VIETNAM

- SYSTEMATIC STRATEGY IS BEGINNING TO TAKE SHAPE

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1 INTRODUCTION

Vietnam lies between the two greatest seismic belts of the planet: the Mediterranean-Himalayan belt and the Pacific Ocean belt. It strongly suffers the influence of these two belts. The complicated geological structures and the strong and differentiated tectonic movements had led to high seismic activity in many zones of this territory. Although the seismic hazard is not so great as the countries lying directly on these belts (e.g., Philippines, Indonesia), it requires precautions.

Many earthquakes of intensity 7-9 (following MM, MSK - 64 Scale) occurred here. These caused damage to houses, construction, and loss of human lives. Since 1900, Vietnam has had two earthquakes of intensity 8-9 (M_S=6.7) and nearly 20 earthquakes of intensity 7 (M_S=5.0 - 5.6) (Figure 1). In 1278 and 1285, earthquakes of intensity 8 occurred in Hanoi, the capital of Vietnam. In 1935 and 1983, earthquakes with magnitude M_S=6.7 - 6.8 occurred in northwest Vietnam. These destroyed or damaged many houses, construction, roads and harvest in an area of about 13,000 km^2. Thirty persons died or were injured. These earthquakes happened in a mountainous zone, where houses and construction were rare, so these were not catastrophic. If these earthquakes will happen in a situation of actual development, rural formation, and population concentration, there is no doubt that they would have serious consequences.

In fact, with an area of more than 320,000 km^2 and a population of more than 70 million, the population concentration of Vietnam is now very high. Together with the expansion and economic development is the concentration of population in industrial centers in extended and new prefectures. Among these industrial centers and prefectures, many are situated in highly seismic zones. Then, the seismic hazard will be greater if there are no measures to ensure seismic safety.

The problem of seismic safety had been suggested in Vietnam only since the 1960's, when the edification of the country began after the war. At this time, it was suggested only by some scientists who were beginning a study on seismology. It had not yet become a strategy of the nation. Only since this decade, because of the enormous quantity of seismic information, the international strategy on seismic safety, the requirement of construction design and building, etc., has the problem of seismic safety become more prominent in Vietnam. The government has founded organizations for natural disaster management and for study of natural disaster reduction. A national committee for the International Decade for Natural Disaster Reduction was also formed.

In this report, we present the evolution and the status of seismic safety strategy in Vietnam and the remaining problems. We also suggest a program for improving this strategy.

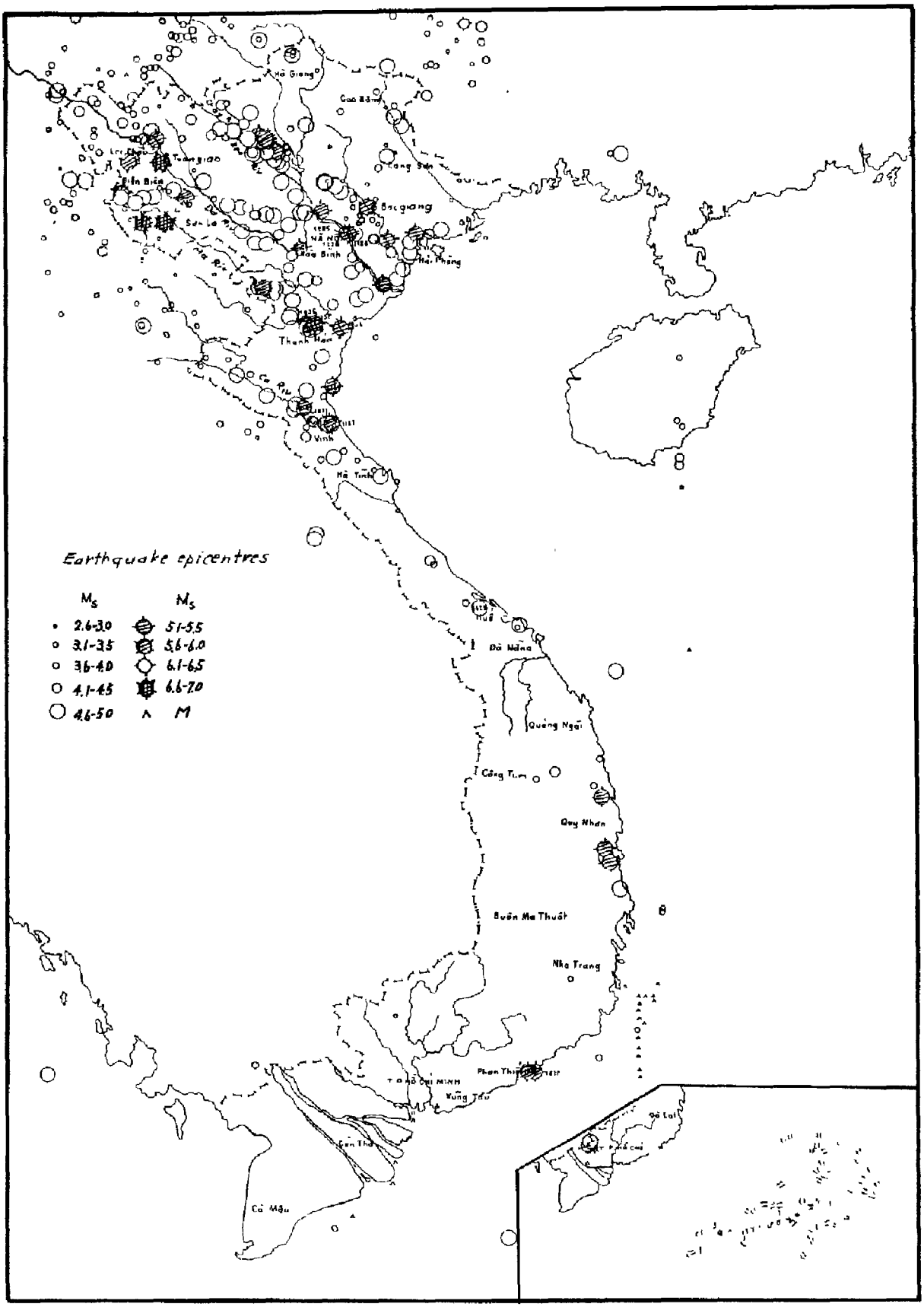

Figure 1: Epicentral map of Vietnam

2 SEISMIC HAZARD AND RISK MANAGEMENT IN THE CURRENT PERIOD

2.1 Seismic Regime Control

The control of seismic regime aims to reveal its variation to estimate the seismic hazard and predict catastrophes. This work has really started since an earthquake of M_S=5.6 occurred on June 12, 1961, in the northeast border of the Red River delta, which caused damage to many houses in a prefecture 60 km from Hanoi. Before 1990, the seismological station network in Vietnam included 7 stations, five of which were situated in the North, and two in the South. All were equipped with Soviet short period seismographs of type CM-3 and CX. Their magnification is about 10,000/20,000 in the range from 0.1 to 1 second. The seismic signals were recorded on photo paper with drum rotatory velocity of 60 mm/mn. This station network recorded all earthquakes with $M_S \geq 3$ in North Vietnam and $M_S \geq 4$ in all the territory. Earthquake focus location was determined with a great error. So, it cannot meet the demand of seismic regime control in Vietnam.

This situation was overcome partly by the UNDP project VIE/84/01 -- "Modernization and reinforcement of seismological service in Vietnam". After the achievement of the first phase of this project in the beginning of 1990, the seismological station of Vietnam was comprised of ten stations, nine of which were equipped with short period seismographs of type LE made in West Germany (by Lennartz Electronic). The seismic signals were recorded on heat paper. It is hoped that the second phase of the project will be finished in 1994. Then, the seismological station network will comprise 13 digital stations and will be centralized, i.e., the seismic signals will be directly transmitted to the recording center for interpretation (Figure 2). Only after this time will we be able to control the seismic activity in Vietnam.

2.2 Assessment of Seismic Hazard

The seismic hazard in Vietnam is estimated by seismic zoning, microseismic zoning of cities and industrial centers and estimation of seismic oscillations in great construction sites.

Seismic zoning

Seismic zoning map is utilized in the planning, the project documentation and the intensity determination of anti-seismic design.

The following maps must be obtained in the seismic zoning:

1. Map of source zones (seismogenic zone maps),
2. Map of maximum seismic intensities I_{max} which indicates the sources generating these earthquakes,
3. Map of return period of seismic intensity ≥6, from which one can deduce the map of seismic intensity for various intervals of time predicted with a determined probability,
4. Map of seismic oscillation parameters, especially maximum acceleration a_{max}.

- The map of source zones is compiled following the geotectonical and seismological data, on the basis of a study on the correlation between

great earthquake focus with tectonic structure and activity. In this map are indicated the situations of zones able to generate earthquakes with magnitude M≥5 (past and predicted), their main seismic characteristics as maximum magnitude, M_{max}, focus depth, return frequency of earthquake with various magnitudes.

- Map of maximum seismic intensity is compiled on the basis of source zone map and correlation between seismic intensity with source characteristics and distance from the source: $I = f(M, h, \Delta)$ (macroseismic field equation). This equation is established following macroseismic data about large and perceptible earthquakes and is described by the Blacke equation:

$$I = bM - S\log\sqrt{\Delta^2 + h^2} + C$$

The coefficients obtained for Vietnam are: $b = 1.5$, $S = 3.0$; 3.5; 3.2 corresponding to the direction along the structure, perpendicular to the structure and between these directions, respectively, $C = 2.6$; 3.0; 2.8 for the above mentioned directions, respectively. In the epicenter (epicentral distance $\Delta = 0$) the seismic intensity is related with the source characteristics by:

$$I_0 = 1.5M - 3.2\log h + 2.8$$

By using the obtained seismic field equation one can calculate, on the basis of source zone map, the maximum seismic intensity I_{max} at each place of the territory and compile the map of I_{max}.

- Return period of seismic intensities $I \geq$ 6-9 at each place of the territory is calculated on the basis of source zone maps, macroseismic field equation and return frequency of the earthquakes in source zones. On the basis of the obtained results the map of return period T_i for intensities $I \geq$ 6-9 will be compiled.

- Finally, because of the lack of recorded data on ground motion in large earthquakes, the map of maximum acceleration a_{max} is compiled on the basis of a_{max} data calculated following source characteristics (map of source zones) using experimental correlation obtained for the world.

To date, only the map of source zones and the map of maximum seismic intensity I_{max} with scale 1:2,000,000 (Figures 3 and 4) are compiled and used.

Seismic microzoning

Seismic microzoning is seismic zoning in great scale, which takes into account the influence of ground conditions on seismic intensity. Maps of seismic microzoning were compiled for Hanoi and some industrial construction sites. The parameters on seismic microzoning maps were utilized in the planning and design of construction.

Assessment of seismic hazard for construction sites

To estimate the seismic parameters for anti-seismic design (maximum seismic intensity, return period of maximum and smaller

intensities (but $I \geq 6$), parameters of ground motion) of construction situated in places where microseismic zoning was not completed, we have carried out the especially detailed prospecting.

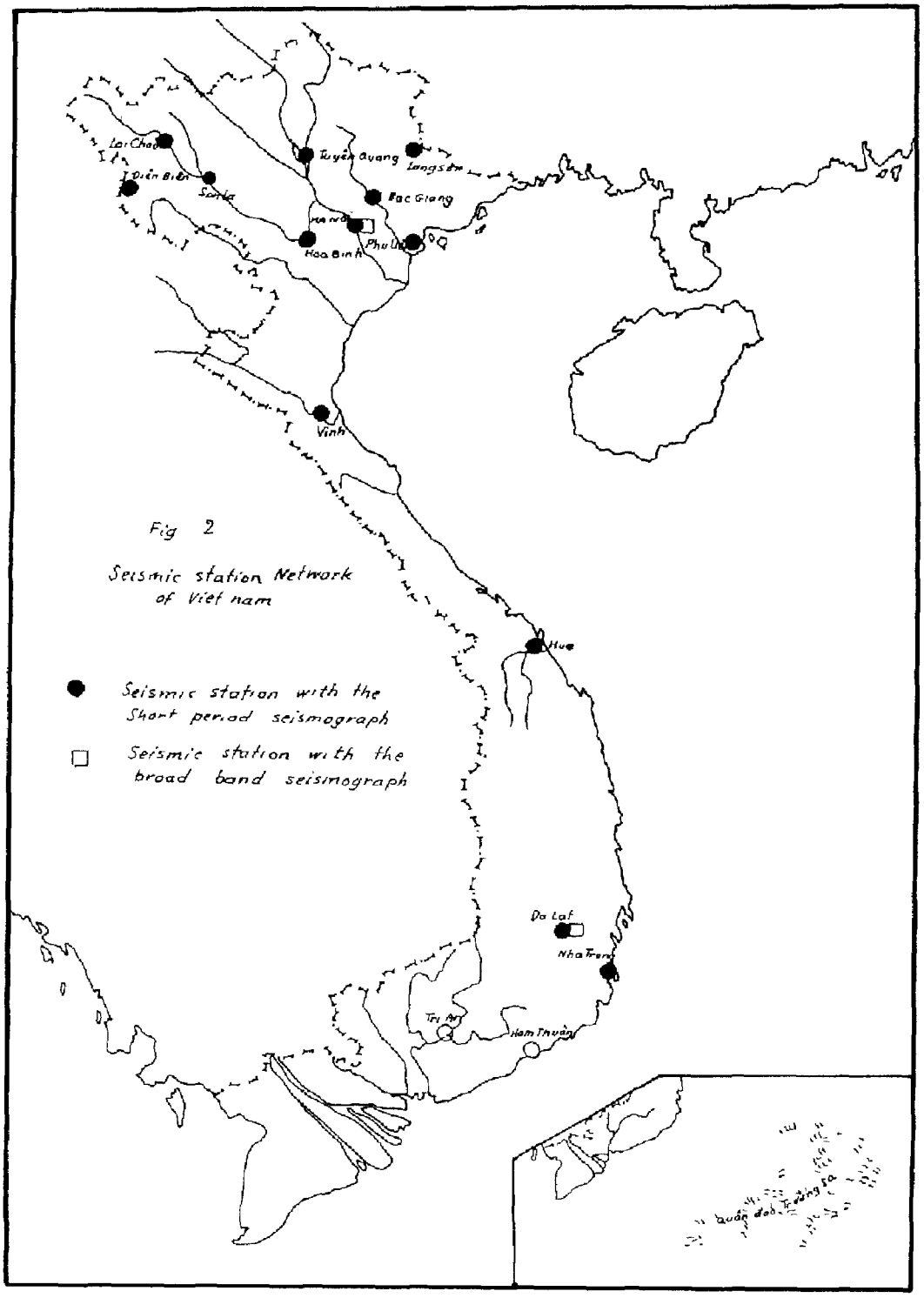

Figure 2: Seismic station network of Vietnam

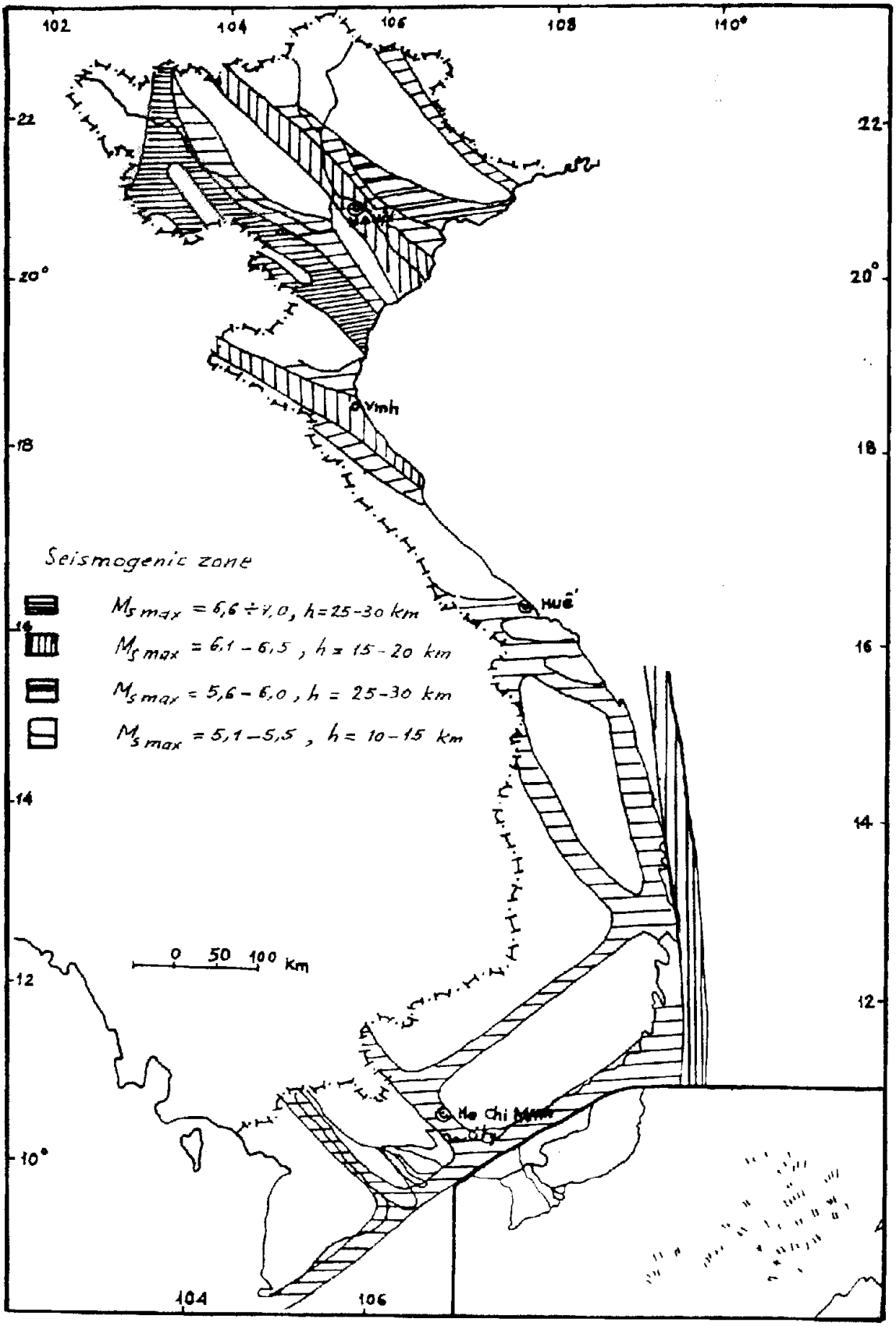

Figure 3: Seismogenic zones map of Vietnam

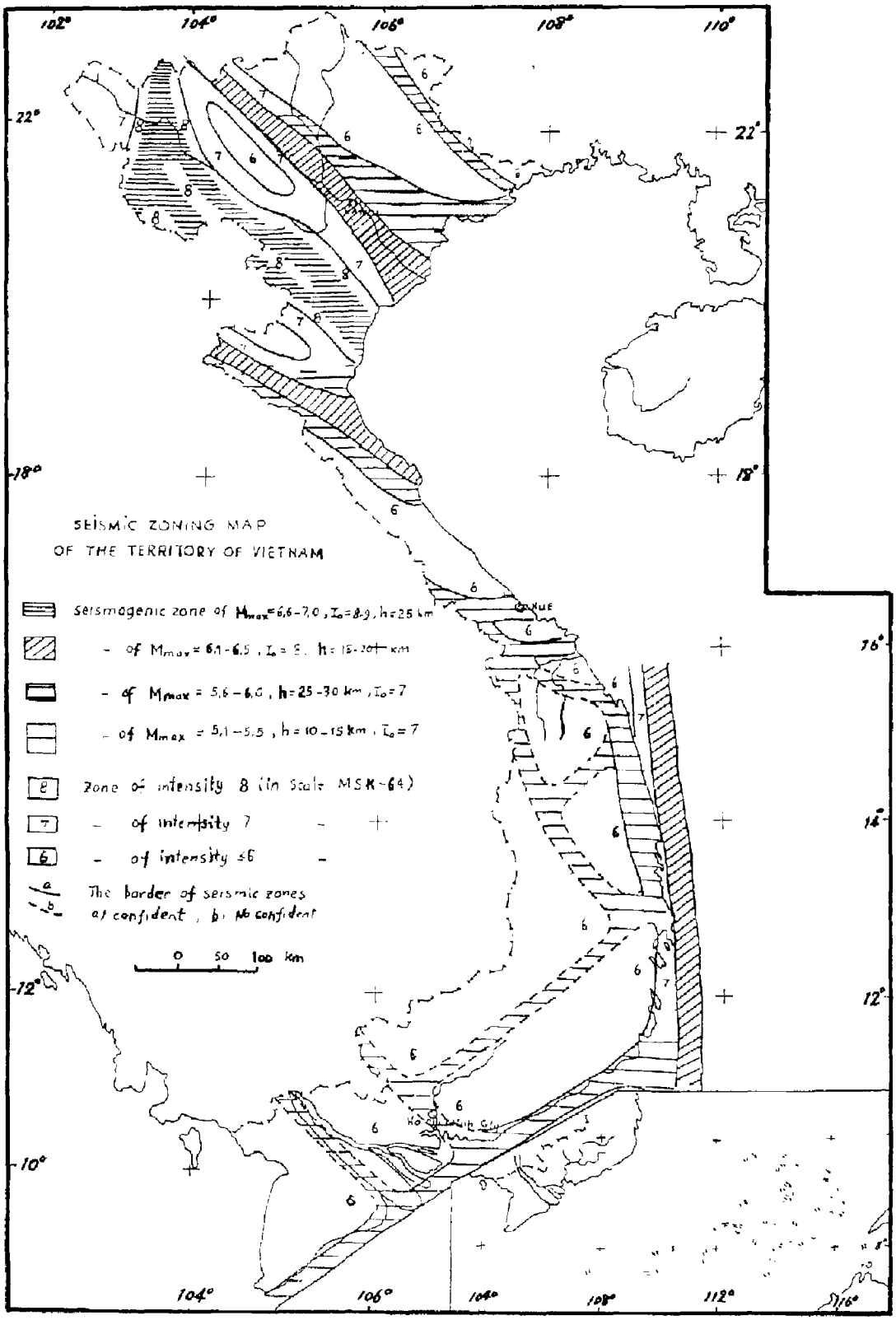

Figure 4: Seismic zoning map of Vietnam

3 MEASURES FOR SEISMIC SAFETY

Construction Regulations

The regulations of anti-seismic construction were only taken into account by some branches in the last few years. In 1985, the Vietnamese Ministry of Construction in collaboration with interested organizations of the USSR had compiled the "common united technical regulations" to be applied to industrial construction by the USSR in Vietnam. In these regulations the anti-seismic measures were considered as obligatory. In 1987, the Ministry of Construction and Transport also made it obligatory to take into account the anti-seismic measures for communication and transport construction. In 1988, the Vietnamese government gave to the Institute of Construction Standard the responsibility of compiling technical regulations to be applied in the foreign investment laws in Vietnam. In these regulations, the anti-seismic measures are also considered as obligatory for some construction. To date, the compilation is not yet completed. There are no government regulations for seismic safety to be applied.

Building Code and Building Standards

The design for anti-seismic construction is only applied to big construction like hydropower construction, large plants, bridges, underground construction, tall buildings, and eternal cultural constructions. Almost all the houses in the countryside were built without anti-seismic measures.

Vietnam does not still have its own building code. So, the anti-seismic design uses building codes of other countries, especially the USSR.

Earthquake Prognostic

Earthquake prognostic is still a problem to be studied. The Institute of Geophysics is searching for the precursors of long-term prediction on the basis of the seismic regime and other geophysical field controls.

Recently, many large reservoirs were constructed and are now in operation. These have induced earthquakes. The problem of control and prediction of induced earthquakes in large reservoir zones became very important and pressing. The projects to study this matter were proposed and carried out for some constructions.

Training and Education

Training and education on earthquakes and seismic safety have begun in the framework of engineers working in seismological research and construction design.

The presentation of popular understanding on earthquake and seismic safety is very limited. It is made by some popular books and some lectures in the club to the population in zones where earthquakes have occurred.

Other Measures

- As with other disasters, the Government had given aid to reduce earthquake consequence, but this service is not taken as a permanent one with a separate committee like the committee for flood and storm control.

- Insurance service and other measures are not applied because the frequency of large earthquakes in condensed populations zones is not high.

4 SEISMIC HAZARD AND RISK MANAGEMENT ORGANIZATION

In Vietnam, there is no unified organization of services for the multilateral management of seismic hazard and risk. But the specialized institutes, following their responsibility and capacity, are carrying out some important activities in seismic safety strategy.

- The Institute of Geophysics - National Center for Scientific Research of Vietnam (NCSRVN).- is responsible for the control of seismic regime in the territory of Vietnam. This Institute has a seismological station network.

The Institute of Geophysics also has the main responsibility for the assessment of seismic hazard. In collaboration are the Institute of Geology - NCSRVN and the National Department of Geology, the National University and the College of Mine and Geology. These institutions are carrying out studies on the geological basis for seismic hazard assessment.

- Those responsible for the compilation of building code and standards are:

  The Institute of Geophysics - NCSRVN: This institute carries out the study of seismic characteristics, e.g., seismic intensity, seismic return period, ground motion.

  The Institute for Construction Design and Technology of the Ministry of Construction, the Ministry of Communication and Transport, the Ministry of Energy: These institutes study the action of earthquakes on various kinds of construction and houses, suggest anti-seismic design measures, material standards, etc.

  The Institute of Construction Standards - Ministry of Construction: This institute studies the regulations and standards of anti-seismic construction.

- Training and education are carried out at the Institute of Geophysics, the University, the College of Mine and Geology, the College of Construction, the College of Architecture, etc. An important form of training is the sending of cadres to training courses organized by international or foreign institutions.

- National Committee for IDNDR was founded by the Government in 1991 to unify the direction of natural disaster management to meet

the International Decade for Natural Disaster Reduction. It focuses its activities on organizing disaster prediction studies, disaster preparedness, cadre training, knowledge diffusion, aid and reduction of disaster consequences. Storm, flood and earthquake are the disasters which are given high priorities.

5 GAPS OF SEISMIC HAZARD AND RISK MANAGEMENT IN THE PAST

Because of the lack of knowledge about the importance of earthquake preparedness in Vietnam, a systematic strategy was organized and carried out only lately. The activities which were completed are the initiatives and effects of the specialized institutions. However, because of funding and organizing reasons, many important works are not being carried out. Many works which were completed do not answer to the requirements. In general, Vietnam is still backward in seismic safety relative to many countries in the region. This is manifested as follows:

- The seismic zoning maps are still not adequate and reliable. The seismic intensities return period map and the ground motion map (maximum acceleration, a_{max}) are not complete.
- The building code and standards suited to the conditions of Vietnam are not yet completed.
- There are no official regulations on seismic safety.
- There is no policy on seismic safety aid, insurance, mitigation, etc.
- The training and formation of cadre have not been given much attention.
- A systematic organization for seismic hazard and risk management is nonexistent.
- Governmental investment for seismic hazard and risk management is still not enough to carry out the most important activities.

6 PROGRAM OF SEISMIC HAZARD AND RISK MANAGEMENT IN VIETNAM IN THE NEAR FUTURE

To overcome the above mentioned problems and to efficiently manage the seismic hazard and risk in the next 3-5 years, Vietnam will have to carry out the following programs:

(1) Implementing the extension phase of the UNDP project VIE/84/011 "Modernization and Reinforcement of Seismological Service in Vietnam," improving the National Seismological Station network, carrying out the program of quick receipt and interpretation of seismological data,

(2) Compilation of seismic zoning maps with scale 1:1,000,000 :

- Map of source zones

- Map of maximum seismic intensity
- Map of seismic intensity return period for intensities ≥ 6-9.
- Map of ground motion, especially maximum acceleration a_{max}

(3) Compilation and implementation of building code, building standard, construction regulations,

(4) Cadre training, knowledge diffusion about seismic safety in the population, especially in the region of seismic activity,

(5) Policy recommendation on seismic safety.

To realize the above mentioned programs, Vietnam will participate in international programs like IDNDR, GSHAP, WSSI. Through this participation, Vietnam will receive the technology, the methodology, the cadre training, and the necessary documents and information. Vietnam, through its activity program, will also organize international workshops, seminars and training courses with support from international institutions.

N. D. Xuyen (Vietnam)

R. Meli (WSSI)

W. D. Iwan (WSSI)

For Posterity *Workshop participants pose for a group photo*

SUMMARY OF THE WORKSHOP ON SEISMIC RISK MANAGEMENT FOR COUNTRIES OF THE ASIA PACIFIC REGION

FEBRUARY 8-11, 1993, BANGKOK, THAILAND

TSUNEO KATAYAMA and HARESH C. SHAH
Cochairmen
WSSI Interim Organizing Committee

1 BACKGROUND

It is well known that the International Decade for Natural Disaster Reduction (IDNDR) was originally conceived within the International Association for Earthquake Engineering (IAEE). In his keynote lecture during the 8th World Conference on Earthquake Engineering (WCEE) in San Francisco in 1984, Dr. Frank Press, President of the US Academy of Sciences, proposed the idea of the Decade in which the societies should endeavor in a concerted international effort to reduce the effects of natural disasters on human lives, properties and socioeconomic activities.

Although the IDNDR started as a UN Program on January 1, 1990, the IAEE was not able to strongly participate in IDNDR activities because of its structural and budgetary constraints. Early 1992 the Central Office of the IAEE asked the Earthquake Engineering Research Institute (EERI), the US National Organization of the IAEE, to draft a document to officially declare the standpoint of the IAEE with regard to the IDNDR. "A Time for Action: World Seismic Safety Initiative" was prepared in time for the 10th WCEE in Madrid in July 1992. The concept of the World Seismic Safety Initiative (WSSI) was discussed in Madrid during one of the Special Theme Sessions and it was unanimously agreed for the IAEE to proceed along the guidelines described in the document. This was endorsed by the IAEE Executive Committee and the General Assembly of Delegates adopted resolutions in which the establishment of the WSSI was clearly mentioned.

To perform such duties as required to establish the WSSI until the members of the Board of Directors are appointed, the WSSI Interim Organizing Committee (WIOC) has been formed. The present members of the WIOC (as of February 1993) are:

G. Grandori (Italy),
G. W. Housner (USA),
W. D. Iwan (USA),
T. Katayama (Cochairman; Japan, Secretary General, IAEE),
R. Meli (Mexico),
H. C. Shah (Cochairman; USA),
C. C. Thiel (USA), and
K. Toki (Japan).