

Earthquake Engineering Education Plan For Low Intensity Earthquake Region

Mohd Zamri Ramli¹, and Azlan Adnan²

¹Faculty of Civil Engineering,
Universiti Teknologi Malaysia,
81310 Skudai, Johor, Malaysia

²Faculty of Civil Engineering,
Universiti Teknologi Malaysia,
81310 Skudai, Johor, Malaysia

Abstract - Earthquakes are one of nature's greatest disasters in this world. Basically the effects of earthquake on the man-made structures are the main problems for architects and engineers because the effects that caused extensive loss of life are collapses of bridges, buildings and dams. Therefore, the earthquake effects may not only be considered by countries that have high risk of strong earthquake but also by those that are exposed to low-to-moderate earthquake such as Kuala Lumpur. In the recent years, other countries like United State of America, England and Japan already have their clear implementation plan for raising awareness to their society. Earthquake Engineering Education is one of the main focuses in their plan. Through to this earthquake engineering education plan; at lease the society are located at the low intensity earthquake region has the guidelines to facing seismic impact. This paper introduced the education plan and hopefully it can be one of the platforms for the further discussion on seismic awareness for Malaysian society.

1.0 Introduction

Malaysia is located in the South East Asia, the spreading center from Sumatera Island (Indonesia), Singapore, Thailand and Philippines. The concern of the earthquake risk has increased substantially because Malaysia is surrounded by region of active and moderately active tectonic plate [1]. Figure 1 shows the seismotectonic setting of Malaysia. Earthquake in Sumatera (8.0 Richter Scale) had shaken several tall building and other structures in Malaysia. Many people felt the tremors and rush out of their homes (figure 2). Malaysia are also have our local faults in Eastern Sabah and thus, we are not 'safe enough' from the earthquake risks [4].

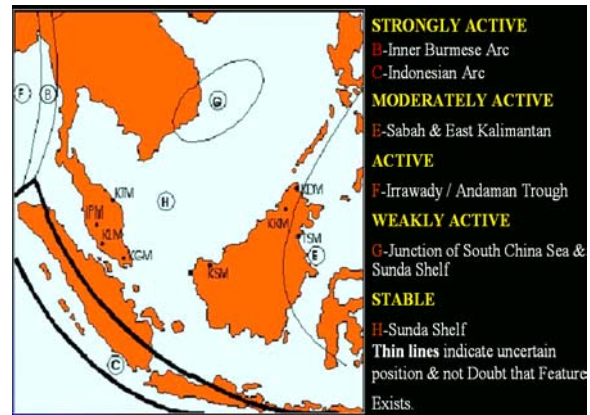


Figure 1: Seismotectonic Setting of Malaysia

Earthquake cannot be prevented, but their impacts can be managed to a large degree so that loss to life and property can be reduced. In Malaysia we need to make our society more awareness about the earthquake impact. The best strategy to make sure our society have their information about earthquake awareness is via education. Furthermore we must have our own education plan where includes the talking and teaching to schoolchildren, build the suitable courses on earthquakes in science and technology programs at university and college level, public education through information dissemination (brochures, "What to do" instructions, radio, TV, programs, newspaper articles), professional education and a clear accountability for implementing code requirements by owners, architects, engineers, contractors, and government inspectors.



Figure 2: Peoples at Bukit Cagar Johor Bahru felt the tremors and rush out of their homes due to earthquake in Sumatera - UTUSAN 5 June 2000

2.0 Building National Capability In Earthquake Engineering

The main strategies were introduced here is to build the national capability in earthquake engineering. To make sure this strategies running properly, it's requires several important approaches [2]. Those important approaches are grouping and listed below:

- i. Involvement of multidisciplinary experts,
- ii. A clear plan for raising awareness,
- iii. A clear implementation plan, and
- iv. A bottoms-up approach to developing disaster management plans for all major urban

2.1 Involvement of Multidisciplinary Experts.

The most important approach is to gather the multidisciplinary experts not only expert from seismic engineering but also from those is related to legislate policies from government and non-government agencies and also consumer. The involvement includes from,

- Academics (schools, colleges and universities),
- Professionals (structural engineers, geotechnical engineers, seismologist, architect, contractors, etc),
- Government personnel from local, state and central government,
- NGOs, and
- General public or consumers of information.

2.2 A Clear Plan For Raising Awareness

The second important approach is making a clear planning for raising awareness in our society. The main idea to this plan is how to give the information about seismic awareness to Malaysian peoples. Some effective ways are suggested bellow according to that matter.

- Talking and Teaching to School Children on Earthquake risk,
- University and college level courses on earthquakes in science and technology programs,
- Public Education Through the information dissemination (brochures, "What to do" instructions, radio, TV, programs, newspaper articles),
- Public education through declaring one day of the year as "Disaster Preparedness Day" including earthquake, and
- Professional Education and Accountability.

2.3 Clear Implementation Plan

The third important approach is to make the clear implementation plan on earthquake awareness and preparedness. Mostly this plan are involved the professional person who are directly involved in earthquake engineering like structural engineers, seismologists, geotechnical engineers and also seismic tools supplier. Several task are suggested bellow:

- Creating national database on hazard, exposure, vulnerability and risk (such as GIS tools),
- Adoption of building codes with earthquake provisions,
- A clear accountability for implementing code requirements by:
 - Owners, architects
 - Engineers
 - Contractors
 - Government inspectors
- Professional organizations who can "License" various professionals in the process, and
- Development of national level tools to understand regional vulnerability and risk.

2.4 Bottoms-Up Approach In Developing Disaster (Earthquake) Management Plans

The final important approach is suggested here is the bottoms-up approach in developing disaster (earthquake) management plans. These plans are

important to make sure all others approaches can be implement smoothly without any query and problems. The plan must have several strategies, such as:

- Plans must be “inclusive and must be developed through bottoms-up approach.
- All professionals (police, firefighters, city/state government officers, NGOs, neighborhood groups) must be knowledgeable about the plans.
- Frequent simulations and drills.
- Regular updating of GIS databases and of the plans.

3.0 How to improve knowledge about earthquake risk and its management

In terms of construction, Malaysia needs the national maps of earthquake shaking hazards provide information essential to creating and updating the seismic design provisions of building codes. Scientists needs frequently revise these maps to reflect new knowledge. Buildings, bridges, highways, and utilities built to meet modern seismic design provisions are better able to withstand earthquakes, not only saving lives but also enabling critical activities to continue with less disruption.

Malaysia government also needs to educate their society on earthquake risks. To make sure that our community is exposed to these problems, we must consider the three major steps based on the event time of the earthquake. For the clear picture, figure 2 shows the earthquake risk and its management life cycle. The steps are before, during and after earthquake event [2].



Figure 3: Earthquake risk and its management life cycle

3.1 Before

These step need to implement before the earthquake event. The important items are listed below,

- Awareness,
- Strong motion instruments -- recording & analysis of past data,
- Seismic hazard mapping (zonation/macro),
- Seismic microzonation for urban regions,
- Design and construction codes,
- Education on seismic risk and responsibility of engineers, contractors, architects, government,
- Inspection departments, owners, general consumers,
- Create “seismic protection” culture, and
- Develop disaster management plans.

3.2 During

These step need the proper planning and its need to be implement during the earthquake event. The two important items are listed below,

- Education of public as to what to do while it is shaking to protect lives and property.
- Educate utilities and organizations in charge of disaster management as to what and how to communicate information on the ongoing disaster.

3.3 After

This is the final step to be implement after the earthquake event. Our society needs the proper guidelines to recover their properties and lives. The guidelines need to be developed and some of them are suggested below,

- Rescue and recovery process implementation,
- Tagging of facilities for safety evaluation,
- Clean-up process,
- Short-term housing, water, sewage, electrical, communication, etc., restoration,
- Reconstruction, retrofitting, and
- Learning from the event for future improvements.

4.0 Seismic Risk Seminar and Workshop, Kuala Lumpur 2001

Normally our government and non-government agencies already play their roles to make the starting point to educate our society on earthquake engineering. In year 2001, Board of Engineers Malaysia (BEM) already organized one-day seminar and one-day

workshop called “Earthquake Risk Seminar and Workshop” and sponsored by Ministry of Works Malaysia. That seminar is participating by various background of participant around the worlds especially related to the earthquake study including the invited professional participants from Japan, United States, Turkey, Singapore, Indonesia and also from our country.

4.1 Some of the comment from the participant

Many important comments related to the seismic study for Malaysia getting from the expert whose attending that seminar. It is include the comment related to the important of the awareness of the society to the earthquake. Here are shows the two of the comment are stated from that seminar.

“West Malaysia is still considered vulnerable due to its proximity to Sumatra fault and Australian tectonic plate”.

“Potential of West Malaysia to experience earthquake tremors of 7.7 scales with a distance of seismic 350-400 meters is probable.”

- Mr Mohd Rosaidi, Malaysia

“Earthquake does not kill people, structures kill the people.”

-Prof. Kimiro Meguru, Japan

Rosaidi state that our country is really not ‘save enough’ from the earthquake risk. Than, Kimiro also gives the challenge to our engineering society to make sure our engineer known that the importance to made the safer structure like buildings and bridges.

4.2 The Test Plan To Do

Organizer of the seminar also arranged the intensive workshop on the second day of the seminar. From that workshop the experts are grouping into various group related to their expertise. From that discussion, all participants agree that Malaysia must have our own committee to organize the seismic plan to our society. There are also agreeing that, Malaysia need to form the committee as soon as possible and the first task for the committee is to perform several items are shown below:

- i. Activities (flow chart in figure 4) and build up experiment facilities,
- ii. Organization Responsible (PWD -East M’sia & West M’sia, Universities, BEM/IEM),

- iii. Probable Linkage (ASEAN, Japan, USA, China, etc), and
- iv. Estimated timeframe for each activity.

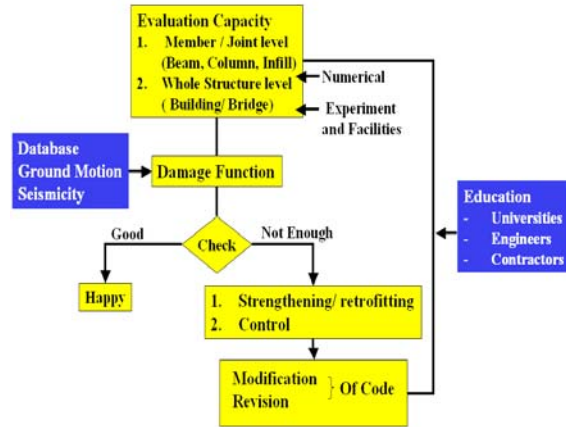


Figure 4: Flow Chart for activities

Figure 4 shows that the activities flow-chart for Malaysian seismic committee. The chart list more about the structural behavior and vulnerability assessment. Its needs to evaluate seismic capacity of structures designed according to current practices. Some study must been made to evaluate the existing and new structural capacity on numerical and experimental study. Some of the expert said that:

“The study of the performance of existing structures is the good start.”

- Assoc. Prof Azmi Ibrahim, Malaysia

“Advice to analyze the typical structures in linear and non-linear.”

- Ir.Dr. Ismail Mohamed Taib, Malaysia

Reflex to this matter, Structural Earthquake Engineering Research (SEER), one of the earthquake research groups in our country base at Universiti Teknologi Malaysia (UTM), actively looking on structural behavior under earthquake loading. They are already done some study on existing and new structural capacity by numerical include buildings, bridges, highways, and utilities built under earthquake loading. They are also ongoing to setup their own structural earthquake laboratories to perform experimental study.

Based on the discussion and presentation from that seminar and workshop, some of the participants

also highlight the importance to build intelligence building with seismic isolation systems.

“The Design must also look to the existing structures. Design the building to be intelligence building. The dampers and base isolation system could be look”

- Dr. Tan Hock Chuan

Before this, Malaysia Rubber Board (MRB) already plays their roles to this matter. Dr. Kamaruddin Ab Malik is one of their active researchers are studying base isolation systems consists of rubber layer and steel plates called rubber bearing or base isolator for building. This area is the advantage to our local researchers because our country is one of the rubber exporters in the world.

In October 1999 the MRB and the Malaysian Palm Oil Board (MPOB) signed a memorandum to jointly construct two identical 3-story reinforced concrete frame office buildings at the MPOB research station in Lahad Datu, Sabah. One of the buildings is installed with rubber bearings and the other is conventionally built. Figure 5 shows that the completed of the two buildings, and the building on the right is base-isolated [3].



Figure 5: MRB demonstration buildings

The important lessons we learn to this seminar are to gather our experts (researchers, engineers, and other experts related to earthquake study) and guide them the right direction to play their roles in their professions. Malaysia already has many experts to accomplish the agreed plan come out from this seminar and workshop. This task must be lead by Board of Engineers Malaysia (BEM) and Public Works Department (PWD) to make sure this earthquake engineering education plan are supervised smoothly. Our community needs this kind of knowledge to become the intelligence and global society.

5.0 Summary

Earthquake engineering education plan may not only be considered by countries that have high risk of strong earthquake but also by those that are exposed to low intensity earthquake region like Malaysia. Our society must have their own awareness on earthquake risks. This is important to minimize the lost of life and damaged of structure such as bridges and buildings. We are also need to make our community ready with the basic knowledge before, during and after earthquake impact. At lease Malaysian people already know ‘what to do’ when they’re facing this problem in others countries. The plan, strategies and step are listed and suggested in this paper hopefully is the platform to the further discussion on the earthquake engineering education in our country.

References

- [1] Azlan Adnan (1998). *Low intensity earthquake effects on steel girder bridges*. Ph.D. Thesis. Faculty of Civil Engineering. Universiti Teknologi Malaysia.
- [2] Hareh C Shah. *WSSI and its global risk management efforts*, Seismic Risk Seminar, Kuala Lumpur, Malaysia, 2001
- [3] Kamarudin A.M & Kamarul B.B. *Natural Rubber Bearings for Earthquake Protection of Buildings*, Seismic Risk Seminar, Kuala Lumpur, Malaysia, 2001
- [4] Mohd Rosaidi C.A. *Earthquake Monitoring In Malaysia*, Seismic Risk Seminar, Kuala Lumpur, Malaysia, 2001