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Proceeding

International Joint Seminar

Muslim Countries and Development :

Achievements, Constraints and Alternative Solutions (Multi-Discipline Approach)

Yogyakarta, 2nd December 2006

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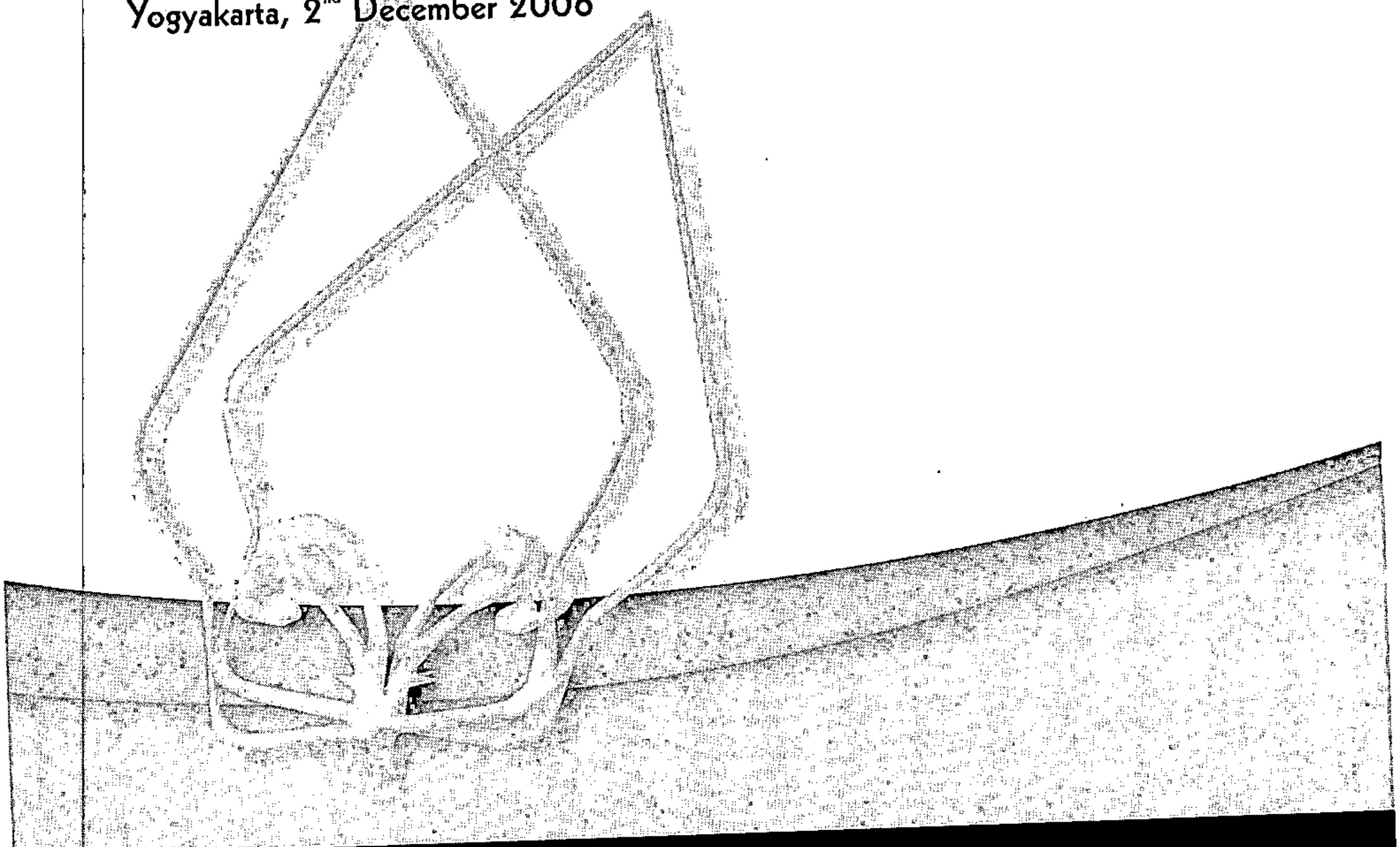

Organized by:

UMY
Universitas Muhammadiyah Yogyakarta

IIUM
International Islamic University Malaysia

Education and Cultural Attache Embassy of The Republic Indonesia in Malaysia

MESSAGE FROM THE RECTOR OF UNIVERSITAS MUHAMMADIYAH YOGYAKARTA (UMY)

Assalamu'alaikum warahmatullahi wabarakatuh

All praise be to Allah SWT, Lord of the world. Peace and blessings on Muhammad SAW, His Servants and Messenger.

First of all, as the rector of Universitas Muhammadivah Yogyakarta (UMY), I would like to welcome to the honourable guests, Rector, Dean of Postgraduate Studies (CPS), Dean of ISTAC, Dean of IRKHS, Deputy Deans and Head Departments from various Kulliyah, lecturers, postgraduate students of International Islamic University Malaysia (IIUM), and all participants in this joint seminar.

Academic cooperation between UMY and IIUM started several years ago. The cooperation between us is based on a solid foundation; both us are Islamic universities having same missions to develop Islamic society, to prepare future generations of Islamic intellectuals, and to cultivate Islamic civilization. In fact, improving academic quality and strengthening our position as the producers of knowledge and wisdom will offer a meaningful contribution to the development of Islamic civilization. This responsibility is particularly significant especially with the emergence of the information and knowledge society where value adding is mainly generated by the production and the dissemination of knowledge.

Today's joint seminar signifies our attempts to shoulder this responsibility. I am confident to say that this joint program will be a giant step for both of us to open other pathways of cooperation. I am also convinced that through strengthening our collaboration we can learn from each other and continue learning, as far as I am concerned, is a valuable ingredient to develop our universities.

I sincerely wish you good luck and success in joining this program

Wassalamu'alaikum Wr, Wb.

Dr. Khoiruddin Bashori

Rector, UMY

MESSAGE FROM THE RECTOR OF INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA (IIUM)

Assalamu'alaikum warahmatullahi wabarakatuh

In the name of Allah, the most Gracious and the most Merciful. Peace and blessings be upon our Prophet Muhammad (S.A.W).

First and foremost, I felt honoured, on behalf of the university to be warmly welcomed and to be given the opportunity to work hand in hand, organizing a respectable conference. Indeed, this is a great achievement towards a warmers bilateral tie between the International Islamic University Malaysia (IIUM) and Universitas Muhammadiyah Yogyakarta (UMY) after the MoU Phase.

I would also like to express my heartfelt thanks to Centre for Postgraduate Studies (CPS), Postgraduate Students Society (PGSS), contributors, paper presenters, participants and our Indonesian counterpart for making this program a prestigious event of the year.
This educational and cultural visit is not only an avenue to foster good relationship between organizations and individuals and to learn as much from one another but a step forward in promoting quality graduates who practices their ability outdoor and master his or her studies through first hand experience. The Islamic platform inculcated throughout the educational system namely the Islamization of knowledge, both theoretical and practical, will add value to our graduates. This comprehensive excellent we strived for must always be encouraged through conferences, seminars and intellectual-based activities in line with our lullaby: The journey of a thousand miles begin by a single step, the vision of centuries ahead must start from now.

My utmost support is with you always. Looking forward to a fruitful meeting.

Ma'assalamah
Wassalamu'alaikum Wr, Wb.

Prof. Dato' Dr. Syed Arabi Idid
Rector, IIUM

MESSAGE FROM EDUCATION AND CULTURAL ATTACHE EMBASSY OF THE REPUBLIC OF INDONESIA KUALA LUMPUR

Assalamu 'alaikum warahmatullahi wabarakatuh

All praise be to Allah SWT. This is the moment where implementation of MoU between Universitas Muhammadiyah Yogyakarta (UMY) and International Islamic University Malaysia (IIUM) comes in the form of action by organizing this Joint Seminar. The efforts of both sides to implement the MoU are highly appreciated, especially, in the context of which both universities effort to enhance the quality of education.

Substantially, I believe that this Joint Seminar will bring many benefits. In term of the development of knowledge, it is a means for developing academic quality, for exchanging of information on academic development, as well as for constructing intellectual atmosphere at both universities. In term of international relations, both universities have taken part in increasing close relationship between Malaysia and Indonesia. RUM and UNIY as well are using 'soft power' to increase bilateral relations among citizens which brings a lot of benefits for both nations.

Therefore, I hope that both RUM and UMY can make use of this program as a 'kick-off' for other programs in the future, especially in using UMY's vast networks with other Muhammadivah Universities in various cities in Indonesia as well as IIUM's network. The support of IIUM for UMY also means a progress for IIUM and UMY. I hope such joint program will continue in future for betterment of both Indonesia and Malaysia. Embassy of the Republic of Indonesia in Kuala Lumpur will always support these efforts.
To our honorable guests, Rector, Dean of Postgraduate Studies (CPS), Dean of ISTAC, Dean of IRKHS, Deputy Deans and Head Departments from various Kulliyah, lecturers and students of IIUM, I warmly welcome you to Yogyakarta. I hope you enjoy your stay in the cultural city of Yogyakarta.
Finally, as the Attache of Education and Cultural, Embassy of the Republic of Indonesia, Kuala Lumpur, I sincerely wish you good luck *and a* successful program with unforgettable memories.

Wabillahit Taufiq Wal Hidayah
Wassalamu 'alaikum warahmatullahi wabarakatuh.

M.Imran Hanafi

Education and Cultural Attache Embassy of the Republic of Indonesia

MESSAGE FROM DEAN CENTRE FOR POSTGRADUATE STUDIES

Assalamu'alaikum warahmatullahi wabarakatuh

Praise be to Allah. May the peace and blessings of Allah be on the last prophet and messenger, our master Muhammad and on his household and companions. It is a great privilege for me to foreword this message to this wonderful event that is jointly organized by the Universitas Muhammadiyah Yogyakarta (UMY) and International Islamic University (IIUM).

First and foremost I would like to record my special gratitude to management of Universitas Muhammadiyah Yogyakarta for their co-operation.

In order to obtain comprehensive excellence, the Centre for Postgraduate studies has always facilitates postgraduate students of the university to achieve the highest quality in their academic work. This seminar is one of the many programs that Centre for postgraduate studies has to ensure quality graduates.

I would therefore like to thank all the participants and programme coordinators who have worked hard to realize this event.

May Allah SWT shower His blessing upon us.

Wassalamu'alaikum Wr, Wb.

Prof. Dato' Dr.Wan Rafaei Abdul Rahman
Dean, Centre For Postgraduate Studies

MESSAGE FROM THE ACTI
PRESIDENT OF POSTGRADUATE STUDE

Assalamu'alaikum warahmatullahi wabarakatuh

On behalf of Postgraduate Students' Society (PGSS), my gratitude and appreciation to our beloved Dean of Studies, the Embassy of Indonesia in Kuala Muhammadiyah Yogyakarta and the organizing com IIUM and the Universitas Muhammadiyah Yogyakarta huge success. Postgraduate Students' Society (PGSS) u supervision of the Center for Postgraduate Studies (CP this event.

As I strongly believe that the initial stages of unity a and building the new generation, who will represent t more, such programs, not only achieve the missio universities but to achieve the global mission and Therefore, I believe today, we have to have understa and then only we can appreciate our diverse cult acknowledge the different strengths posses in us an weaknesses through knowledge in this age of informa sure this joint seminar will initiate unity among the fut along with integrating them.

Thank you,

Mohd Nabi Habibi

Acting President Postgraduate Students' Society (PGS

MESSAGE FROM PROGRAM DIRECTOR

Assalamu'alaikum warahmatullahi wabarakatuh.

Praise be to Allah. May the peace and blessings of Allah be on the last Prophet and Messenger, our master Muhammad and on his household and companions.

Honestly speaking, we are pleased to be trusted by Postgraduate Students' Society (PGSS) and Centre for Postgraduate Studies (CPS) to organize the programme named Educational and Cultural Visit to Yogyakarta, Indonesia. For this, We express our gratitude to the management of both PGSS and CPS. This programme is of immense value. It has the potentials to promote intellectual endeavor, develop leadership capabilities and enrich cross-cultural understandings. We sincerely believe and hope that program of this kind will be organized in a regular fashion in future.

It is a great privilege for us to play twofold role in organizing this event: *as a host* and as *guest.* In fact, this is a fascinating experience to manage this event. Since our inception here, we have found meaningful interaction of students in an interweaving of cultures into complicated, yet beautiful, embroidery of social fabric. We are proud to say that this dearly loved university has produced graduates of high quality, who are distinct from those of the local universities.

Finally, we wish to express our special thanks to Bapak M.Imran Hanafi, Education and Cultural Attache of Indonesian Embassy, Bapak Herdaus, S.H., Assistant of Immigration Attache of Indonesian Embassy, Bapak Tharian Taharuddin for their immensely valuable assistance and co-operation in making this program a success. I sincerely appreciate all local committees at Yogyakarta, the colleagues and program coordinators and committee members who worked diligently to materialize this event. We wish to pass on good wishes to the PGSS for their valuable efforts it expended for this event.

May Allah s.w.t shower His blessing upon us.

Wassalam,

Nasrullah
Programme Director

Todi Kurniawan
Co-Programme Director

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Development Of Earthquake Disaster Management System In Bantul: Study On Housing And Infrastructures Damages For Their Reconstruction

Sri Atmaja P. Rosyidi[1], Surya Budi Lesmana[2], Chu-Chieh Jay Lin[3]
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Abstract

Right after the huge devastation of the earthquake of 6.3 Richter scale in Yogyakarta and Central Java on May 27, 2006, which caused 5,800 people to die, injured around 38,000 and robbed hundreds of thousands of residential buildings, emergency response procedures, and reconstruction and recovery programs have been undertaken. This is followed by resources mobilization by both the central and local governments, and non-governmental organizations for rescue and relief efforts. After attending the emergency measures of rescuing trapped survivors, treating the injured and providing care and shelter for the needy, the government focuses its attention on the long-term task of reconstruction, rehabilitation, and enhancing the prevention and rescue mechanism. The severe but tolerable damages to lifeline systems (water and sewer, electricity, and telecommunication systems) are mostly found on pipes and joints, because of the damages to buildings and roads. Being responsible for the restoration and reconstruction of residential building (housing) and infrastructures, the central government provides an estimated budgetary allocation of more than 10 trillions IDR. This paper presents the study of development of disaster management system, which currently becomes an important topic in Indonesia, to provide information and data for the governmental emergency relief measures and the rehabilitation programs after the earthquake, especially for infrastructures damages. The benefit of this system is to assist the government in managing regional society and the lifeline system after the disaster. However, studies of this topic and its components have been relatively few. This study is based on the Taiwan Earthquake Loss Estimation System (TELES), integrating research accomplishments on seismic hazard analysis, structural damage assessments and socio-economic impacts in Taiwan, as developed by the National Center for Research on Earthquake Engineering (NCREE). After putting lots of efforts, it has been successfully used in preparing disaster mitigation plans and emergency response affairs by governments and cooperative institutions. Scenario simulation technologies (including seismic scenario database), which have been developed and used for the decision-making support system, is proposed to be part of the

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[2] Head, Board of Engineering Consultant and Services, Muhammadiyah University of Yogyakarta
[3] Associate Research Fellow, National Center for Research on Earthquake Engineering

completed system of disaster management application for infrastructures rehabilitation in Bantul, Indonesia and with the expectation of being a handy tool for Indonesia to build a safer society.

Keywords: Earthquake, Infrastructures, Hazards Mitigation, Scenario Database

Introduction

1.1 *Background of Study*

On May 27, 2006, a magnitude 6.3 earthquake on the Richter scale and lasted for 52 seconds struck Central Java and Yogyakarta, center for Javanese traditional arts and culture as well as a center of Indonesian higher education. Because the earthquake was relatively shallow at 33 kilometers under ground, shaking on the surface was more intense than deeper earthquakes of the same magnitude, resulting in major devastation, in particular in the districts of Bantul in Yogyakarta Province and Klaten in Central Java Province. The earthquake took over 5,800 lives, injured around 38,000 more and robbed hundreds of thousands of residential buildings. Meanwhile, the Mt. Merapi's volcanic activity is increasing and producing lava flows, toxic gases, and clouds of ash, prompting the evacuation of tens of thousands of people. At the same time, the government of Indonesia started the emergency response procedures right after the earthquake while preparing reconstruction and recovery programs. The earthquake was the third major disaster to hit Indonesia within the past 18 months. In December 2004, a major earthquake followed by a tsunami devastated large parts of Aceh and the island of Nias in North Sumatra, and in March 2005, another major earthquake hit the island of Nias again. With Indonesia's more than 18,000 islands along the Pacific "ring of fire" of active volcanoes and tectonic faults, the recent disaster is a reminder of the natural perils facing this country.

A comprehensive analysis by a team of Indonesian Government and international experts estimate the total amount of damage and losses caused by the earthquake at Rp 29.1 trillion, or US$ 3.1 billion. Total damage and losses are significantly higher than those caused by the tsunami in Sri Lanka, India and Thailand and are similar in scale to the earthquakes in Gujarat (2001) and in Pakistan (2005) (Data from BAPPENAS, 2006). The damage was very heavily concentrated on housing and private sector buildings. Private homes were the hardest hit, accounting for more than half of the total damage and losses (Rp 15.3 trillion). Private sector buildings and productive assets also suffered heavy damage (estimated at Rp 9 trillion) and are expected to lose significant future revenues. An estimated 154,000 houses were completely destroyed and 260,000 houses suffered some damage. More houses will have to be replaced and repaired than in Aceh and Nias at a total cost of about 15% higher than the damage and loss estimate of the tsunami. The impact of the earthquake on public and private infrastructure was relatively limited, with the value of damage and losses estimated at Rp 397 billion and Rp 153.8 billion, respectively. The sector worst affected is energy with damage to the electricity transmission and distribution facilities estimated at a total Rp 225 billion and losses at a further Rp 150 billion from physical damage.

Indonesia is located in a seismically active region. Seismic disaster of earthquake is one of the devastating natural hazards that people in Indonesia must face to. Probabilistic seismic hazard analysis is often applied in estimating seismic risk in different regions. The hazard curves obtained from the analysis are often in terms of ground motion intensity parameters such as peak ground acceleration (PGA), response spectra, etc. Other quantities, such as soil liquefaction potential, damage-state probabilities of civil infrastructures, number of casualties and amount of losses, are then derived indirectly from the hazard curves of ground motion intensity. Since the relationships among these factors are very complicate, they can not be expressed as simple linear functions of ground motion intensity parameters. In order to mitigate seismic disasters and to manage catastrophic risks, it is necessary to have appropriate damage assessment tools and risk management strategies in all times including emergency response period as well. The proposed tool must be based on the reliable information from scenario simulation, which is based on the existing inventory database and state-of-the-art analysis models. Therefore, development of such seismic scenario simulation technology is very important in countries that suffer from earthquake threats. This paper intends to introduce the study on earthquake disaster management system which is needed to develop in order to assist the Indonesian government to minimize the miss management of infrastructure analysis and reconstruction after earthquake occurrence. The proposed system has been developed from the Taiwan Earthquake Loss Estimation System (TELES) considering its useful application in Taiwan earthquake experience.

1.2 *Framework of TELES*

The National Center for Research on Earthquake Engineering (NCREE) of Taiwan has developed "Taiwan Earthquake Loss Estimation System (TELES)" to estimate ground motion intensity, ground failure extent, damage-state probabilities/quantities of civil infrastructures and pipeline systems, induced socio-economic losses, etc. The TELES software intends to provide scenario-based data for preparing seismic disaster mitigation plans in normal times for central and local governments. It can also provide useful information for emergency response actions soon after occurrence of strong earthquakes (Yeh et al., 2003).

To build up a loss estimation system as the TELES, three major parts of the tasks are needed: 1. the collection of seismic sources, geologic and inventory database. 2. The development and modification of analysis modules in estimating hazard, risk and losses. 3. The update of integrated application software. The input database consists of three types of data: inventory data with GIS information, earthquake hazard and geologic data maps, and analysis parameters. The analysis modules take the required inventory and analysis parameters as on site-specific outputs from hazard analysis, and output estimates in the result database. The third part, integrated with commercial GIS software, is the PC-based application software to execute user's requests, to display input/output databases in both tabular and graphical forms, to generate summary reports, and so on.

The analysis part of TELES contains four groups of modules, namely, potential earth science hazard (PESH) analysis, direct physical damage assessment, induced damage assessment, and social/economic loss estimation (Figure 1). These modules and sub-modules are interdependent. The output from one module acts as input to another. The modular approach allows estimates based on simplified models and limited inventory data. Addition or replacement of existing modules/data may be done without changing the entire methodology. The modular approach also facilitates the rapid transfer of information and technology between the academic/research communities as well as the end users. Specific regional analysis models and data can be incorporated in the framework. Another advantage of modular approach is that it enables users to limit studies to selected losses, which may be desirable because of limited budget and inventory constraints. In general, each module requires a comprehensive loss estimation study. However, the degree of required sophistication and associated cost varies greatly by user and application. It is necessary and appropriate that the modules accept multiple levels of detail and precision of input data.

Besides, the collection of complete and useful database is the key factor in success of the TELES project. However, database collections are often the most time consuming and expensive aspects while performing a comprehensive study. In general, the inventory data are often classified by their usage and functionality. For example, engineered structures are classified into four categories: general building stocks, essential facilities, transportation systems and utility systems, as shown in Figure 1. Each category is further divided into several classes according to their structural types, seismic resistant capacity, etc. to assess damage-state probability of individual object based on ground motion intensity and ground failure extent. The data classification schemes and the associated analysis models depend on the content of inventory database.

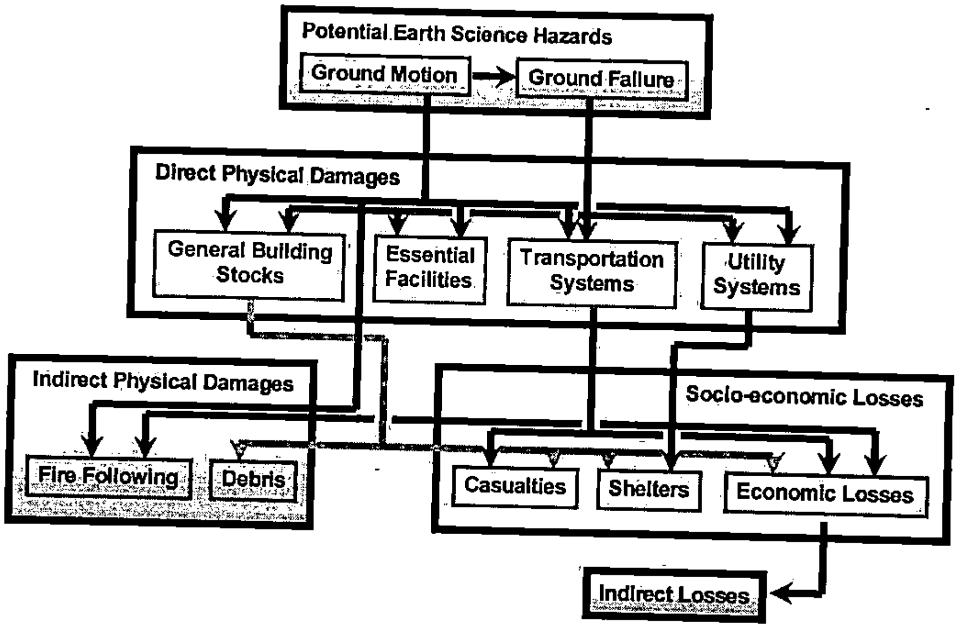

Figure 1. Framework of TELES (Lin et al., 2006)

Housing And Infrastructures After 27 May Earthquake

The scale of the natural disaster was compounded by man-made failures to build earthquake resistant structures. Large-scale damage to buildings is associated with a lack of adherence to safe building standards and basic earthquake resistant construction methods. Most of the private homes used low-quality building materials and lacked essential structural frames and reinforcing pillars and collapsed easily as a result of lateral shaking movements. The poor are the least able to afford building safe houses and many of their homes were damaged. Many public buildings also collapsed due to poor building standards, in particular schools, many of which were built in the 1970s and 1980 with special government grant funds. Clearly, there was minimal enforcement of building codes.

There has been widespread but generally minor damage to roads and bridges in the earthquake affected areas. Total damage costs are estimated at Rp 45 billion based on road damage data provided by the provincial public works agencies. All important road links are now usable and there has been no significant impact on traffic speeds. Damage to roads includes transverse and longitudinal cracking. Sections of roadway have suffered minor subsidence and pavement deformation mainly due to failure of retaining walls. Damage to bridges includes longitudinal cracking of deck slabs and unfastening of expansion joints. Bridge damage accounts for 60% of total costs, national roads for 16% of total costs, while provincial and district roads account for 84%. Two thirds of the damage to sub-national networks is in Bantul and Sleman.

Development Of System

Based on TELES study, the earthquake disaster management system on infrastructures assessment and reconstruction has been proposed. This system has still studied in initial stage by authors and the concept of system is presented herein. The system which is called as EDIMs, has been developed in order to verify the damage causes, to classify the destruction level and to give the alternative reconstruction scenarios of infrastructures. EDIMs is divided into three main modules: 1. Database Module, 2. Destruction Identification and 3. Reconstruction Scenario. EDIMs is built to compare different thematic maps and obtain in-depth understanding of the relationships between input and output database. It is also used to provide the information of potential areas which are much affected by earthquake occurrence and simulation the reconstruction scenarios where the system users will not miss any important information from the seismology analysis. The frame of EDIMs is illustrated in Figure 2.

Database Module

Database module is divided into three groups: 1. Data suppliers, 2. Data distribution system (DDS) and 3. Data management system (DMS). Figure 2 shows the organization of this database system. Data suppliers are local (province, and district or kabupaten) and central government and non-government organizations that will support daily and/or required data in the event of requirement. BAKORNAS, BAKORDA, Department of Public Works, Fire Rescue Department, Department of Defense, Indonesian Military, Indonesian Police, Department of Energy and Minerals Sources, Meteorology and Geophysics Board, are examples of the data suppliers for EDIMs. Data are classified into three main groups as described below:

a. Group 1 : Populations and areas which shows the people density in each hectare.
b. Group 2 : Infrastructures database and housing types.
c. Group 3 : Damage areas after earthquake occurrence.
d. Group 4 : Visual observation in each important damage areas after earthquake disaster.

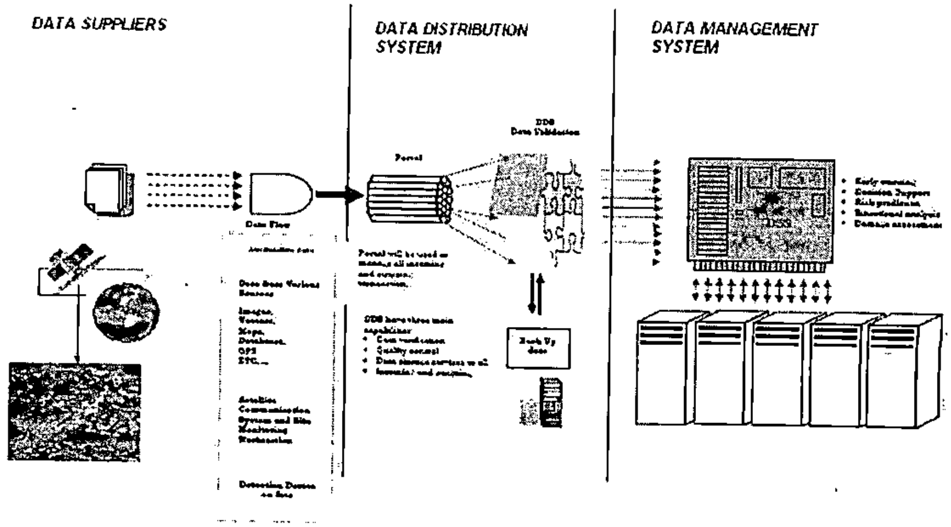

Figure 2. EDIMs system configuration

Format of data are quite variable such as Air/Satellite data, data from various sources, images, vectors, maps, databases, GPS, ETC, Satellite communication system and site monitoring, workstation, detection devices on site, hot links and so on.

At the interface level, the DDS has the functionality of administrating user and portal. It manages data information distribution by controlling who gets what, at in different time, at different places. Its functionality can be summarized as follow:

a. Perform rapid and accurate mapping of disaster evolution
b. Easy, efficient and enable real-time communication
c. Able to support the distribution of data
d. Support at central level, the configuration users' profiles and security issues
e. Serves the needs of emergency managers that include the on-scene commander and management of the personnel in the field
f. Serve the needs of operational crews that include all squads in charge of various field activities

DDS has three main capabilities; Data verification, Quality control and Data storage services to all incoming and outgoing data. There have to be a sub system as portal to manage all incoming and outgoing transaction. In the DDS, data/information have to be managed and stored properly. The quality of the data including its format will be strictly controlled so that it can be used throughout the system.

DMS is a collection of state-of-the-art hardware and software that can be used for the management of earthquake disaster at every stage of the crisis before, during and after. It has to be designed in a modular and expandable architecture concept and have to be able to evolve later in an incremental way through the integration of new sensors, the implementation of new centers and actors (fixed or mobile) and the integration of new application software when available.

Destruction Identification

1.3 *Ground Response Analysis*

To set source parameters of a seismic event is the first step while conducting simulation. In general, three ways are provided to define source parameters in a deterministic approach: historical events, active faults and arbitrary events. The source parameters include event date, time, magnitude, epicenter location and focal depth. Besides, the fault mechanism (reverse, normal, or strike), the orientation of trace, the inclination angle, length and width of rupture plane are required to define the source parameters if the earthquake accompanies with fault rupture. Estimation of ground motion intensity due to a scenario earthquake may divide into three steps. As shown in Figure 3, the first step is to predict the intensity at bedrock level using the attenuation laws. The second step is to obtain the intensity at ground surface through the local site modification factors. Finally, the local intensity can be updated accordingly when the monitored data at strong-motion stations are available.

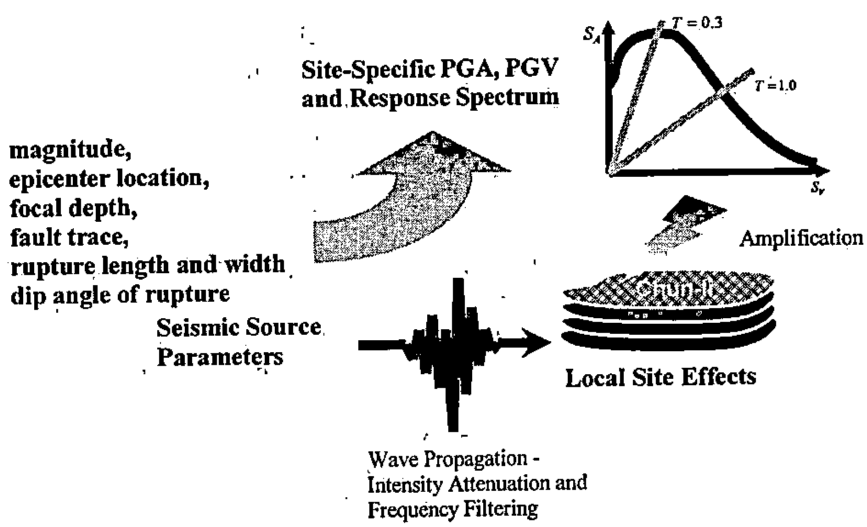

Figure 3. Estimation of ground motion intensities (Lin et al., 2006)

1.4 *Soil liquefaction potential and settlement*

The soil liquefaction potential in EDIMs is classified into six categories: "very high", "high", "moderate", "low", "very low", and "none". The further investigations and researches by governments and universities are needed to analyze and to propose a classification scheme to identify the liquefaction susceptibility category in each important area in Bantul or other district in Indonesia. Furthermore, the semi-empirical formulas to estimate the liquefaction probability and the amount of settlement are obtained from nonlinear regression analysis and statistics (Yeh et al., 2002). The earthquake magnitude, peak ground acceleration and ground water depth were included in the influence factors of the semi-empirical formulas.

1.5 *Building and Public Infrastructures damage assessment*

The first group of structure category for direct physical damages is the general building stocks (GBS). There are many buildings of different structural types, seismic behavior and usages within the GBS. In order to facilitate damage assessment, casualty and loss estimation, these buildings are grouped into several model building types (MBT), seismic design levels, and occupancy classes. Since the only database that provides consistent format and up-to-date information of buildings in Indonesia is the building tax data from ministry of finance and local governments, these information has been used to calculate various statistics of general building stocks. The MBT in this proposed system is adopted from TELES classification, are mainly defined by their construction material and building height. In TELES, there are 15 MBT, namely, wood (L), steel (L, M, H), light steel (L), reinforced concrete (L, M, H), pre-cast concrete (L), reinforced masonry (L, M), un-reinforced masonry (L), and steel reinforced concrete (L, M, H) buildings. The letter L, M and H in the parenthesis indicate low-rise, mid-rise, and high-rise buildings, respectively. Each MBT is further divided into four seismic design levels: high-, moderate-, low-, and pre-seismic design levels. The total floor areas for each MBT and seismic design level are calculated according to their construction years, seismic zoning factors, and local site conditions.

EDIMs evaluate the damage state probabilities for each MBT with different seismic design level due to ground motion and liquefaction-induced settlement. Furthermore, the damages in structural systems and nonstructural components are evaluated separately. While calculating the seismic demand, the effects of hysteretic damping and system degradation are both considered. The seismic capacity and fragility curves for each MBT with different seismic design level are determined by reference to seismic design codes in various periods, nonlinear push-over analysis, and historical data collected after earthquake.

For road and bridge construction, the condition assessment by the visual observation must meet to the pavement management system codes. The assessment is grouped into damages type, such as cracking, pot-holes, bleeding, etc., and their damage level as low, moderate and high level. In the case of classified in transversal and longitudinal pavement cracking. Figure 4 and 5 shows the example of damage type in housing and road construction after earthquake May, 27 in Yogyakarta.

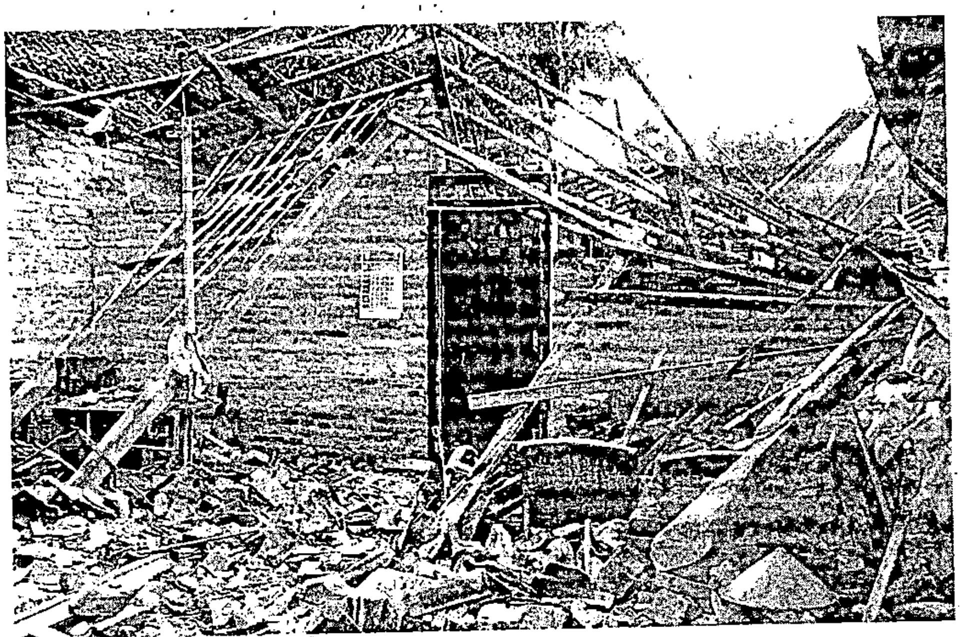

Figure 4. Collapsed residential housing

Figure 5. Landslide on edge state road

Reconstruction Scenario

The mapping schemes of MBT are used to calculate the number of damaged housing and infrastructure in each type and zoning. The output of module contains estimates in four damage severity levels: "hard damage," "moderate damage," and "low damage." The damage states are calibrated considering the effects of structural and nonstructural damages while hard damage state of buildings is further divided into "collapse" and "without collapse".

From the scenario database of EDIMs, there are simple application on calculation of the annual seismic risks of infrastructures in specific regions. The expected annual seismic risks may have different values depending on the assignment of annual occurrence rates of scenario earthquakes. First scenarios, S_1, denotes the expected loss when the earthquake occurrence rate of grid is uniform in each seismic source zone. S_2 denotes the expected loss when the earthquake occurrence rate of grid is proportional to the number of historical earthquake events. S_3 is the average of the previous two cases. It is suggested that the mean value S_3 can be used to compare the relative magnitudes of annual seismic losses.

The seismic risk maps are useful for local governments in proposing seismic mitigation plans. If the seismic sources zoning scheme are changed or the parameters in the Gutenberg-Richter magnitude recurrence relation are obtained by different methods, the maps of expected annual seismic losses in towns are changed accordingly. For emergency response purpose, local government may prepare alternate plans for reconstruction of building and public infrastructures. They will be studied in more detail in the near future.

Concluding Remarks

Formulation of strategic implementation plan needs to be taken for an effective earthquake disaster management system. To achieve success in these aspects, creation of earthquake disaster data and management system should be given prime importance among policy initiators, decision makers, and administrators at national and local levels, professional bodies, financial institutions, NGOs and voluntary organizations. The scope of disaster management activities need to expand implying participation of wider range of stakeholders in much wider range of activities. Local government institutions need to build up their capacities in order to meet the growing demands in the area of earthquake disaster management. Detailed databases need to be created on hazard occurrences containing damages caused to buildings and infrastructures and the economic losses suffered and its accessibility should be ensured regarding preparedness, and research data for effective pre and post disaster analysis with data on mitigation techniques and action plans. Earthquake Disaster Management System (EDIMs) is proposed to develop the integrate research accomplishments on seismic hazard analysis and infrastructural damage assessments in Indonesia. After establishing the seismic scenario database, several potential applications have been created.

significantly since the damages due to any future earthquake were calculated beforehand. This information is important for decision-making support systems or emergency response centers to properly dispatch rescue forces and medical resources to the right places. It may be used in a systematic approach to estimate various kinds of seismic hazard and risk in different regions. Scenario simulation technologies (including seismic scenario database), which have been developed and used for the decision-making support system, is proposed to be part of the completed system of disaster management application for infrastructures rehabilitation in Bantul, Indonesia and with the expectation of being a handy tool for Indonesia to build a safer society.

Acknowledgement

We gratefully acknowledge National Center for Research on Earthquake Engineering, Taipei, Taiwan and some assistants in Lembaga Konsultasi dan Pelayanan Teknik, Muhammadiyah University of Yogyakarta, for their kindness, enormous help and friendship when authors conducting earthquake reconnaissance investigation.

References

BAPPENAS. 2006. Preliminary damage and loss assessment, Yogyakarta and Centrak Java Natural Disaster. The 15th meeting of the consultative group on Indoensia, Jakarta June 14, 2006. A joint report of BAPPENAS, the Provincial and Local Governments of D.I. Yogyakarta, the Provincial and Local Governments of Central Java, and international partners.

Lin C-C. J., Yeh C-H, Kao C-Y & Ke S-S. 2006. Application of Taiwan Earthquake Loss Estimation System (TELES) on Hazards Mitigation. International Symposium on Earthquake Engineering and Infrastructure and Building Retrofitting, August 28, 2006.

Yeh, C. H., C. H. Loh, and K. C. Tsai, 2003. *Development of Earthquake Assessment Methodology in NCREE*, Proceedings of Joint NCREE/JRC Workshop, November 17-18, Taipei, Taiwan, NCREE-03-029.

Yeh, C. H., M. Y. Hsieh, and C. H. Loh, 2002b. *Estimations of Soil Liquefaction Potential and Settlement in Scenario Earthquakes*, Proceedings of the Canada-Taiwan Natural Hazards Mitigation Workshop, July 17-19, Ottawa, Canada.