considered from beginning; they are timeframe needed for developing of curriculum, schedule for testing ATM in the school for not disturbing school’s teaching program itself, an understanding of disaster problems and DM concepts of professional developers. But all risky issues had been ignored by strong will and optimistic vision of all partners and stakeholders.

ATM came out with an acceptable quality and it will be very practical and suitable tool for several projects on disaster management and development event in urban or rural areas.

The link had been made from DRP-LVC to Lao Urban Disaster Management Program. This project used 2 material topics on fire prevention and traffic accident reduction for public education campaign in 8 schools, resulted nearly 300 school’s children had aware, 35 school’s teachers passed orientation course. ATM came out with an acceptable quality and it will be very practical and suitable tool for several projects on disaster management and development event in urban or rural areas. This could then be extended to secondary and tertiary education. The Director felt ownership of the process and noted the fact that the need for international consultants was minimal.
1. Introduction

The most severe climatic related natural disasters in Malaysia are monsoonal floods and flash floods. By virtue of its geographical location, Malaysia is directly influenced by the Asian Monsoon which receives abundant rainfall mainly from the Southwest and Northeast Monsoons. The Southwest Monsoon which prevails during the later half of May or early June to September brings less intense rainfall. The Northeast Monsoon which prevails during the months of November to March brings heavy rains to the east coast states of the Peninsula, northern part of Sabah and southern part of Sarawak. The average rainfall is estimated to be around 2,500 mm for Peninsular Malaysia, 2,600 mm for Sabah and 3,800 mm for Sarawak. Such abundant rainfall causes monsoonal and flash floods and Malaysia experiences several floods in 1926, 1931, 1947, 1954, 1957, 1963, 1965, 1967, 1969, 1971, 1973, 1983, 1988, 1993, 1998 and 2001. These floods are common hydrological phenomena in Malaysia and on average affecting 29,000 sq. km or 9% of total land area, more than 4.82 million people (22%) and an annual damage of RM915 Million. The flood prone areas are shown in Figure 1.

Besides widespread flooding caused by monsoonal rain, a more localised flooding which covers a large area has been reported in recent years. The most recent is the flood of October 2-6, 2003 that affected a large area in the northwestern part of the Peninsula covering three states namely Kedah, Penang and Northern Perak (Figure 2). According to the report by the Malaysian Meteorological Service the heavy rain episode of this flood is due to the southward progression of the monsoon trough with an embedded quasi-stationary low-pressure centre over northern Peninsula, effectively setting up the Inter-Tropical Convergence Zone (ITCZ) over the area. On recurrence interval scale this flood is estimated to occur once in 200 years. About 25,000 flood victims had to be evacuated to the relief centres and more than 10,000 hectares of paddy plantation were destroyed by the flood. This flood resulted in three casualties.
2. Flood Mitigation Policy and Strategy

There no practical means to control and eliminate floods altogether as they are one of the natural disasters. However, it has been recognized that both structural and non-structural measures are available for reducing the extent and impact of flooding. Structural measures always seek to regulate the flood flow and reduce the flood magnitude while the non-structural measures such as land conservation tries to regulate man's activities in a river in order to minimize the impact of flooding. Other non-structural measure which has been accepted as an
An indispensable measure is the adoption of flood forecasting and warning system in order to reduce the effect of flooding on loss of human lives and property. With this in mind, the policy guidelines for implementing flood mitigation measures will include:

2.1. Implementation of structural flood mitigation where appropriate and feasible in terms of engineering and socio-economic aspects
2.2. Implementation of complementary non-structural measures to enhance the effectiveness of structural measures where necessary
2.3. Where there is no feasible or no effective engineering solution for a flood problem, implementation of appropriate non-engineering measure should be carried out over a reasonable period of time
2.4. Continuation on strengthening the flood forecasting and warning systems in flood prone areas.

3. Flood Mitigation and Management

Flood mitigation and management programmes if they are carried out in a well-structured and planned manner will result in minimizing the effect of flood considerably. More emphasis is given to curative measures of mitigating flood in how best losses to lives and property can be minimised. The government has painstakingly carried out various programmes as curative measures. These programmes include flood forecasting and warning, evacuation and relief measures, food, clothing and medical supplies and inter-agency coordination. The shift in paradigm began when the government carried out a detailed National Water Resources Study in 1982 which gives amongst others recommendations on structural and non-structural measures of flood mitigation and management. Subsequently detailed design and construction of many flood mitigation projects comprising canalization of rivers, raising river embankments, multi-purpose dams etc. are realized. The financial involvement of such projects is evidenced by the increase in Malaysia's five yearly development allocation for which account for RM700 million (1991-1995), RM940 (1996-2000) and RM1.6 billion (2001-2005). Such escalating expenditures require the need for the Government to be more proactive in finding the ways and means to address the flood problem in a holistic manner. As structural measures cannot combat or curtail the flood completely Malaysia needs to adopt sound watershed development and management system. The Malaysia Government Machinery allows the Economic Planning Unit, Prime Minister’s Department to coordinate all aspect of planning, design and implementation of water resources in the country.

3.1 Flood Disaster Relief and Preparedness Machinery

After the disastrous flood of 1971, the National Disasters and Relief Committee was formed. This Committee is now headed by the Deputy Prime Minister and its secretariat, the National Security Council is at the Prime Minister's Department. This committee which normally meets at least once a year prior to Northeast Monsoon season is responsible for planning, coordinating and supervising the relief operations during flood. Most members of this committee are governmental departments/agencies and social organization which could provide shelter, rescue, food and medical supplies. Having the nationwide State Security Committee, the
police, the armed forces, the civil defense, the social and welfare department and various voluntary organisations, the task of rescuing and evacuations of flood victims to predetermined relief centres could be organized and carried out effectively. Figure 3 exemplifies the typical flood disaster relief Control Machinery in administrating any flood disaster with the objective of minimizing flood loss.

3.2 Flood Forecasting and Warning System

It was also realized that non-structural measures such as improved flood forecasting and warning system could reduce loss of lives and property. The Department of Irrigation and Drainage Malaysia (DID) is responsible in providing flood forecasting and warning service to the public. As the infrastructure for flood forecasting and warning systems, a network of rainfall and water level telemetric stations has been installed in 38 river basins. To date a total of 233 telemetric rainfall stations and 190 telemetric water level stations have been established. In addition 256 manual stick gauges have been installed at strategic locations to monitor river levels to supplement the telemetric water level stations. To enable the public in flood prone areas to know of the impending flood and its extent in terms of inundation flood depth, a total of 84 flood warning boards have been installed to date. By knowing the water level information of an upstream water level station which is usually broadcasted via radio and television or announced by the police authority, the public can then decide by themselves as to whether to move to safer places. In areas where flash floods are frequent and forecasting systems cannot be provided, a warning system using flood sirens has been

![Figure 3: Flood Disaster Relief Control Machinery](image-url)
established. A total of 217 flood sirens have been installed and they are triggered when river levels reach critical levels.

Real-time flood forecasting and warning systems have been established in nine river basins prone to flooding using a simpler model such as stage-correlation technique to a more complex mathematical model such as Linear Transfer Model. For example, the Kelantan River basin uses Sugawara’s Tank Model as shown in Figure 4 to forecast flood levels of the Kelantan River at the Guillemard Bridge during the Northeast Monsoon. In carrying out flood forecasting routines DID gets its source of hydrological data from its network of telemetric rainfall and water level stations in the Kelantan River basin. These data are processed and checked and become input to the computer-based flood forecasting model and the forecasts are relayed to the control centre of the respective states as shown in Figure 5.

Figure 4 : Sugawara’s Tank Model Configuration for Kelantan River Basin
In the last few years flood disaster management worldwide has benefited from tremendous development that has taken place in ICT. Using ICT as the driving force DID has established an internet-based National Flood Monitoring System known as Infobanjir which can be assessed at the website www.infobanjir.moa.my. Such a centralised system as shown in Figure 6 allows collecting and displaying of rainfall and water level data be displayed for the whole country irrespective of the types of telemetric systems used by the states DID. This has been achieved through the agreements and installation of an e-mailer program at master servers using a common data format by the various vendors of the telemetric systems.
Figure 6: Internet Based On-line Infobanjir System

As an effort to improve the disaster information management technology using the state-of-the-art technology in flood forecasting, the Malaysian Government has been working closely with the Canadian Government to implement a monsoon flood monitoring system known as GEOREX Monsoon Flood System for the Kelantan River Basin. This system integrates the use of remote sensing, hydrological model and geographical information system (GIS). Maps of forecasted flood extent will be produced based on the SSARR model that combines rainfall and river levels measured at different locations in the river basin during the monsoon periods and the extent of floods as observed by the fine resolution RADARSAT imageries. This system allows us to see the geographical extent of floods, hydrological model that predicts river flow and corresponding stage (Figure 7). When such information is merged with a geo-referenced database containing demographic data and transportation infrastructure, a better understanding of the flood situation will be realized and could assist the government in timely setting priorities in its mitigation and relief operation. Since the system will be tested in the forthcoming monsoon season in the state of Kelantan, evaluation criteria on its operational ability and human resources competency and development have not been carried out.
3.3 Urban Stormwater Management

Flash floods are becoming very common phenomena in Malaysia especially in urban areas arising from very intense thunderstorms which are active during the periods of March to June and September to November. Due to its flashy nature very little advance warning can be provided for the flash flood in the affected areas. Such flood generally causes damages to properties, occasional loss of lives and frequently disrupt traffic flow particularly in Kuala Lumpur City.

Under the Asian Development Bank’s programme a flood forecasting and warning system known as Flood Watch as outlined in Figure 8 has been developed. Flood Watch is a decision support system combining an advanced time series databases with MIKE 11 hydrodynamic modelling and forecasting system and Arc View GIS. With such integration a powerful forecasting and warning tool has been established. The system output is an updated graphical display of in Arc View of most recent flood information. In addition, forecasts can be produced as graphs of measured and forecasts water levels and discharges which can be printed as bulletins or saved in HTML format for display on the Internet or Intranet.
An important counter measure in preventing occurrences of flooding in urban areas is the recent introduction of the Urban Stormwater Management Manual for Malaysia (MSMA) to be followed closely by the local authorities in approving drainage systems in the development of new residential and commercial areas. The 20 volume manual replaces the older manual by incorporating best practices of control measures of stormwater at sources such as runoff quantity and quality controls. The philosophy of this manual is that stormwater should not be regarded as a nuisance that needs to be disposed rapidly but a resource that could be utilised. In essence the stormwater management hierarchy of MSMA is shown in Figure 8.

Figure 8: Outline of Kuala Lumpur Flood Watch System

- Retain (and restore if degraded) valuable feature of stormwater system
- Manage the quantity and quality of stormwater at or near its source
- Install facilities for runoff quality and quantity control
4. Conclusion

Flood problems will continue to pose a challenge to the Government in her pursuit to plan and implement various curative and preventive measures in dealing with flood disasters. By coupling experiences in dealing with the flood problems throughout the years and adopting state-of-the-art technology in ICT, mitigation and management of flood disaster can be carried out efficiently and effectively.

A sustainable way of mitigating and managing flood disaster is of course the implementation of an integrated river basin management. To this end, the Government is working hard to ensure river basins are managed in a holistic manner using this approach. As an initial effort the National Rivers Blue Print Study will be conducted soon. The objective of this study is to formulate policy framework, strategies, targets and action plans for a holistic, integrated and sustainable management of rivers in the country. One of its realistic targets that has been set to conform is in the development programme of flood damage reduction.
MALAYSIA

ASIAN INTERNATIONAL CONFERENCE ON TOTAL DISASTER RISK MANAGEMENT (TDRM)

2ND – 4TH, DECEMBER, 2003, KOBE, JAPAN

COUNTRY REPORT ON COLLABORATION AMONG STAKEHOLDERS FOR HIGHLANDS CONSERVATION AND MANAGEMENT FOR SUSTAINABLE DEVELOPMENT
INTRODUCTION

1. Highlands are environmentally sensitive areas. The fragmented administrative and management of highlands resources pose difficulties for holistic and integrated decision making. Given that many highlands in Malaysia straddle over two or more states, managing them as single entities would lead towards holistic solutions. Many districts have common boundaries in the highlands, making it necessary to plan and manage highlands as integral and physical planning units. As such, the strategy and recommendations presented in the Country Report are to improve inter-agency and inter-stakeholder collaboration on environmental management, development planning and biodiversity conservation of the highlands, so as to ensure sustainable economic development.

2. THE RECOMMENDATION OF BEST PRACTICES FOR COLLABORATION AMONG STAKEHOLDERS

2.1. Local Residents should be educated on environmental conservation.

   2.1.1. Local Residents need to be educated on environmental conservation and the importance of sustainable development in the highlands. The Local residents as key stakeholders should be encouraged to gain further knowledge and detailed understanding of environmental issues. This process would help lead to a change of perception and attitudes towards environmental conservation and sustainable development in the highlands. Local residents should also be expected to acquire skills in identifying, preventing and resolving environmental problems. The extent of civic consciousness should be greatly enhanced in the highlands.

2.2. Government decision-makers, officers and administrators should be educated on environmental conservation.

   2.2.1 Government decision makers, officers and administrators should be educated on environmental conservation and management in order to integrate environment concerns into the decision making and policy making process. Environmental education would include awareness rising on highlands issues. The Local Authorities are a prime candidate for environmental education, since they are frontline agencies involved in day-to-day operations. Administrative training programmes should include environmental education modules to raise awareness.
2.3. **Environmental awareness and capacity among all stakeholders shall be increased.**

2.3.1. Environmental education should be promoted and intensified to enable and encourage all stakeholders to participate in the sustainable development of the highlands. The first step in environmental education is raising awareness. Then stakeholders would be encouraged to gain further knowledge and understanding of environmental issues and of each stakeholder's role in overcoming the problems. This would lead to a change of perception and attitudes towards environmental conservation and sustainable development, which should then motivate people to actively participate in and continue towards sustainable development. Individuals and communities should also acquire skills for identifying, preventing and solving environmental problems.

2.4. **The emphasis on environmental education in the schools in the highlands should be increased.**

2.4.1 The Ministry of Education should increase the emphasis on environmental education in the schools in the highlands in order to raise environmental awareness and educate students on the importance of environmental conservation right from a young age. The Ministry of Education should continue its partnership work with non-governmental organisations to incorporate environmental education module into the formal education curriculum. Nature education centres in the highlands should be utilized to expose students to environmental issues unique to the highlands. Teachers and trainers will also need to be trained to teach the environmental subjects and use the teaching aids developed for the purpose. Some NGOs are presently involved in conducting environment education modules for students and in training teachers to include environmental awareness elements in the school curriculum.

2.5. **A systematic slope maintenance programme should be undertaken with emphasis on early detection and prevention of slope instability problems.**

2.5.1 Based on the regular inspection and monitoring slopes, government agencies and private property owners and occupants should formulate and implement slope maintenance programmes to carry out preventive maintenance of slopes. This is especially important for slopes which pose risk to the public, such as slopes along main
roads and slopes adjacent to densely populated areas. It is recommended that the Local Authorities, and Public Works Department (PWD) undertake a systematic slope maintenance programmes that include:

(i). establishment of a database of slopes characteristics.
(ii). identification and mapping of critical slopes.
(iii). regular inspection of all slopes.
(iv). establishment of a physical monitoring programme of all critical slopes.
(v). a system to disseminate information on slopes to relevant stakeholders including the local community.

2.6. Occupants and property owners should be educated on ways to monitor slopes within their property.

2.6.1 The Local Authorities should educate occupants and property owners on the importance of regularly monitoring slopes within their properties. Example may be drawn from Hong Kong, where Civil Engineering Department of the Local Government provides information to the public on ways to inspect slopes and walls within private property. Property owners should be given guides on early detection of potential slope problems and how to recognise the warning signs of potential slope failure. The public will then be able to assist the authorities in monitoring slopes on a wider scale. The public can be further motivated for being informed on the catastrophe that could befall them should any major slope failure occurs. The Public Works Department could assist by providing technical advice to the Local Authorities.

2.7. An annual essay competition focusing on the highlands should be organised.

2.7.1. It is recommended that a nationwide essay competition focusing on ‘Sustainable Development in the Malaysian Highlands” be organised by The Ministry of Science, Technology and the Environment. The aim of such an essay competition, which should be divided into appropriate categories, would be for further knowledge, awareness and interest among the Malaysian public, including school children, in sustainable development.

2.8. The role and function of the Nature Education Centres in the Highlands should be enhanced.
2.8.1. The education centres run by the government departments and NGOs should be made to function as a place of information dissemination and environment awareness for the local community, with an emphasis on targeting students and farmers who reside in the highlands. In addition, the education centre should be promoted as a stopover for local and foreign tourists. Exhibits on the ecology and natural attractions of the highlands should be set up and open for public viewing. The education centre should be a place for visitors to learn about environmental issues through various exhibition units, literature, audio-visual, posters and displays. Nature trail guides and brochures should also be made available to tourists as reference materials and souvenirs.

2.9. The participation of the aborigines (Orang Asli) in all phases of economic development must be encouraged.

2.9.1. The aborigines should be given sufficient opportunities to be involved in future development, especially those close to their settlement. The opportunities could be in the form of employment opportunities, local product development, entrepreneurship and management of their cultural heritage. The Departments concerned should ensure that there will be efforts to establish, where appropriate, arrangements to strengthen the participation of the Orang Asli as stakeholders in the formulation of national policies and programmes relating to resource management.
CONCLUSION

3. There is at present, no overarching policy or strategy with regard to the land use in highland areas, often resulting in haphazard and ecologically insensitive development. Therefore, strategies for the optimal sustainable utilization of the highlands and the resources are essential to guide the development plans for the Main Range as well as the highlands in the rest of the country. In this context, the current situation in Malaysia with regard to highland conservation, has presented the critical need for a holistic and integrated approach to disaster reduction, mitigation and preparedness, which focuses on collaboration among all stakeholders. This would enable a much better basis for the conservation and management of the highlands environment for sustainable development.
BACKGROUND

The Philippine Archipelago, consisting of over seven thousand (7,000) islands and home to over 80.2 million Filipinos is located in the western rim of the Pacific Ocean. It is a most active part of the earth that is characterized by an ocean-encircling belt of active volcanoes and earthquake generators or fault lines. (Refer to Figure 1.)

Figure 1. Pacific Ring of Fire

The country is situated along two major tectonic plates of the world namely, the pacific plates and the Eurasian plates, hence, earthquakes occur everyday, close to 4 however, most of these are not felt as they occur tens of kilometers underground. There are 220 volcanoes, out of which 22 are potentially active. (Refer to Figure 2.)
The country is also in the so-called typhoon belt where tropical depressions and typhoons develop and pass through. Every year close to twenty (20) typhoons with about five (5) destructive ones occur. Natural events such as earthquakes, volcanic eruption, flooding, landslides, fire incidents are experienced by the people. Likewise, complex emergencies, which are form of man-made emergency wherein the cause and assistance are complicated by political issues and peace and order situation also occur.

When the abovementioned events, whether natural or man-made, occur where twenty percent (20%) of the population are affected and in need of emergency assistance, bringing about loss of lives and property and causing disruption in its social structure or at least forty percent (40%) of the means of livelihood, and epidemic, then the event is considered a disaster. This now becomes the business of the National Disaster Coordinating Council (NDCC).
Presidential Decree 1566 was passed in June 11, 1978 in order to strengthen the Philippine disaster control capability and establish the national program on community disaster preparedness. The NDCC was then constituted to perform the following functions:

1.0 to serve as the highest policy making, coordinating and supervising body at the national level for disaster management in the country;

2.0 to advise the President on the status of the national disaster preparedness and management plans; and

3.0 to recommend to the President the declaration of state of calamity and the release of the national calamity fund.

The Secretary of National Defense heads the NDCC with the head of eighteen (18) department/agencies as members. The following are the members of the council:

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<tr>
<th>Position</th>
<th>Department/Administration</th>
<th>Role</th>
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<tbody>
<tr>
<td>Secretary, Department of National Defense</td>
<td>Chairman</td>
<td>Secretary</td>
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<tr>
<td>Secretary, Department of Public Works and Highways</td>
<td>Member</td>
<td>Member</td>
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<tr>
<td>Secretary, Department of Transportation and Communications</td>
<td>Member</td>
<td>Member</td>
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<tr>
<td>Secretary, Department of Social Welfare and Development</td>
<td>Member</td>
<td>Member</td>
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<tr>
<td>Secretary, Department of Agriculture</td>
<td>Member</td>
<td>Member</td>
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<td>Secretary, Department of Education</td>
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<td>Secretary, Department of Finance</td>
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<td>Secretary, Department of Labor and Employment</td>
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<td>Secretary, Department of Justice</td>
<td>Member</td>
<td>Member</td>
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<tr>
<td>Secretary, Department of Trade and Industry</td>
<td>Member</td>
<td>Member</td>
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<tr>
<td>Secretary, Department of the Interior and Local Government</td>
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<td>Secretary, Department of Health</td>
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<td>Secretary, Department of Environment and Natural Resources</td>
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<td>Secretary, Department of Budget and Management</td>
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<td>Secretary, Office of the Press Secretary</td>
<td>Member</td>
<td>Member</td>
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<td>Executive Secretary</td>
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<td>Member</td>
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<tr>
<td>Chief of Staff, Armed Forces of the Philippines</td>
<td>Member</td>
<td>Member</td>
</tr>
<tr>
<td>Secretary-General, Philippine National Red Cross</td>
<td>Member</td>
<td>Member</td>
</tr>
<tr>
<td>Administrator, Office of Civil Defense</td>
<td>Member and Exec. Officer</td>
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The Office of Civil Defense (OCD) serves as the secretariat and operating arm and its facilities and services are utilized by the council. At the regional level, the Regional Disaster Coordinating Council (RDCC) coordinates the activities of the national government agencies in the administrative region. The Philippine National Police (PNP) Regional Director has been designated as the RDCC Chairman. The RDCC, like the NDCC, does not have a budget of its own, and operates only through its member-agencies under the principle of coordination, complementation of resources and participation.

At the local government level, the Chief Executives are, by law, the Chairmen of their respective councils. The Governor is the Chairman of the Provincial Disaster Coordinating Council (PDDC), the City Mayor becomes the Chairman of the City Disaster Coordinating Council (CDCC), the Municipal Mayor heads the Municipal Disaster Coordinating Council (MDCC) while the Punong Barangay heads the Barangay Disaster Coordinating Council (BDCC).
FUNDING FOR DISASTERS

The sources of funding for disasters are the lump-sum amount included annually in the General Appropriations Act and the local government calamity fund equivalent to five percent (5%) of the estimated income from regular sources. Other than these, included in the budget of department and agencies, by their mandates, are amounts regularly appropriated annually to cover activities related to disaster preparedness, mitigation, and rehabilitation such as the concreting and completion of unfinished roads and bridges; rehabilitation and replacement of damaged/deteriorated infrastructures under the Department of Public Works and Highways (DPWH). Under the regular budget of the Department of Social Welfare and Development (DSWD), some amounts are allocated for assistance to victims of disasters and natural calamities to include the handling and hauling of commodity donations. Also, under the Department of National Defense (DND), there is an amount annually provided to cover civil military operation of the Armed Forces of the Philippines (AFP). The DPWH, DSWD, DND, and the local government units (LGUs) are, among others, the main recipients of the calamity fund.

Pursuant to Section 32 of the General Provisions of the FY 2003 General Appropriations Act, except for the Office of Civil Defense (OCD), the Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA) and Philippine Institute of Volcanology and Seismology (PHILVOCS) whose basic concerns are disaster prevention, mitigation and preparedness projects, all concerned departments, bureaus, offices and agencies are authorized to use their appropriation to implement projects designed to address their disaster prevention, mitigation and preparedness concerns pursuant to P.D. No. 1566.

NATIONAL CALAMITY FUND

The annual lump-sum appropriation in the General Appropriations Act shall be used for aid, relief and rehabilitation services to communities/areas affected by man-made and natural calamities, and repair and reconstruction of permanent structures, including other capital expenditures for disaster operation, and rehabilitation activities.

Under the Special Provisions of the FY 2003 General Appropriations Act, the said appropriation may be made available for relief, rehabilitation, reconstruction and other works or services in connection with calamities which may occur during the budget year or those that occurred in prior year; and pre-disaster activities such as acquisition of supplies, rescue equipment and training of personnel engaged in direct disaster management.

Releases from the fund are made directly to the appropriate implementing departments/agencies, government owned and controlled corporations and/or local government units in accordance with the recommendation of the National Disaster Coordinating Council (NDCC) and upon approval of the President of the Philippines.

In order to respond immediately to an emergency or disaster, twenty five (25%) of the amount appropriated for aid, relief and rehabilitation services to communities/areas affected by calamities, including of training of personnel, and other pre-disaster services is released to lead agencies such as the DSWD and twenty percent (20%) to the OCD as Quick Response Fund (QRF). This is used exclusively as a stand-by fund to be utilized in connection with calamities occurring during the year and intended primarily to grant relief and rehabilitation to the
calamity-affected communities/areas and to normalize as quickly as possible the situation and living conditions of the people in such communities/areas. Of the amount appropriated for repair and reconstruction of permanent structures, twenty percent (20%) shall be immediately released to the DPWH and fifteen percent (15%) to the DND as QRF.

The QRF is distributed as follows:

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<th>Dept. Agency</th>
<th>MOOE</th>
<th>CO</th>
<th>TOTAL</th>
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<tr>
<td>DSWD</td>
<td>350,000,000</td>
<td></td>
<td>350,000,000</td>
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<tr>
<td>OCD</td>
<td>350,000,000</td>
<td></td>
<td>350,000,000</td>
</tr>
<tr>
<td>DPWH</td>
<td>25,000,000</td>
<td>325,000,000</td>
<td>350,000,000</td>
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<tr>
<td>DND</td>
<td>25,000,000</td>
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**LOCAL CALAMITY FUND**

Under the local government code, the calamity fund is one of the budgetary requirements prescribed therein. The annual lump-sum equivalent to five percent (5%) of the estimated income derived from regular sources shall be set aside for the relief, rehabilitation, reconstruction and other works or services in connection with calamities which may occur during the budget year. Provided, however, the fund shall be used only in the area, or a portion thereof, of the local government unit or other areas affected by a disaster or calamity, as determined and declared by the local legislative body concerned. Calamity is defined as a state of extreme distress or misfortune, produced by some adverse circumstance or any event of great misfortune or cause or loss or misery caused by natural forces.

The use of the local calamity fund was further expanded by virtue of the Joint Memorandum Circular No. 2003-1 dated March 20, 2003 issued by the Department of Budget and Management (DBM) in coordination with the Department of the Interior and Local Government (DILG). In the said circular, the appropriation for the local calamity fund may be validly used for relief, rehabilitation, reconstruction and other works or services in connection with man-made disasters resulting from unlawful acts of insurgents, terrorists and other criminals as well as for disaster preparedness and other pre-disaster activities. It shall include the following:

1.0 medical assistance, death and funeral benefits to the victims, their dependents and immediate families, including victims who are overseas Filipino workers (OFW);

2.0 financial assistance and other services for medical, rescue and relief workers who have been tasked to attend to the victims; and

3.0 preparation of relocation site/facilities, disaster preparedness training and other pre-disaster activities.

In extreme cases and under extra-ordinary circumstances, such as but not limited to, acts of terrorism and the outbreak of dangerous and highly communicable diseases, the calamity fund may be used for disaster preparedness without the need for a local legislative body resolution, provided there is a Presidential proclamation to the existence of an adverse event.

For first class LGUs, referring to those belonging to the high income bracket, such as cities and municipalities, the 5% percent of the estimated income from regular sources would mean some
P150 Million and for the lower class LGUs, it would mean P5.0 Million.

OTHER SOURCES, FUNDS BUILT-IN DEPARTMENTS/AGENCIES BUDGET

Other than the lump-sum amount allocated as calamity fund, there are amounts that are included in budget of departments and agencies for regular programs/projects/activities which arise from the mandate of the agencies and which are related to disaster preparedness and mitigation.

Like in the past years, for CY 2002, some P48.7 million is appropriated under DSWD for assistance to victims of disasters and natural calamities including the handling and hauling of commodity donations.

In the DPWH, some P6.04 billion is allocated for the construction, maintenance, repair and rehabilitation of infrastructure facilities such as roads, bridges, flood control, water supply, irrigation, school buildings, other public buildings and equipment including the replacement of parts, regional depot/base shops and area shops.

In the budget of the DND, about P214.5 million is provided for civil military operations of the Armed Forces of the Philippines.

Under the PAGASA, some P222.9 Million is appropriated for climate data management; installation, repair of telemetering multiplex for flood forecasting and warning covering Agno, Pampanga, Bicol and Cagayan River basin; weather and flood forecasting; observation and acquisition of data; research and atmospheric, geophysical and allied sciences; and training activities.

In the budget of the PHILVOCS, about P41.5 million is devoted to scientific and technical documentation and information dissemination and for the research and development of volcanology and seismology and disaster mitigation.

PROCEDURE IN THE RELEASE OF FUND

National Government Agencies (NGAs), Local Government Units (LGUs) and Government Owned and/or Controlled Corporations (GOCCs) submit their requests to the National Disaster Coordinating Council (NDCC) for financial assistance chargeable against the Calamity Fund.

The NDCC acts as the clearing house for all the requests for funding by evaluating the same and recommending to the Office of the President (OP) the release of funds.

The OP approves the release of funds and forwards to DBM the directive for processing of the release documents.

The DBM, on the basis of the OP directive, prepares the release documents namely, the Special Allotment Release Order (SARO) and the corresponding Notice of Cash Allocation (NCA) for the release of funds.

The implementing agencies execute the programs and projects. Financial and physical accomplishment reports are submitted by the implementing agencies to the NDCC and DBM.

Figure 3. Cycle of the Disaster Management
Mitigation refers to the measures aimed at minimizing the impact of a natural or man-made disaster on a nation or community in terms of casualties and damages. It also refers to measures designed to prevent natural phenomena from causing or resulting to disasters or other related emergency situations. In our country, mitigation and prevention of disasters are carried out through the conduct of surveys of unsafe buildings for demolition and regular inspection of public and private infrastructures for their safe occupancy. In the locality, officials encourage strict compliance to structural soundness of all forms of construction under the National Building Code, taking into consideration land, use, zoning and soil condition. Strict compliance with the Fire Safety Code by all establishments is also required.

Preparedness, on the other hand, refers to pre-disaster actions and measures being undertaken to avert or minimize loss of lives and properties, such as, but not limited to, community organizing, training, planning, equipping, stockpiling, hazard mapping and public information and education initiatives.

Preparedness activities include the conduct of hazard vulnerability analysis and risk assessment; continuing coordination with the community, local and regional levels to include resources inventory, emergency response capability and disaster base mapping; organize, train and equip disaster control groups in the various levels and sectors; and coordinate regular drills and exercises in schools, hospitals, malls and other public buildings.

Rehabilitation refers to the process by which the affected communities/areas receive financial or immediate basic provisions, in terms of food, shelter, clothing, medicines, etc and temporary restoration of structures in place of those damaged and devastated. In the Philippines, this is spearheaded by the DSWD, DPWH and the DND Engineering Brigade. Other agencies such as the Department of Health (DOH), Philippine National Red Cross (PNRC), Department of Education and other non-government organizations (NGOs) likewise contribute services and works to expedite the rehabilitation of the affected communities.
Response refers to inter-agency concerted efforts, whether public or private, to provide emergency assistance or relief to persons who are victims of disasters or calamities, and in the restoration of essential public activities and facilities. Consequence Management is the core activity under this phase.

Case: Mt. Pinatubo Eruption

To cite one application of disaster management, we would like to bring to focus the response and rehabilitation undertaken in connection with the eruption of Mt. Pinatubo, Zambales in 1991.

The eruption is considered the biggest in the world for the last eighty (80) years. Nine (9) billion cubic meters of volcanic materials expelled 3 billion cubic meters dispersed as ashfall 6 billion cubic meters deposited on the mountainside, came down as lahar from 1992 onward.

REHABILITATION
Due to the vast destruction, particularly in Region II which is considered the rice granary, the lump sum fund alone was not enough to provide the necessary relief and rehabilitation. Hence, to immediately respond to the eruption of Mt. Pinatubo, a Task Force Mt. Pinatubo, which was an inter-agency body was constituted under Republic Act No.7637, entitled, “An Act Appropriating the Sum of Ten Billion Pesos for the Aid, Relief, Resettlement, Rehabilitation and Livelihood Services as Well as Infrastructure Support for the Victims of the Eruption of Mt. Pinatubo, Creating the Mt. Pinatubo Assistance, Resettlement and Development Commission, and for Other Purposes”

The Philippine Government saw the need to assist the victims in the communities damaged or destroyed by the eruption and to extend to them relief, resettlement, rehabilitation and livelihood services to restore their lives to its normal level or actual condition at the earliest possible time. Hence, a long term rehabilitation plan was established.

The objectives of the law are:

- to help the victims of the eruption of Mt. Pinatubo and its after effects;
- to provide additional funds for the immediate relief of the victims;
- to establish resettlement centers, homesites and townsites for displaced families;
- to provide livelihood and employment opportunities;
- to repair, reconstruct or replace government infrastructure damaged or destroyed by said disaster whenever economically, socially and technically advisable; and
- to construct new infrastructure facilities needed by the community.

Pursuant to said law, the national government appropriated the total amount of P10.0 Billion which were to be released in a span of three (3) years from CY 1993 to CY 1995. The fund was to be utilized for various infrastructure projects, resettlement and livelihood programs, social services, etc.

To administer the disbursement of the above-cited amount, the law created a commission called the “Mt. Pinatubo Assistance, Resettlement and Development Commission” The term of the commission will be six (6) years or up to October 19, 1998 which was later extended for another three (3) years or up to the year 2000 through Proclamation Order No. 1201 to complete critical tasks on the rehabilitation, security and welfare of Mt. Pinatubo victims as well as to ensure its programs and activities to concerned agencies.

The commission was composed of various government officials from the cabinet, government corporations, local government units in the surrounding area, and the private sector. The commission was responsible for policy-making, planning, fund administration and monitoring of projects undertaken using the P10 Billion.

The major activities of the Mt. Pinatubo Commission are as follows:

- Completion of permanent resettlement sites to make room for prospective victims in existing evacuation centers;
- Relocation of evacuees to completed housing units; and
- Construction/rehabilitation of bunkhouses and support facilities in existing evacuation centers.

After the termination of the commission on December 31, 2000, it was reported that the P10.0 Billion was utilized for the following programs: Infrastructure, P5.0 Billion; Resettlement,
P2.912 Billion; Livelihood, P1.170 Billion; Social Services, P715.558 Million; Others, P201.397 Million.

In the area of livelihood for the displaced families, the national government has initiated various programs on areas such as, employment generation; micro and small and medium enterprise (SME) development; and marketing and investment promotion.

In terms of housing, the Philippine government established twenty (26) fully developed and serviced Resettlement Centers populated by about 250,000 lahar victims in the Pinatubo affected provinces and resettled 54,000 families evacuated to government evacuation centers.
EXECUTIVE SUMMARY

This paper is divided into 2 sections. Section 1 describes the disaster response system in a city-state, Singapore and Section 2 shares the recent experience in managing the Severely Acute Respiratory Syndrome (SARS) crisis and steps taken to eliminate the threat and preventive measures put in place to prevent future outbreak.

BACKGROUND

Singapore, a City State

Singapore is a small city-state with a population of about 4 million people, 80% of whom live in high-rise buildings. Geographically, Singapore is located just outside the ‘Pacific Rim of Fire’ and is thus spared from the ravages and destruction caused by natural phenomena such as earthquakes and volcanic eruptions. However, being highly urbanized Singapore’s main challenges are localised man-made and technology-based disasters. Examples of past major incidents are the collapse of a 6 storey Hotel New World in 1986 and oil refinery fire in Pulau Merlimau involving 3 storage tanks in 1988.

2. More recently the SARS crisis that occurred in Singapore and the world is one of the most major incidents that Singapore has encountered in recent years. This topic will be further discussed in section 2 of this paper.

SECTION I: DISASTER RESPONSE SYSTEM

Singapore’s Lead Agency for Disaster Response – The Singapore Civil Defence Force (SCDF)

3. In Singapore, the lead agency for disaster response is the Singapore Civil Defence Force (SCDF). The SCDF operates on a 3-tier command structure, consisting of HQ SCDF commanding four territorial Civil Defence Divisions (CDD). The CDDs command 14 fire stations, which provides the resources for incident management on the ground. In addition to this, SCDF also operates 2 training institutions, namely the Basic Rescue Training Centre and the Civil Defence Academy (CDA).
4. In the event of any major disaster, the SCDF will activate the national response plan code-named the Operations Civil Emergency (Ops CE) Plan, which outlines the work of SCDF and all the Related Agencies (RAs)\(^7\) in the management of an incident. The types of incidents for which this plan will be activated are as follows:
   a. Oil refinery fires and major industrial accident and explosions.
   b. Mass Rapid Transit\(^8\) (MRT) incidents, involving underground and overhead trains and cableways.
   c. Chemical related incidents involving HazMat.
   d. Maritime incidents in the port area.
   e. Air crash incidents, both in populated areas and airport areas.
   f. High rise fire incidents.
   g. Building collapse incidents.

5. Under this plan SCDF as the Incident Manager is overall in charge of the multi-agency response from the onset of a civil emergency. The IM directs and co-ordinates all the agencies ground response forces through the Joint Planning Staff (JPS - representatives from all agencies) who support him with specialist advice for planning and mitigation of the incident.

6. In addition, the Executive Group (EG) headed by the Permanent Secretary (Home Affairs) and other Permanent Secretaries and Chief Executive Officers of key government ministries and statutory boards is activated when needed. The role of EG is to provide policy guidance to the IM.

7. This national plan is exercised with various scenarios highlighted above regularly on an annual basis to ensure that all agencies involved are familiar with their roles and functions and develop capabilities for incident management.

### Provision of rescue and fire-fighting coverage

8. Singapore is small yet modern and effective. With just 14 fire stations over a landmass of 660 square kilometers and serving a population of about 4 million, 1 fire station covers 47 square kilometers and serves about 286 thousand people. These 14 fire stations form our frontline operational service delivery elements for fire fighting, rescue, HazMat and ambulance response services. Out of the 14 fire Stations 4 are HazMat Specialist Stations. Upon receipt of a distress call, response teams from the nearest fire station will be dispatched to reach most parts of the island within 8 minutes. Thus there were some operational gaps beyond the 8 minutes response zones.

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\(^7\) There are altogether 18 Related Agencies (RAs) from various ministries and statutory boards that provide ground forces for incident management, specialist advice for planning and coordination with IM on issues or plans to manage a disaster.

\(^8\) Mass Rapid Transit (MRT) is Singapore’s equivalent of a subway train system that covers the whole of Singapore.
9. The traditional solution to address this problem will be to build more fire stations to meet the operational requirements. Based on past experience it takes about 3 to 4 years to complete a fire station project and the costs are very high. However, the greatest hurdle was the dynamic shift in traffic conditions, population density and urban developments. Hence, building more fire stations may not solve the problem.

10. Thus, SCDF introduced the Satellite Fire Post (SFP) concept, for fire fighting and emergency response, as part of a nation wide review to enhance its operational service delivery. The main function of the SFPs is to bridge the operational gaps around Singapore to enable faster response to incident sites whenever incidents occur. The SFPs unlike Fire Stations were built into existing buildings and/or infrastructure. The advantage of these SFPs is that it can be relocated quickly and at a low cost when the need arises (only 5% of the cost of a typical fire station). To date, SCDF has established 15 fire posts within the community heartlands/residential districts. This has brought our services to the doorsteps of the population.

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### Manpower

11. SCDF has a workforce of about 5,100 people of whom 1,700 are regular uniformed staff, 200 civilian staff and 3,200 Full-time National Servicemen\(^9\). In addition, another 10,000 Operationally Ready National Servicemen\(^{10}\) (ORNSmen) from the reserve service are available for call up during emergencies upon activation. These ORNSmen can be called up quickly through the open mobilisation system, using the public radio and television networks.

### Training and Readiness

12. In line with SCDF’s motto of “Readiness is our only Protection”, SCDF ensures that response personnel are geared up for any disaster response. In maintaining this preparedness, regular training is conducted for the personnel at the Civil Defence Academy (CDA). CDA is a purpose-built training academy costing almost $100m, equipped with a wide range of training facilities. CDA is dedicated towards equipping not only SCDF officers but also the local, regional and international community with the knowledge, skills and values to protect and save lives and property. Courses such as fire-fighting and rescue techniques and Urban Search and Rescue (USAR) were organised at CDA for more than 300 foreign trainees from 22 countries.

### Response to International Disasters

13. SCDF has strengthened international ties as a member the International Search and Rescue Advisory Group (INSARAG). As an active member of INSARAG we co-hosted the INSARAG exercise 2002 together with United Nations Office for

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\(^9\) Full-time National Servicemen are Singaporean males who are 18 years and are called to enlist and serve between 2 to 2 and a half years of National Service, either in the military, police or civil defence.

\(^{10}\) Operationally Ready National Servicemen are Singaporean males who have completed their full-time national service and are operationally ready to respond to any emergency situation. They will then be placed in the reserve list until the age of 40 and will be regularly recalled every year for in-camp training.
the Coordination of Humanitarian Affairs (UN OCHA) and the recent United Nations Disaster Assessment & Coordination (UNDAC) Asia Refresher Course was held between 3 - 10 Nov 2003 at CDA. The course is the first of its kind in Asia with 32 representatives from 19 countries participating. Singapore will also be the host for the coming INSARAG meeting in 2004.

14. Singapore also has a response plan for International disasters. Under this plan, SCDF has a rotating Overseas Rescue Contingent on standby at all times, ready at 2 hours’ notice to render assistance. The Overseas Rescue Contingent was deployed in several incidents around the region, such as the Baguio City earthquake in Philippines (1990), the Kuala Lumpur condominium (12-storey block) collapse in Malaysia (1993) and the Taiwan earthquake (1999).

CONCLUSION

15. Singapore’s primary responsibilities for disaster management have evolved over time in response to the changing needs of Singapore, the regional and international communities. Singapore’s disaster management capabilities will continue to remain relevant and effective in the face of changing threats, risks and the global environment.

SECTION 2: MANAGING THE SARS CRISIS

Background

16. Singapore was taken off the World Health Organization’s (WHO) list of SARS affected areas on 31 May 03. Since mid Jul 03, Singapore has progressively stepped down the SARS control measures in line with the improvement in the global and local SARS situation. However, an isolated SARS case occurred in Sep 03 due to a non-compliance in lab procedure. The possibility of a resurgence of SARS in the coming Northern Hemisphere’s winter is a serious one. To maintain a high level of preparedness for a recurrence of SARS, the Ministry of Health (MOH) in Singapore has reviewed lessons learnt and implemented measures to strengthen our ability to detect new cases early to prevent a SARS outbreak and to respond effectively to contain new clusters.

<table>
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<tr>
<th>SARS Response Framework</th>
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Framework

17. A SARS response framework is in place to provide a clear command structure for decision making. At the Operations level, the Ministry of Health Operations Group (MOH Ops Group) the operational arm of MOH is responsible for the planning, crisis management, co-ordination of health services and operations during peacetime. It commands and controls all the medical resources during a crisis and serves as the main operational linkage between MOH and all healthcare providers. It also prevents and controls major communicable disease outbreaks including bio-terrorism events. (Refer to Slide). It is the nerve centre for all
decision-making and early warning capabilities. With links to related agencies, the Group has two principal capabilities:

a. Surveillance Capabilities
   (1) Early Warning;
   (2) Trend Analysis;
   (3) Medical Situation/Threat Assessment;
   (4) Communal Diseases Policy and Recommendations; and
   (5) Response Measures and Recommendations.

b. Response Capabilities
   (1) Co-ordinating/Control Operations e.g. Decant/Evacuation,
       Decontamination, Civil Emergency etc.;
   (2) Medical Response such as to prevent, diagnose, treat, vaccinate, as well as hospital & healthcare ops;
   (3) Field Response: Disaster Site Medical Command (DSMC) and Forward Response Teams (FRT) for on-site medical support and ground assessment and to assist the Incident Manager;
   (4) Liaison with relevant agencies (Hospital, Health Care Institutions and Cross-border, Ministry of Home Affairs (MHA), Ministry of Defence (MINDEF));
   (5) Contact Tracing and Quarantine Enforcement (with SCDF & CISCO);
   (6) Information Management i.e. Media Liaison, Advisories, Feedback and on-site capability; and
   (7) Forward Planning and preparation for new outbreaks/ incidents.

18. The Operations Group will report further up the management command chain. At the apex is the SARS Ministerial Committee (MC) chaired by the Minister for Home Affairs, which provides policy guidance and strategic decisions. Next in line are a few select Permanent Secretaries who will lead the Crisis Management Groups. Each of these groups will have distinct roles and responsibilities for the operational and tactical actions for the combat of SARS. They will report to the Executive Group of SARS chaired by the Permanent Secretary of Home Affairs.

| Colour-Coding and Definition |

19. Singapore has in place a 3-level response system to correspond with the existing level of local transmission and severity of threat to public health. It will serve as a platform for coordinating the response measures for the various government agencies.

20. The definition of the colour-coded alert status, known as SARS Condition (SARSCON) is as follows:
   a. **YELLOW**: No cases or sporadic imported cases but with no local transmissions.
b. **ORANGE**: Local transmissions confined to close contacts in healthcare settings or households.

c. **RED**: Outbreak in the community. Local transmissions are no longer confined to close contacts in healthcare settings or households.

21. This SARSCon status correlates with the colour-coded alert status adopted by the hospitals.

### 3-Prong Strategy

22. A 3-prong strategy is adopted to combat the spread of SARS: prevention, detection and effective response and is explained below:

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<tr>
<th>1st Prong – Prevention of SARS Outbreak</th>
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23. At the national level, the campaign against SARS is ongoing. Several preventive measures have been set up.

   a. The public is educated to adopt a healthy lifestyle so as to build body resistance, to have good personal hygiene, and to visit the doctor should they feel unwell;

   b. A high level of vigilance is ensured in healthcare institutions, regular checks of hospitals, specialty centres, and residential step-down facilities, are carried out;

   c. At SARSCon YELLOW, infection controls at healthcare settings are stepped up. In high risk areas such as hospitals’ Accident & Emergency Departments, isolation facilities and Intensive Care Units (ICU). Healthcare workers handling febrile patients are required to put on N95 masks, disposable gloves and gown. This requirement is the same for isolation rooms in nursing homes;

   d. As for primary healthcare clinics, masks and gloves are required when handling patients with fever and during triage. To minimise the risk of spreading to the community, currently each inpatient is limited to only 2 visitors, out of a registered list of 4; and

   e. Healthcare workers and those travelling to cold countries are encouraged to receive influenza vaccination ahead of the northern winter. Mandatory influenza vaccination is given to long-staying patients in nursing homes. Aside from improving public health, this would also help to limit the confusion arising from flu symptoms similar to those of SARS.

24. To prevent import of SARS cases into Singapore, various measures to safeguard the land, sea and air borders are in place. Temperature screening is conducted for in-bound travellers at the checkpoints. Febrile travellers are further assessed and may be referred to hospital for further management. The single isolated case of SARS resulting from lax control in a research laboratory underscores the need to ensure the safety measures in laboratories are strictly enforced. Follow-up actions to the recommendations of the expert panel are currently ongoing.
2nd Prong – Detection of SARS Cases

Establish External Linkages

25. Singapore continues to strengthen the linkages with international health organisations and other health authorities, and has enhanced the external surveillance for SARS and other infectious disease outbreaks.

Medical Surveillance System

26. For patients who come down with SARS at the hospitals, the strategy is to detect them early, isolate them from others to prevent the spread of the disease, and contain the disease by protecting the health care workers who are caring for them. A revised surveillance system for SARS was implemented in public and private acute hospitals, nursing homes, chronic sick hospitals, community hospitals and hospices since Aug 03. This system comprises surveillance and investigations into inpatients with atypical pneumonia, unexplained fevers for more than 72 hrs with relevant travel history, sudden unexplained deaths with acute respiratory symptoms, and fever among healthcare staff and inpatients in hospitals.

Capturing of Infectious Disease Alert and Clinical Database

27. A new IT infrastructure is being rolled out to support the surveillance and management of SARS and other infectious diseases. Known as the Infectious Disease Alert and Clinical Database, the system allows online interface between MOH and the public hospitals for timely and accurate collation of epidemiological findings, clinical data as well as laboratory results. This will facilitate swift decision-making at the Ministry and hospital level.

3rd Prong – Effective Response

Graduated Operations Response System

28. To ensure an effective response system, all the agencies have put in place their own contingency plans. Exercises and audits are also carried out to ensure a high level of preparedness going into the Northern Hemisphere’s winter months. During SARSCON YELLOW, the medical ops response system comprising surveillance and operations control staff will manage the key functions of the system. Depending on the SARSCON level and threat assessment, additional manpower resources from within MOH would be called in to meet the requirement. Likewise, various Crisis Management Groups under the direction of the MC and EG may be called upon to mount a national level response.

Quick Containing the Spread of SARS

29. In the last SARS outbreak in Singapore in Mar to May 03, healthcare workers and close family contacts formed the two major groupings of SARS cases. Research also suggested that early isolation of cases would drastically cut down the
number of secondary transmissions. Hence the critical factor in containing an outbreak is the early detection and isolation of the infected patient, and the generation of a complete list of close contacts who are then put on home quarantine. Extra cautions are applied to immuno-compromised patients who tend to have atypical presentations of the disease.

Importance of Hospital Containment Strategies

30. To contain a SARS outbreak in Singapore, we have used three separate hospital containment strategies successfully and these are:
   a. Hospital closure;
   b. Ring fencing and transfer of an exposed group to a designated SARS hospital;
   and
   c. Management in place of an exposed cohort.

31. Supporting this containment strategy are the restrictions of movement of healthcare workers and patients, and the close monitoring of discharged patients from SARS affected wards. In this way, the intra-hospital transmission of SARS is contained and the risk of the virus transmitting to their family and community is minimised. Since the last outbreak, all hospitals have either built up or developed contingency plans for additional isolation rooms. At the national level, a new isolation centre, Communicable Disease Centre 2, with 39 isolation beds and 18 ICU beds has been built beside Tan Tock Seng Hospital (TTSH). TTSH/CDC2 has been nominated as the SARS hospital to isolate and contain an outbreak when the situation requires.

Implementation of Contact Tracing System

32. A system for contact tracing has been put in place, through the establishment of a contact-tracing centre within the Ministry of Health. The contact-tracing centre undertakes all community contact tracing and coordinate and assists in the contact tracing efforts undertaken by the hospitals and government bodies. It also informs foreign governments on the movement out of Singapore of their nationals who are possible close contacts. In SARS CON ORANGE, minimum skeletal staff man the Contact Tracing Centre, but contingency plans are in place to call in at short notice trained contact tracers from within MOH and other ministries to augment the contact tracing centre. The objective is to be able to complete the contact tracing of all identified cases within 24 hours.

Enforcement of Quarantine System

33. The Ministry centrally manages all matters related to the conduct of quarantine operations which encompasses the issue and enforcement of Home
Quarantine Orders (HQOs) (which was issued by CISCO and SCDF), phone surveillance, ambulance services, HQO allowances, appeal board and alternate housing facilities for those on home quarantine. The HQO is a measure to minimise the risk of the spread of SARS to the community. Persons on HQO are well and therefore not infectious. They are however at risk of becoming ill with SARS due to prior close contact with a SARS patient. Close monitoring of those on HQO for early signs of SARS, including twice-daily temperature taking to be carried out by officers designated by MOH. If they develop a fever, an ambulance will be sent immediately to fetch them to TTSH/CDC2 for a medical evaluation and for treatment if necessary. This will break the chain of transmission and control the spread of SARS.

Leverage on IT

34. The SARS IT infrastructure is intended to provide the MOH and other agencies with the ability to access integrated information to all SARS cases in Singapore in a timely fashion. For medical surveillance, there is the Infectious Disease Alert and Clinical Database System which integrates critical clinical, laboratory and contact tracing information on SARS. In addition, the Health Check System allows health-care professionals in hospitals and clinics to identify patients

35. It also provides customized advisories for precautionary measures as well as follow-up actions to be taken. For contact tracing and quarantine operations, the Contact Tracing System is in place to capture SARS cases, contact history and HQO status. This in turn allows speedier generation of the HQO report, contact listings, and listings for external agencies automatically. An e-Quarantine Management System (eQMS) has also been developed for the better management of processing and enforcement of HQO by CISCO, the executive agent for HQO. The eQMS also facilitate the data exchange between MOH and CISCO.

CONCLUSION

36. We are glad to share some of these lessons learnt in the SARS outbreak in order to safeguard our country and our neighbours and the region. The strategy of prevention, early detection and effective response has worked for us. It has contained and eventually eradicated SARS during the last outbreak. By maintaining a high level of vigilance in the high-risk areas, and a high level of preparedness to step up all the containment measures, we are ready to meet any possible SARS resurgence. This model can be judiciously applied in the future to any other infectious disease outbreak and response.

37. It is necessary for Singapore to have in place the capabilities to respond to incidents in our urban landscape. The sudden attack of SARS showed how Singapore managed to isolate and eventually eliminate the virus. Furthermore, Singapore through its research and experience has shared invaluable lesson learnt and information with the worldwide community. It is in this notion that with good management and use of information and response plans that Singapore remains our safe and secure best home.
Total Disaster Risk Management (TDRM): Best Practices
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