



# OUTLINE OF 21<sup>ST</sup> CENTURY COE PROGRAM: EVOLUTION OF URBAN EARTHQUAKE ENGINEERING

Tatsuo OHMACHI<sup>1</sup> and Kohji TOKIMATSU<sup>2</sup>

<sup>1</sup> Member of JAE, Professor, Department of Built Engineering  
Tokyo Institute of Technology, Japan, ohmachi@enveng.titech.ac.jp

<sup>2</sup> Member of JAE, Professor, Department of Architecture and Building Engineering  
Tokyo Institute of Technology, Japan, kohji@o.cc.titech.ac.jp

**ABSTRACT:** Densely populated urban cities that comprise a complicated web of people, urban facilities and urban system are highly vulnerable to earthquake disasters. Once an earthquake strikes such a metropolitan city, catastrophic disasters and widespread disaster chain, which may even lead to chaos in the global economy, can be anticipated. This has led to the pressing need for improving the overall earthquake risk reduction technology for urban cities. The Center for Urban Earthquake Engineering has been established to carry out the 21<sup>st</sup> Century COE program entitled "Evolution of Urban Earthquake Engineering," that aims not only to promote the above research objectives but also to strengthen the graduate education program as well as to launch international collaboration in research and education. This paper describes the outline of our COE program on Urban Earthquake.

**Key Words:** 21<sup>st</sup> COE program, urban earthquake engineering, research, earthquake loss reduction, graduate education, international collaboration

## INTRODUCTION

Since the 1995 Kobe Earthquake, various researches and proposals have been made for developing measures to reduce seismic risks in urban cities; however, there still remains much to be done to develop and disseminate feasible risk reduction technologies for the benefit of urban society. Densely populated urban cities that comprise a complicated web of people, urban facilities and urban system are highly vulnerable to earthquake disasters. Once an earthquake strikes such a metropolitan city, catastrophic disasters and widespread disaster chain, which may even lead to chaos in the global economy, could be anticipated. This has led to the pressing need for improving the overall earthquake risk reduction technology for urban cities.

The Center for Urban Earthquake Engineering (CUEE, <http://www.cuee.titech.ac.jp>) was established on September 1, 2003, to carry out the 21<sup>st</sup> Century Center of Excellence (COE) program, entitled "Evolution of Urban Earthquake Engineering," which is sponsored by the Ministry of Education, Culture, Sport, Science, and Technology (MEXT).

## Overview of the COE Program

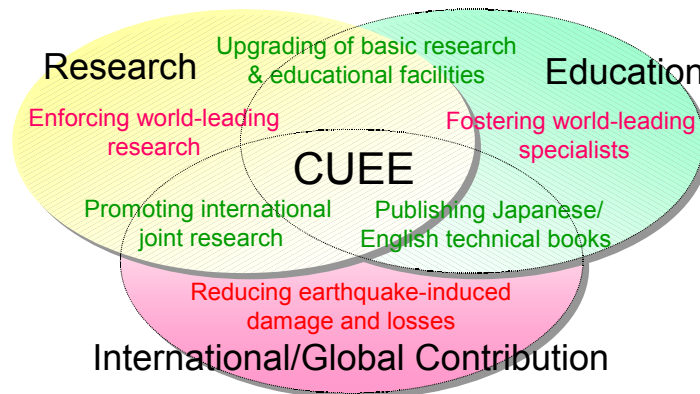


Fig. 1 Overview of the COE Program

CUEE program includes extensive and in-depth research and development (R&D) of new technologies for preventing urban disasters caused by earthquakes. CUEE will work towards making global contributions in the areas of research and education as well as aim to become one of the most advanced international centers for Urban Earthquake Engineering (Fig. 1).

### OVERVIEW OF THE COE PROGRAM

The faculty working in six departments in three Graduate Schools of Tokyo Institute of Technology, which may be ranked as one of the world's top level faculties in the field of earthquake engineering, shall be unified under CUEE together with its research and educational bases to further strengthen the resources. This would enable the research and study on Urban Earthquake Engineering to attain the world's highest standards, making CUEE a global hub, interconnecting North and South Americas, Asia and Europe, for international studies on Urban Earthquake Engineering. To develop in-depth, strategic technologies on urban disaster mitigation, CUEE will focus on the following three major research topics:

- (1) *Advanced Technology for Earthquake Disaster Mitigation*
- (2) *Renovation Technology for Urban Earthquake Resilience*
- (3) *Strategic Plan for Urban Seismic Risk Reduction*

CUEE will also offer special doctoral courses involving overseas studies and OJT (On-the-Job Training) programs to foster potential leaders in the international community. CUEE will forge ahead with more active efforts in collaborating and interacting with foreign as well as local research institutions, government and non-government institutions and Non Profit Organizations (NPO) in order to promote the research on Urban Earthquake Engineering for practical applications.

### PROMOTION OF RESEARCH ON URBAN EARTHQUAKE ENGINEERING

## Research Themes & Topics

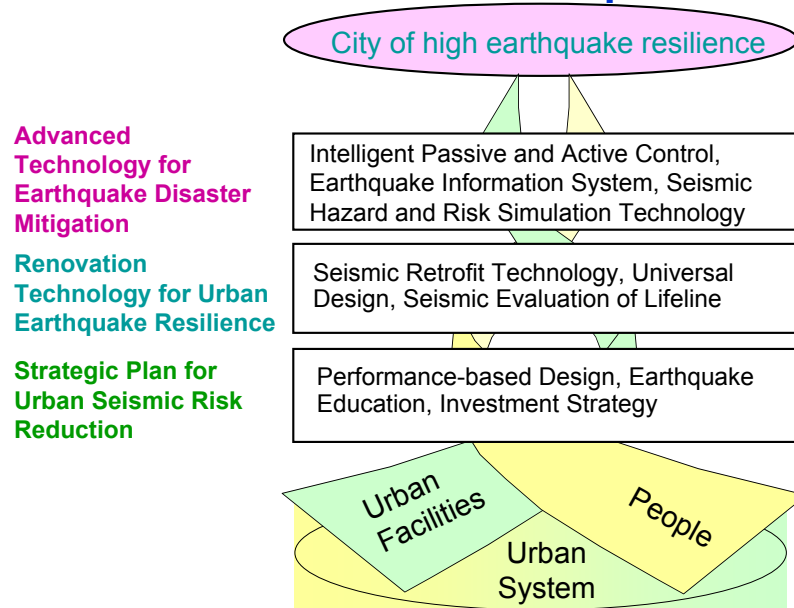


Fig. 2 Research themes and topics

To effectively reduce the earthquake-induced damage and losses that are related to people, buildings and infrastructures, CUEE will enforce studies from the following three viewpoints (Fig. 2):

### **Advanced Technology for Earthquake Disaster Mitigation:**

To develop advanced technologies for the creation of safer cities and communities, R&D will be carried out on topics including: seismic hazard and risk simulation technology, smart material structures, intelligent passive and active control, real-time processing of ground profile survey, high seismic performance foundations, and real-time earthquake information system.

### **Renovation Technology for Urban Earthquake Resilience**

To reduce seismic risks in existing cities and communities, R&D will be carried out on topics including: seismic evaluation of existing facilities in urban areas, comprehensive disaster mitigation technology for ground and underground structures, seismic retrofit technologies with limited environmental impact, regional planning for mitigating fire spread, evacuation planning, and universal design for disaster mitigation.

### **Strategic Plan for Urban Seismic Risk Reduction**

To develop basic strategies for reducing seismic risks of urban cities, R&D will be carried out on topics including: evaluation of urban seismic risks, evaluation of investment required for risk reduction, performance-based design, damage control design, and earthquake education.

## **FOSTERING YOUNG RESEACHERS AND SPECIALISTS ON DISASTER PREVENTION**

CUEE educational program (Fig. 3) aims to offer two special doctoral courses to foster world-leading

## Urban Earthquake Engineering Education Implementation Plan

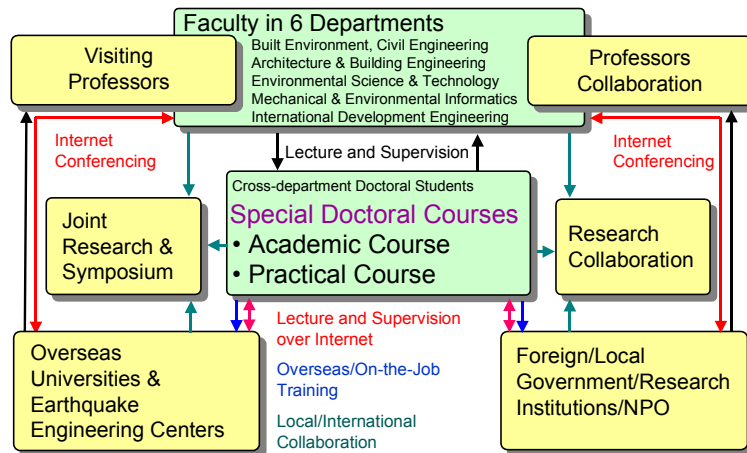


Fig. 3 Educational Implementation Plan

specialists in the area of the disaster prevention, e.g., Academic course to foster researchers and Practical course to foster specialists and experts for immediate deployment.

In order to foster the ability in international communication, teaching, research, creativity, and practice for doctoral and post-doctoral fellows, the CUEE education program includes the following implementations: (i) intensive lectures on English technical presentations, (ii) assignments to Research Assistant (RA) and Post-Doctoral Fellow (PD), (iii) scholarships for overseas school training and participation in international conferences, (iv) research awards to young researchers, (v) supervision by overseas visiting professors, and (vi) publication of technical books on Urban Earthquake Engineering in Japanese and English.

### UPGRADING OF BASIC RESEARCH AND EDUCATIONAL FACILITIES

Basic research facilities such as a high-precision dynamic experimental system and an emergency assessment system will be introduced and/or upgraded. An advanced IT system, enabling internet conferencing and multimedia lectures not only within the university but also with local and foreign institutions, will be introduced, facilitating worldwide collaboration.

### PROMOTION OF INTERNATIONAL RESEARCH COLLABORATION AND CONTRIBUTION

CUEE also aims to promote active international involvements through planning and sponsoring international joint researches, international symposia and exchange programs for young researchers and graduate students. CUEE will also make international contributions through conducting specialized seminars on earthquake engineering for developing countries as well as promote and develop the implementation of practical measures through collaboration with local and international

government and non-government research institutions.

### **PROMOTION OF EDUCATION TO GENERAL PUBLIC ON DISASTER PREVENTION**

Knowledge and information accumulated through these programs will be disseminated to the general public through seminars and Internet, to promote education on Urban Earthquake Engineering and enhance their awareness on disaster prevention.

**(Submitted: March 31, 2004)**

**(Accepted: July 2, 2004)**

**Copyright JAEE**