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INTERNATIONAL TRAINING PROGRAM ON SEISMOLOGY AND EARTHQUAKE ENGINEERING AT INTERNATIONAL INSTITUTE OF SEISMOLOGY AND EARTHQUAKE ENGINEERING

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ABSTRACT: The International Institute of Seismology and Earthquake Engineering (hereinafter referred to IISEE) of the Building Research Institute (hereinafter referred to BRI) has conducted the international training program for over 40 years and has received 1200 participants from about 90 countries. In this paper, history and present activities of the training courses are introduced, and its future will be discussed.

Key Words: training on seismology & earthquake engineering, ODA of Japan

INTRODUCTION

Over forty years have now passed since the Seismology and Earthquake Engineering Training Program was begun in 1960 at Tokyo University and then taken over by the BRI in 1962. The number of the researchers and engineers completed the training program reaches a figure of as much as 1200 persons. The institute has been implementing not only the training on seismology and earthquake engineering but also the other courses provided for young researchers and engineers from developing nations. In this article, the past and current trainings in the institute are described and the role of which the institute ought to play in the future is discussed.

HISTORY OF THE IISEE

It was in the late 1950s that a significant increase first began to occur in the number of young engineers and researchers coming to Japan to study seismology and earthquake engineering from developing nations subject to frequent earthquakes and earthquake damage. Then spurred on by the holding of the Second World Conference on Earthquake Engineering in 1960, leading researchers in seismology and earthquake engineering from Japan and from around the world began to discuss the need for and importance of a program for the training of groups of young researchers and engineers who had until then come to Japan to undertake their studies only on an individual basis. In response to these calls, Prof. Shinji Nasu, then the director of the Tokyo University Earthquake Research Institute, and other researchers got together to form a Special Committee for an International Training Program in Earthquake Engineering (headed by Kaya Seiji, then the president of Tokyo University) at Tokyo

University, and beginning from July of that same year a nine-month training course was held with the help of scholarship funding provided by the Overseas Technology Cooperation Agency, the forerunner of today's Japan International Cooperation Agency.

The success of this program served as an impetus to establish the program on an ongoing basis, and with the consent of the Science and Technology Agency, the Ministry of Foreign Affairs, the Ministry of Education, the Ministry of Transport, the Ministry of Construction, and other related government agencies and ministries, the International Institute of Seismology and Earthquake Engineering (hereinafter referred to IISEE) was established as an organization responsible for the conduct of a training program to be offered at the BRI, and from the second year onward the training program was established as a one-year course beginning in September on an annual basis. It was in 1962 that the IISEE was actually founded, and until the time when the institute could actually be established the second course was given at the Naito Kinenkan (Naito Memorial Hall) at Waseda University.

From the time of the original founding of the United Nations Economic and Social Council (ECOSOC), there had been an increasingly strong recognition of the need for international cooperation in seismology and earthquake engineering to prevent major loss of life and physical resources from earthquakes and tsunamis. Towards this end, a decision was reached whereby the United Nations Educational, Scientific and Cultural Organization (UNESCO) would provide support for the IISEE training program using special UN funding, with this funding to be provided over the ten years from 1963 to 1972. This UN funding was then used to invite renowned scholars from overseas, to purchase seismographs and other equipment, to build a library for the institute, and to otherwise improve the quality of the training program. Each year two to four visiting foreign scholars were invited, and a total of 27 visiting foreign scholars taught at the institute during these ten years. This assistance from UNESCO helped the IISEE training program in seismology and earthquake engineering gain a reputation throughout the world as an important and valuable program.

From 1972 onward this program became a regularly offered course, and it has continued to be offered as a course supported by the Japanese government. During this time the BRI was moved from Tokyo to Tsukuba, major improvements were made in the research and training facilities of the institute, and the content of the training program was updated to provide education in the latest knowledge and information on seismology and earthquake engineering.

Over the twenty years from 1980 to 2000, in addition to the regular course earthquake engineering seminars were also held once every two years to provide participants with advanced specialized knowledge and to study methods of preventing and reducing earthquake damage in ways which take into account local conditions in different countries, to identify the problems each country faces, and to contribute to further technological cooperation and cooperative research. The central topics addressed in these seminars have been the discussion of the most effective and most up-to-date methods in seismology and earthquake engineering. Over the period from 1985 to 1995, the calling of visiting foreign scholars to the institute, which had been halted since the end of the original joint program with UNESCO had ended, was restarted with the assistance of the UNESCO Southeast Asian regional bureau for science and technology.

Beginning from 1995, a new course in global earthquake monitoring was added to provide training in the techniques used to detect underground nuclear tests. Designed to contribute to the construction of a worldwide earthquake monitoring network as part of a larger plan for trying to prevent underground nuclear testing through the transfer of state-of-the-art Japanese earthquake monitoring technologies to nations with less developed seismological and monitoring technologies, this course represents one of the most important efforts being undertaken by Japan to assist in the monitoring of adherence to the Comprehensive Nuclear Test Ban Treaty.

The year 1992 marked the thirtieth year since the beginning of the international earthquake engineering training program at the BRI, and to commemorate this anniversary the institute held its ninth International Seminar on Earthquake Engineering together with the IDNDR (International Decade for Natural Disaster Reduction) International Symposium on Earthquake Disaster Reduction Technology. Held over the three days from December 15 to December 17, 1992 at the international conference hall of the Tsukuba Center for Institutes in Tsukuba, this symposium was held, in accordance with the objectives of the United Nations IDNDR, to focus on the issues of how to promote the spread of earthquake damage mitigation technologies and technological transfer, and with the assistance of the United Nations Centre for Regional Development and other organizations, over thirty leading figures in fields related to earthquake damage mitigation technologies were invited from Japan and abroad to act as lecturers and panelists, thus obtaining the participation of over 220 persons from 27 countries including Japan and making the symposium an exceptionally successful one.

In addition to this, in 1998 the twelfth earthquake engineering seminar was held over a special extended period of some forty days as a special seminar targeted at technical specialists involved in the RADIUS (Risk Assessment Tools for Diagnosis of Urban Areas against Seismic Disasters) initiative planned and implemented in accordance with the United Nations IDNDR. With the participation of leading researchers from a total of 17 countries, this seminar proved to be successful as a place for the building of networks amongst researchers involved in the fields of seismology and earthquake engineering.

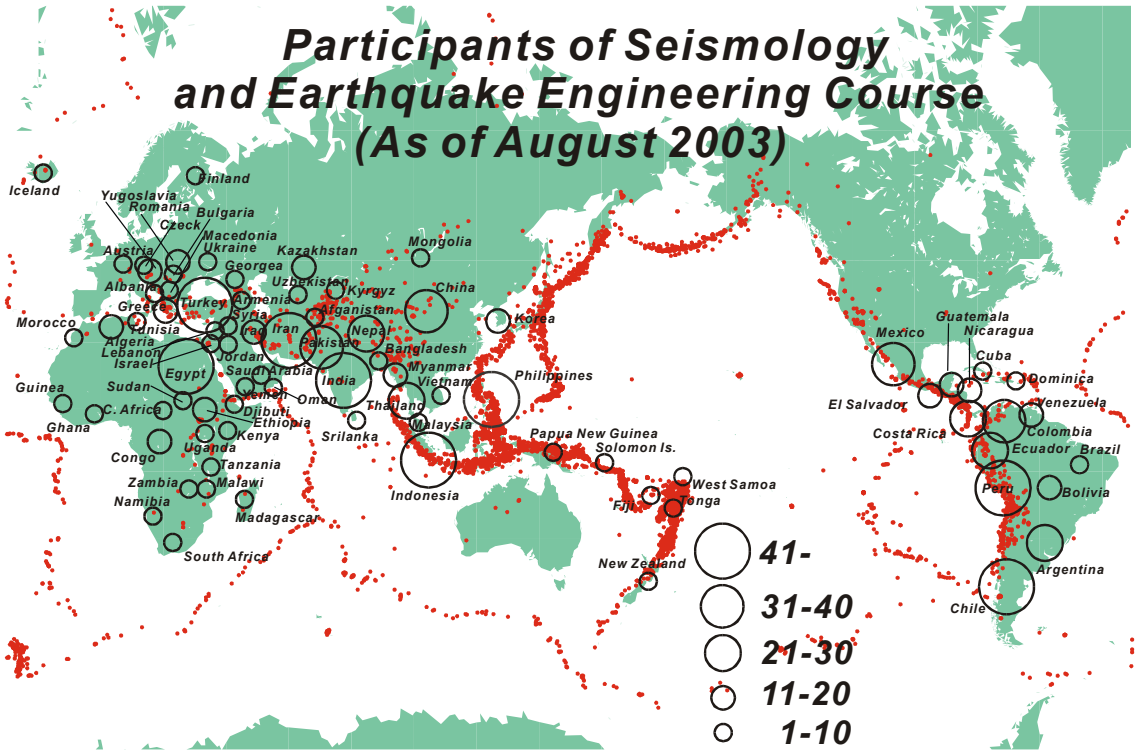

Figure 1 Participants for training courses at IISEE

CURRENT-DAY ACTIVITIES AT THE IISEE

At the present time, the IISEE offers three different types of training courses: a regular course, a global seismological observation course, and individual courses.

Regular Course

The regular course is an 11-month training program divided into two separate subcourses: a course in seismology and a course in earthquake engineering. The first two months of this period are spent in intensive training with lectures on the basic topics in mathematics, physics, computers, and other related disciplines needed in order to understand more specialized lectures in seismology and earthquake engineering. In the seismology course, this is followed by lectures which include discussions of source processes, the internal structure of the earth, plate tectonics, volcanoes, and geology, and in the earthquake engineering course this is followed by lectures which include discussions of geotechnical engineering, structural analysis, seismic design, and earthquake damage control. Lecturers include not only instructors from the IISEE, but also many visiting professors and researchers from universities, research institutes, private corporations, and other organizations as well. In addition to these lectures themselves field trips are also held, field trips which include two one-week trips to Hokkaido and to the Kansai area held for both the seismology and earthquake engineering courses and other trips which include trips to volcanoes, geological faults, seismological monitoring stations, construction sites, and other research institutions. Whenever a destructive earthquake occurs anywhere in Japan, the institute also conducts tours to view the earthquake damage, e.g., as in a tour to Okushiri after the Hokkaido Nansei-Oki Earthquake in July 1993, a tour to the city of Kobe and its environs after the Kobe Earthquake of January 1995, and a tour to the city of Sendai and its environs after the earthquake with an epicenter located in northern Miyagi Prefecture which occurred in July 2003. Participants in the training program are also provided with a period of about four months at the end of the training period which serves as an independent study period during which the participants may perform research on topics of their own selection under the guidance of a supervising instructor.

Global Seismological Observation Course

While the international earthquake engineering training program has always been conducted as part of a larger effort by the Japanese government to provide international cooperation and contribute to the international community in cases of disruptions caused by war or natural disaster, since 1995—which marked the fiftieth anniversary of the end of the second world war—this program has also been viewed as a measure for contributing actively to the international community by promoting the spread of seismological observation technology throughout the world and expanding the global network of seismological observation stations to discourage the conducting of underground testing by the nuclear powers and thereby promote nuclear disarmament in particular and disarmament in general. Lasting for a period of two months, this program is designed to help participants acquire the skills and techniques needed to use seismological methods of determining epicenters to detect underground nuclear tests. The countries targeted by the program are mainly countries which have no seismological observation technologies of their own or which have only less advanced forms of such technologies.

IISEE-net

Over the forty years of the existence of the program, the IISEE has provided training to nearly 1200 participants from 89 different countries. The ties formed between the graduates of this program and the IISEE have resulted in the creation of a valuable network of people involved in seismology and earthquake engineering. In order to make more effective use of this network, in 2003 the IISEE created a website (http://iisee.kenken.go.jp/) for the posting of information on earthquake disaster mitigation technologies and related information. This website provides free access at any time to anyone with a computer connected to the Internet to technical information on seismological observation networks, major earthquake observation networks, reports of earthquake damage from past earthquakes, seismic building standards, and example of seismic microzoning throughout the world. Most of the materials contained on this site consist of materials accumulated during the course of training and materials collected through the network formed by graduates of the program. IISEE-net, however, is not just a framework for the one-way presentation of information, but instead has the characteristics of being able to serve as a forum for the two-way exchange of information with and between researchers and research institutions in developing nations. This makes it possible to obtain

the latest information from developing nations while helping to prevent older information becoming swamped by new information, and it also makes it possible to increase the amount of information available on an ongoing basis.

In addition to materials such as these, the site also contains data collected using our strong seismic motion observation network posted at http://iisee.kenken.go.jp/smo/index.html. When major earthquakes or earthquakes resulting in significant damage occur in Japan or overseas, a special page is created within the website to provide breaking reports on analyses of such earthquakes performed by the IISEE, breaking reports on strong seismic motions, damage information, earthquake information from other organizations, and collections of links to related organizations and news sites. Examples of such special pages were created in 2003 include the Colima Earthquake in Mexico on January 22, the earthquake in northern Algeria occurred on May 21, the Miyagi-Oki Earthquake on May 26, the Northern Miyagi Earthquake on July 26, and the Tokachi-Oki Earthquake on September 26 of that year.

THE FUTURE OF THE IISEE

While today's IISEE is a product of the effort and dedication shown towards the program by everyone who has worked here until now, it would be worthwhile here to examine the future of the IISEE in a way which takes into account the demands of people from developing countries.

First, just as in the project for the 'Development of Systems for the Early Estimation of Earthquake Damage in Building Structures' in which all IISEE researchers are now currently involved, research topics ought to be selected from areas where it is possible to build upon the results of research in Japan and obtain new results of a kind which would be able to be applied in developing nations, and these results should then be made widely available through training lectures and IISEE-net. It is particularly important to deepen and broaden the range of information made available through IISEE-net. The BRI, which has been involved in JICA technological cooperation projects, has played a role in the creation of CISMID which is an earthquake disaster mitigation organization in Peru associated with the National University of Engineering, CENAPRED which is National Center for Disaster Prevention in Mexico, and the Earthquake Disaster Prevision Research Center in Turkey which is an organization associated with the Turkish Ministry of Public Works and Settlement and Istanbul Technical University. The BRI has also worked with the improvement of the Indonesian Research Institute for Human Settlement, and at the present time is working on the Romanian Earthquake Damage Mitigation Center project. In addition to work such as this, the BRI has also proven successful in providing technological cooperation in seismological observation to the National Research Institute of Astronomy & Geophysics of Egypt, participating in research cooperation on the seismic design of building structures with the Catholic University of Chile, and providing technological cooperation to the Kazakhstan Institute of Seismology about seismological technologies for earthquake disaster prevention and earthquake risk analysis. As graduates of the IISEE training program may be found working at all of these institutions, these people should play a rule in selecting their research topics in seismology and earthquake engineering common to all developing nations and conducting joint international research under the direction of the IISEE.

From the standpoint of serving as a source of information on earthquake disaster prevention, it is important that the IISEE creates electronic versions of the lecture notes used in training and creates its own series of IISEE textbooks on seismology and earthquake engineering. The creation of electronic versions of the lecture notes would be highly useful not only to current trainees but should also prove extremely useful in the reeducation of earlier graduates of the program. Our ultimate objective in doing so would be to allow these educational materials to be used by graduates of the program to provide training to later students themselves. This is very important in the sense that it would thus make it possible for people from developing nations to act upon their own initiative to increase the

number of persons involved in earthquake disaster prevention in their own countries.

In regards to the reeducation of trainees, one problem for the IISEE training program which must be addressed is that of the reinstitution of the earthquake engineering seminar course eliminated in 2001. Designed to provide persons who have finished their training at the IISEE in their younger days and have attained authoritative positions after the passage of several years with the opportunity to come back to Japan again, these seminars provided a forum in which trainees could identify specific problems from amongst the problems they have faced at their home countries, discuss possible solutions to these problems together with all of the other seminar participants, and learn about the latest developments in earthquake engineering. This method, whereby people come to learn in Japan while they are still young, return to their own countries to put that knowledge in practice, and then learn new knowledge with an increased awareness of the issues involved, would be an extremely effective way of transferring knowledge and technology from Japan to the world at large. This course ought to be reinstituted.

It has already been pointed out by many instructors that there are large differences in the basic level of academic ability between trainees in core subjects, and one possible way of improving this situation might be to have trainees undergo preparatory courses in the core subjects before coming to Japan. In regards to basic knowledge of mathematics and other subjects needed for participation in training, preparatory textbooks could be created and distributed through the Internet so that trainees could acquire the necessary knowledge before coming.

As for the subjects covered in the training program, efforts have been made to expand the breadth and depth of subjects covered in keeping with the times. Beginning from the 2004 training period, in addition to courses on seismology and earthquake engineering a new course on earthquake disaster mitigation policies has also been added, and rather than aiming only for the acquisition of knowledge of advanced earthquake-related technologies, we now aim to foster the development of professionals who also have the capability to participate in earthquake disaster mitigation policies of the kind which would make it possible to utilize and promote the spread of related knowledge and technology. While efforts have been made in developing nations to transfer earthquake engineering technologies from developed nations, the actual state of affairs is such that there continues to occur repeated tragic damage from earthquakes as the result of the collapse of weak residential buildings highly vulnerable to earthquake damage. This problem of taking measures to protect building structures in developing nations in earthquake-prone regions from earthquake damage cannot be solved simply by the transfer of earthquake and earthquake-resistance technologies from developed nations alone, and instead there is a need to make it possible for individual nations and regions to develop workable earthquake and earthquake-resistance technologies of their own designed fully in accordance with a consideration of the conditions, policies and other factors unique to each such nation or region, and it is for this reason that the fostering of personnel able to respond to such needs is an urgent issue which must be addressed.

In past years, UNESCO funding had been provided to allow for the invitation of renowned specialists from overseas to conduct lectures, and this proved extremely valuable to trainees. In 2001 the BRI was reorganized as an independent administrative agency thus making it easier for the BRI to invite foreign specialists to the institute. The one way of improving the depth and breadth of the curriculum might therefore be to invite persons involved in front-line activities from amongst leading specialists and graduates of the program and give lectures especially on areas not found in Japan's earthquake-related technologies, e.g., lectures on the seismic behavior of building structures using local construction techniques and lectures on methods of improving such seismic performance.

The best means of improving the effectiveness of training is to attract outstanding trainees. While improving the quality of the program itself to make it an attractive one is also important in achieving that goal, it would also be effective to provide graduates with an internationally recognized form of

certification and thereby increase the willingness and desire of trainees to learn. There have been many trainees in the past who expressed a wish to be able to receive a masters degree for almost one year of training, and there have been efforts made towards that end, but that goal has never yet been reached. Since the time when the program first began, the level of the courses has always been maintained at a level equivalent or higher than that of a master's program at a Japanese graduate school. The knowledge and abilities of trainees at the time of the completion of the program with regards to their own areas of specialization are commensurate with those needed for a master degree. Since the IISEE is not in itself an educational institution, it would be necessary to work in conjunction with a university in order to confer master degrees. Every possible effort should be made to realize this goal sometime in the near future.

CONCLUSION

It is now over forty years since the Seismology and Earthquake Engineering Training Program first began in 1960, and it has only been through the understanding and effort of the people involved that the program has been continued to this day. Yet even now that over forty years have passed, the IISEE has lost none of the mission and importance of this program, and ought to come to play a new role in fostering the development of leading personnel who can put their knowledge of seismology and earthquake engineering to use in contributing towards earthquake disaster mitigation in developing nations.

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