REPORT OF VISIT TO

BENGKULU EARTHQUAKE STRICKEN AREA

10 – 13 JUNE 2000

INDONESIAN URBAN DISASTER MITIGATION PROJECT
INSTITUTE FOR RESEARCH-INSTITUT TEKNOLOGI BANDUNG
ASIAN DISASTER PREPAREDNESS CENTER

VISIT REPORT TO
BENGKULU EARTHQUAKE STRIKEN AREA (4TH JUNE 2000)

BACKGROUND

On the 4th of June 2000, on 23:28 local time, the Bengkulu Province in Sumatra was shaken by a 7.3 Richter scale earthquake, with its epicenter 100 km south west of Bengkulu City, 33 km under the seabed of the Indian Ocean.

The Province of Bengkulu is located at the western coast of Sumatra on 2° 61' S - 5°31' S and 101° 01' E - 103° 46' E with 19,788.70 km^2 surface area, populated by about 1.5 million people. Its annual population growth in the last 7 years is about 3.85 %. The Province is divided into 4 districts, i.e. South Bengkulu, North Bengkulu (which includes also the nearby Enggano Island), Rejang-Lebong and Municipality of Bengkulu City. Population of Bengkulu City is approximately 300.000.
On the request of the ITB (Institute of Technology, in Bandung), the IUDMP coordinated and dispatched a 9 persons survey team to the disaster site. The team divided into two small teams, the first one (LP/LPM team) left on the 9th of June while the second one (IUDMP team) left on the 10th of June. Both teams stayed in Bengkulu until 13th of June. Both teams flew from Jakarta.

Fund for the visit comes from various sources, e.g. ITB (for the LP/LPM team), IUDMP CDMP support fund (IEC2) for the IUDMP team, and other source.

OBJECTIVE OF THE VISIT

The purpose of sending the team (at least the IUDMP team) is:

1. To learn how emergency response is put in place and how the coordination is established on the field

2. To give input to the local DM unit on emergency response issues based on IUDMP's work on the manual for earthquake emergency response. It is expected that this would be beneficial for both the local community and the IUDMP, because using the real case experience, the manual can be improved.

3. To collect information on the damages level of the critical facilities and lifeline infrastructure and its impact toward the community and how they respond to the situation. This will improve our understanding on the seismic vulnerability situation of Indonesian cities.

4. To establish contact with the local government and assess their needs in term of possible support and future collaboration from IUDMP/ ITB Disaster Mitigation Center for the implementation of mitigation measures during the recovery/reconstruction period.

SURVEY TEAM

The team members follow:

- IUDMP Team:
  - Dr. Krishna S. Pribadi (Coordinator, IUDMP)
  - Ir. Engkon K. Kertapati (Geologist from GRDC)
  - Dr. I Wayan Sengara (Geotechnique and Earthquake Mitigation Specialist, IUDMP)
  - Ir. Hamerdian Putra, MT. (Earthquake Mitigation Assistant, IUDMP)
  - Dr. Jodi Firmansyah (Earthquake Engineer from PAU-ITB, self funded)
  - Ir. Hendriyawan (Assistant Earthquake Engineer, self funded)
- LP/LPM Team:
  - Dr. Masyhur Irsyam (Geotehcnical Engineer)
  - Dr. Hamzah Latief (Geophysist and Tsunami Specialist)
  - Drs. Ronny Hendrawan (Geophysist and Sociologist)

COORDINATION ON SITE

Several local agencies were visited. On arrival, the team reported the visit to the SATKORLAK PB (Disaster Management Coordination Unit) of the Bengkulu Province and received by its secretary. The team was shortly briefed on the current situation of the disaster area.

Another coordination meeting was held at the KANWIL PU (Regional Office of the Department of Public Works). The Head of the Regional Office briefed the team on the extent of the physical damage of infrastructures, buildings and residential areas. KANWIL PU requested specifically help from the team to investigate the extent of the damage of several important government and public buildings and to recommend actions to be taken concerning those particular buildings.

The team also assisted meetings at SATKORLAK PB, in particular the one when the Coordinating Minister of Welfare and Poverty Alleviation as the Chairman of BAKORNAS PB briefed the SATKORLAK PB on the national government policy toward the disaster.

The team brought information materials prepared under the IUDMP (posters, leaflet and brochures on how build simple earthquake resistant non-engineered construction and how to protect oneself before and during an earthquake). The materials were distributed through the Regional Office of Public Works and some were distributed directly to the community. Later on the Ministry of Settlement and Regional Development requested to IUDMP more materials to be distributed in Bengkulu.

THE EARTHQUAKE

The earthquake was recorded by BMG (Bureau of Meteorology and Geophysic, Jakarta), besides the USGS, Harvard and ERI networks. Location of epicenter is approximately 4.73° S - 102° E at the depth of 33 km (BMG), and it was the biggest earthquake in 80 years recorded in the region. The seismic mechanism is reported as reverse fault (USGS) or strike-slip (ERI).

Figure 1 Location of Bengkulu earthquake epicenter

Strong aftershocks were still felt during the visit. Up to one week after the main shock, strong aftershocks were recorded quite often, some exceeding 6.0 Richter scale.
Basically the western part of Sumatra is located between two tectonic system, e.g. the Sumatran fault which is found inland along the island from Aceh to Lampung and the Mentawai fault which run parallel to Sumatran fault on the sea bed in the Indian Ocean. This fault is the location of the sub-duction zone at the place where the Indo-Australian plate and the Eurasian plate meet.

Historically Bengkulu is seismically very active. Several major earthquakes have been recorded since the 19-century (1833, 1871, 1902, 1914, 1933, 1938, and 1979) where intensity as high as MMI IX has been recorded. The 1933 earthquake was followed by a tsunami.

Fortunately, although the 4 June, 7.3 Richter scale earthquake epicenter is relatively shallow, it did not caused tsunami, thus the coastal zone along Bengkulu and the nearby Enggano island was saved from more severe devastation.

OBSERVATION

Visited Location

The team visited several locations where damages were reported, mostly in the City of Bengkulu (the provincial capital), and some places in the rural areas

outside of the city. The team visited among others the Bengkulu airport/aerodrome, Pulau Baai harbor, low income residential areas in the city of Bengkulu, road and bridges connecting Bengkulu City to Pulau Baai harbor and also the regional road connecting Bengkulu City to to the southern part of the province, Bengkulu thermal power plant and Bengkulu water treatment plant. The team visited also the following buildings:

- Office of Bengkulu Province Governor
- Office of Parliament of Bengkulu Province
- Regional Office of Department of Mining and Energy
- Main General Hospital M.Yunus
- Grand Mosque of Bengkulu
- Regional Office of Department of Education
- Other buildings such as banks, schools etc.

Affected Areas

The earthquake has affected all the districts in the province (South Bengkulu, North Bengkulu, Rejang-Lebong and the Bengkulu City), but damages were actually found in a sporadic manner in those areas. There were no large totally damaged areas in the affected areas.

Casualties

Up to 12 June, the earthquake has caused 90 loss of lives and severely injured 803 persons, while 1782 others were lightly injured.

Infrastructure and Lifelines Damage

- Airport

  Airport Padang Kemiling is the only air gate to the province., During the earthquake, the control tower and the terminal buildings have suffered some non structural damages, while the runway and apron are still intact. The airport is operated on VFR and on the 7th of June, it can be operated again and relief material and personnel can be transported by air.

- Harbor

  The Padang Baai Harbor suffered some damages on its jetty, but it can still operate. The only problem is in the main access road, where a major bridge connecting the access road to the City if Bengkulu has suffered major damage on its approaches, but it was soon restored to operation by the 7th of June by putting new embankment on its approaches. Relief material can be transported again from this port.

Figure 2 Damage at Pulau Baai harbor

- Road and Bridges

  Land transportation was disrupted slightly by damages in 56 location and damaged bridges (light and heavy) recorded in 17 bridges location, almost all have been operating normally when the visit was carried out.

Figure 3 Bridge near the Pulau Baai harbor after temporary rehabilitation

- Telecommunication

  Telecommunication network suffered only slightly when some telephone poles fell down, but within few days the telecommunication line has been fully reestablished.

- Power

  Power line has been reestablished within 3 days of the main shock. Some damages were observed at the power plant (shifted engine foundation).

Some distribution lines were cut off when a series of power line pole tumbled down (along the road to the Padang Baai harbour). During the visit, some parts of Bengkulu city were still under power outage for rehabilitation/maintenance purpose.

Figure 4 The generator No. 2 at PLTD Suko Merindu is under repair after the earthquake

- Piped Water

  Water supply system in the city suffered from damages in the powerhouse and chemical mixing building and some damages (about 1000 meters) of transmission and distribution lines including a 12 m pipe bridge. Two small sub-district water treatment plants (IKK Talang Alai and IKK Suka Raja in South Bengkulu district) suffered heavy damages. At the time of the team visit, piped water distribution in some places in Bengkulu City was not yet recovered.

Figure 5 Damaged powerhouse in water treatment plant in Bengkulu City

- Irrigation System

  Several damages have been induced to the irrigation system in the province. Damages were recorded in 22 locations, consisting of damages to dikes and embankment, channel linings, water regulating structures, bridges etc.

Figure 6 Example of irrigation system damage

Damage in Public Buildings and Facilities

- Schools

  Damages were recorded in 639 elementary/primary schools, 36 junior secondary schools and 36 senior secondary schools. Besides, 3 university level institutions were also recorded as damaged. Damage varies from total collapse, heavy damage and light damage. However, only a few cases were found to be totally collapsed, in particular public primary schools built with INPRES fund.

Figure 7 Damaged school in Bengkulu City

- Government Offices and Public Facilities

  324 government offices and public facility buildings were affected. However, most of the damages are of the non-structural types, and many buildings can be quickly used again after proper fixing. Some buildings would need structural retrofit before use again.

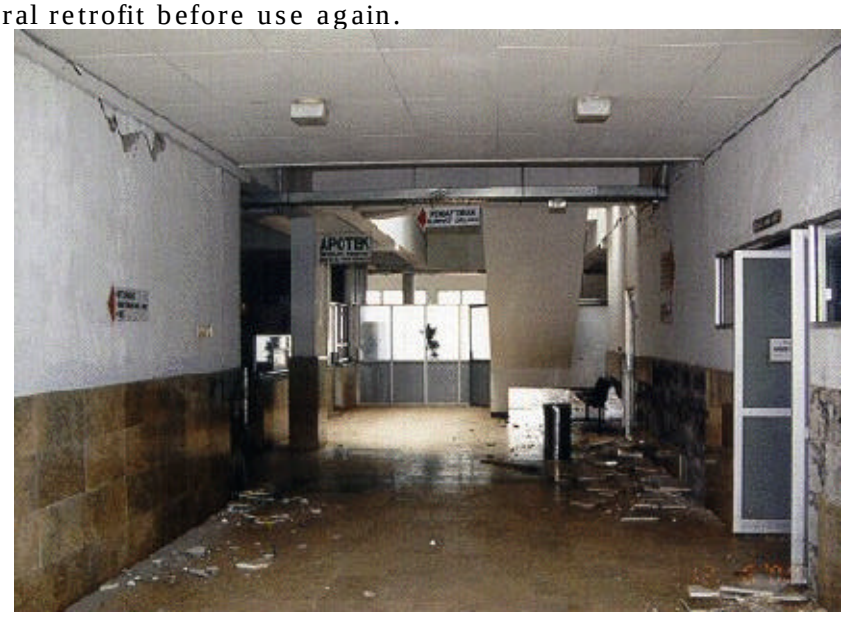

Figure 8 Damaged general hospital in Bengkulu City

- Mosques, Churches and Temples

  357 worshipping places were affected.

- Residential

  42,342 houses were reported as affected (1,386 total damage, 15,512 heavily damaged, 25,424 lightly damaged)

Figure 9 Example of residential damage in Bengkulu City

General Remark on Building Damage

From general observation, it can be seen that most of the collapsed or heavily damaged buildings and houses were the non-engineered, masonry constructions, with or without reinforced concrete frame, in particular those built by low-income community or low-cost housing. In most cases non-structural damages were observed (cracked walls, collapsed interior ceilings, falling roof tiles, falling fixed furniture and equipment etc.). Cases of structural damage mostly due to improper detailing in the reinforcement (beam and column connection), improper concreting and inadequate steel stirrup/reinforcement and also from soft story effect on first floor columns.

Some liquefaction phenomenons were also observed, causing building subsidence. In many cases, collapsed structures in low-cost residential areas were caused by inadequate foundation built on poor soil condition (improper fill over swamp area or solid waste dump area).

Surprisingly, in spite of the extraordinary magnitude of the main tremor, many government offices and public buildings survived the shock, suffering only from non-structural damages, which can be repaired quickly without demolishing the buildings.

In general, the engineered buildings proved to be performing well. In contrary, many non-engineered structured, in particular those belong to low-income people in urban and rural area, suffered heavy damages.

No fire incidence was reported during the disaster.

Emergency Response

An emergency operation center was set up and activated by the local (provincial level) SATKORLAK PB at the front yard of the Governor's office in the City of Bengkulu on the 5th of June, involving all vertical agencies and local departments.

Figure 10 Scene at Emergency Operation Center (POSKO) of SATKORLAK PB

Figure 11 Coordination meeting with national ministers in Emergency Operation Center (POSKO) of SATKORLAK PB

Quick Response Team from Jakarta was dispatched promptly for need assessment, followed by emergency relief aids such as medicine, foods and tents for temporary shelter. The badly damaged main General Hospital necessitated to evacuate its emergency unit to outside temporary shelters made from tents, set up on the hospital front yard. Search and rescue has been conducted by the local community and related organizations, NGO volunteers, Army and Police units. Medical teams from Singapore, Japan, Taiwan, MSF and medical volunteers from Jakarta have been seen on the spot in field operation giving medical care to disaster victims.

Unfortunately the expatriate medical teams were not ready for orthopedic surgery, since many casualties suffered injuries needing this kind of surgery (broken bones) and the local hospitals were overwhelmed by the number of patients. Only when surgery team from Jakarta, Palembang and Ujung Pandang came later this need was fulfilled.

Other helps come from Holland, Thailand, Switzerland, UNDAC/Geneva, Belgium and Australia.

The Public Works Department has mobilized emergency response team to clear landslide which blocked the main provincial road to the south of Bengkulu and restoring damaged bridge on the main harbor road by putting new embankments, constructing emergency sanitation in the damaged main hospital, assessing damaged buildings for re-occupation possibility and other emergency construction works.

Temporary shelters were set up by local neighborhood groups, using improvised materials. Field kitchens were set up also in the damaged neighborhoods to provide food for the homeless. Main problem comes from the delay in the distribution of aids (food, medication, tents) to the victims, due to the poor coordination and management of aid distribution.

Social Issues

Damaged sites were spread geographically over a large area in a sporadic manner in the province of Bengkulu. This situation prevents the fast distribution of help, aggravated by difficult communication system, resulting in delay for the goods to arrive to those in need. But the situation on site is much better than what is said in the mass media. There were tendencies to exaggerate and dramatize damage to an extreme level, to pull as much aid flow as possible.

One thing is certain, the disaster became the political battle ground for many politicians, who took the central government as being irresponsible for the disaster, which doesn't help much for the people who suffers.

In general emergency response has been classically slow as the SATKORLAK PB was not effective as they were not well prepared and did not know what to do. Worse is that they refuse to collaborate with local community groups like student volunteers and NGOs, in distributing the relief aid. No standard procedure seems to be in place for emergency response.

There were many strong aftershocks which traumatized the people and most of them choose to stay out of their house for long period. There were not enough authoritative information to tell the people what to do, and rumors became the only source of information for them. This has lead to the situation of uncertainty for a certain long period, which prevent people from taking action to recover their life back promptly. At the seventh day aftermath (during the visit), mental state of the local people was not improving. They were still very passive, waiting for others to come to help them with goods, very little effort for self help and recover.

Another problem related to social issue is the distribution of relief aids. Until the 8 days of the disaster, the community demanded that all the help goods (food, clothing, medicine) should be distributed uniformly to all household in the stricken area, based on the number of the habitant in a village, regardless of their situation. This situation resulted in ineffectiveness of the relief aids, as the homeless and the people who still have their houses receive the same amount of aid.

Figure 12 People demonstrating for relief aid distribution

As the country is still in a difficult political transition period, the government lacks the credibility and law and order is in the worst position. The people lacking of patience tend to short cut and use force to take over relief material on the way.

LESSONS LEARNED

Notwithstanding the high seismicity of the region, lack of public awareness to seismic risk contributed to most of the problem in the disaster stricken area. The public institutions, the people, the whole community seem to neglect the risk, leading to unpreparedness toward the disaster.

All lifelines have to be prepared to face against seismic risk, with enough redundancies (case of harbor access road). Low-income people have to learn how to construct their houses safely using local material, using low cost seismic resistant building technology.

The emergency response organization should be strengthened and given enough resources to develop their preparedness. They should be trained effectively to react in an emergency situation.

The local people should also be trained what to do to survive during an earthquake.

CONCLUSION AND RECOMMENDED ACTION

In retrospect, the objective of the visit mentioned in the beginning of this report has been achieved, at least partially, as activities related to objective No.2 were not carried out, local situation was not permitting. Contact with various organizations had been established and opportunity for future collaboration has been discussed.

Public awareness is the main issue in the Bengkulu disaster scene. The whole community has forgotten the lesson given by past disaster events in the region. A good mitigation strategy should involve a sound, sustainable, public awareness raising program.

The disaster in Bengkulu has opened a precious window of opportunity which should be used timely and properly to introduce preventive culture through a well designed, sustainable mitigation initiative.

It is recommended to initiate a mitigation approach through the following short and medium term actions, focusing on Bengkulu city and some other urban concentrations in the province:

- Assess properly (and quickly) the seismic risk of Bengkulu city and prepare hazard and vulnerability maps of the city.

- Conduct process to sensitize policy makers in the region toward the seismic risk.
- Develop earthquake mitigation strategy for the city and for the province.

- Develop an action plan for implementing mitigation program in a sustainable manner.
- Launch a public awareness program on the following issues:
  - Understanding earthquake risks in Bengkulu
  - How to avoid losses during earthquake by simple things to do at home, in the office, in business/work places
  - How to build simple low-cost earthquake resistance houses and other non-engineered construction (schools, mosques, church etc.)
  - What to do when there is an earthquake (duck and cover drill, evacuation
  - Etc.)

- Inspect and retrofit prioritized critical facility buildings: hospitals, police stations, fire stations, main airport facility, telecommunication switching center, water treatment plant, power plant, both for structural and non-structural elements.
- Strengthen the emergency management organization, procedure and personnel in the provincial and municipal level, which include also improving the performance of local emergency responders organizations (fire department, hospitals, Red Cross etc.)
- Include mitigation principle and practices in the future earthquake rehabilitation program.

Public awareness program should have multi-target audiences, which include

politicians and government officials, low-income population in the rural and urban area, school children, tradesmen, small and medium contractors etc.

It is expected that if the recommended actions are implemented, the window of opportunity provided by the disaster will have been utilized optimally.