



## US-JAPAN COOPERATIVE RESEARCH FOR URBAN EARTHQUAKE DISASTER MITIGATION

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**Abstract:** The activities of the US-Japan Cooperative Research on Urban Earthquake Disaster Mitigation are described. The program was supported by the MEXT, Japanese government, and the NSF on the US side. Statements include motivations aroused by complex disasters in urban earthquakes, multi-disciplinary research framework, efforts for coordination, outputs and significant features of the program.

**Keywords:** US-Japan collaboration, urban earthquake disaster, multi-disciplinary framework, project management

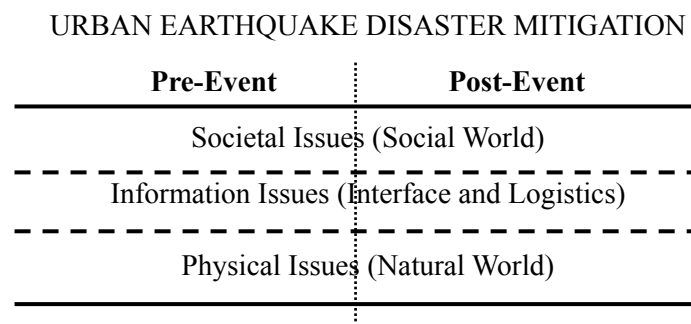
### INTRODUCTION

A five-year bilateral research program “US-Japan cooperative research for Urban Earthquake Disaster Mitigation” was completed in March 2004 (Japan side) and April 2004 (US side). Although the mechanism of funding was different between Japan and the US, efforts were taken on the both sides in order to execute the program in appropriate and effective manners. This program provided the Japanese academic community with a precious research opportunity of focusing on comprehensive urban earthquake disaster mitigation under a framework of US-Japan collaboration. The Japan side funding was provided through Grant in Aid for Scientific Research sponsored by the Ministry of Education, Culture, Sports, Science and Technology (MEXT), and the US side funding by the US National Science Foundation (NSF).

### DEVELOPMENT OF THE US-JAPAN COOPERATIVE RESEARCH

The US-Japan Cooperative Research on Urban Earthquake Disaster Mitigation was developed on the basis of the recommendations developed in the Second U.S.-Japan workshop on Cooperative Research for Mitigation of Urban Earthquake Disasters: -Learning from Kobe and Northridge-, Tokyo, February 27-March 1, 1997 (Okada, Shinozuka, Toki and Mahin, 1997). Since the occurrence of the

disasters in Northridge in 1994 and Kobe in 1995, many bilateral efforts in research projects and workshops were conducted among researchers from Japan and the US, which eventually led to the development of a comprehensive cooperative research program, which is the subject of this paper. It has been recognized that the disasters in Northridge and Kobe demonstrate needs for multidisciplinary approach for the seismic disaster mitigation and recovery. Especially, the lessons from the case of Kobe, which was truly a complex urban disaster, were that urban earthquake disaster mitigation research projects should have a scope to look at physical issues as well as societal agenda on an equal basis, and information-related agenda as an interface between them (Kameda and Hayashi 1995), see **Fig.1**. This orientation was discussed in the Tokyo workshop of 1997, and has been reflected in planning the cooperative research program.



**Fig.1 Physical Issues, Societal Issues and Information Issues in Urban Earthquake Disaster Mitigation**

On this basis, arrangement works began both on the US and Japan sides. They eventually led to the Japan side MEXT program and the NSF program under the same title “US-Japan Cooperative Research on Urban Earthquake Disaster Mitigation.” The Japan-side program was planned to have a one-year preparatory phase in 1998 fiscal year followed by a five-year full budget phase for 1999-2003 fiscal years. The budget size for the preparatory year was 30million JPY, and 60million-71million JPY for the five years of the full budget phase.

The Japan side program was operated under ten designated projects encompassing a holistic framework of urban earthquake disaster mitigation. The framework was stably sustained throughout the period of the program. In contrast, the US side program by NSF was a more dynamic processes based on proposal-review-award processes. The periods of the awarded projects ranged from one to three years. This difference required continuing coordination efforts to find out matching counterparts for individual projects.

### RESEARCH PROJECTS OF THE JAPAN-SIDE MEXT PROGRAM

The Japan-side program for the academic community was operated under the framework of the Grant-in-Aid for Scientific Research of MEXT, category of Priority Research Program (B). It consists of ten designated projects classified in five multi-disciplinary sections. Their titles and the principal investigators are as follows.

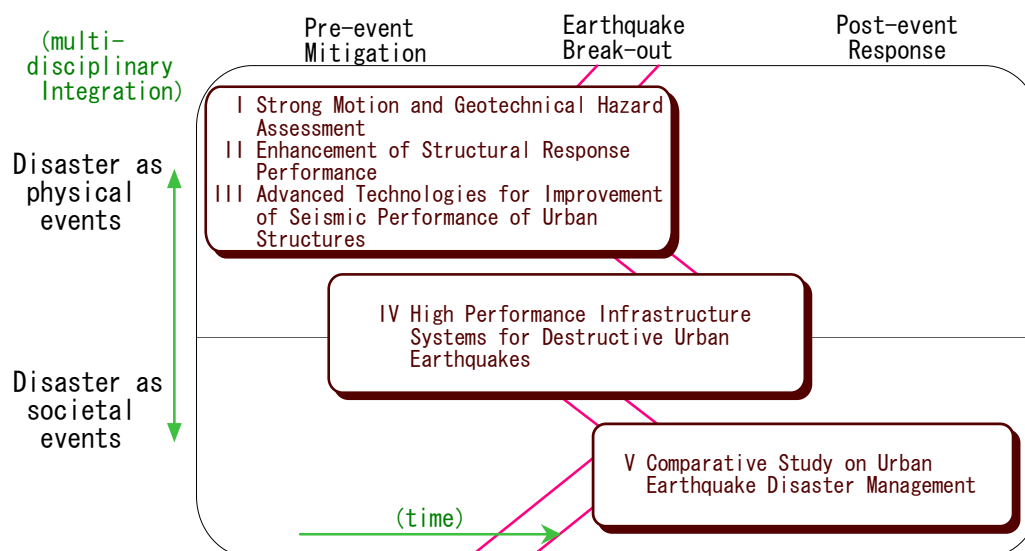
(1) Section 1: Strong Motion and Geotechnical Hazard Assessment

Project 1-1: Prediction of Strong Ground Motions in Urban Regions / PI: Tomotaka Iwata,  
Disaster Prevention Research Institute, Kyoto University;  
[iwata@egmdpri01.dpri.kyoto-u.ac.jp](mailto:iwata@egmdpri01.dpri.kyoto-u.ac.jp)

- Project 1-2: Protection of Underground Structures against Strong ground Motion and Liquefaction / PI : Masanori Hamada, School of Science and Technology, Waseda University; [hamada@waseda.jp](mailto:hamada@waseda.jp)
- (2) Section 2: Enhancement of Structural Response Performance
- Project 2-1: Development of Performance-based Design Methodologies / PI: Toshimi Kabeyasawa, Earthquake Research Institute, University of Tokyo; [kabe@eri.u-tokyo.ac.jp](mailto:kabe@eri.u-tokyo.ac.jp)
- Project 2-2: Preventing Brittle Structural Failure and Ductility Enhancement / PI: Kazuo Inoue, Graduate School of Engineering, Kyoto University; [inoue@archi.kyoto-u.ac.jp](mailto:inoue@archi.kyoto-u.ac.jp)
- (3) Section 3: Advanced Technologies for Improvement of Seismic Performance of Urban Structures
- Project 3-1: Seismic Enhancement of Urban Infrastructures Using New Technologies and Smart Materials / PI: Kazuhiko Kawashima, Department of Civil Engineering, Tokyo Institute of Technology; [kawashima@cv.titech.ac.jp](mailto:kawashima@cv.titech.ac.jp)
- Project 3-2: Development of Structural Monitoring and Damage Detection Systems / PI: Yoshiyuki Suzuki, Disaster Prevention Research Institute, Kyoto University; [suzuki@zeisei.dpri.kyoto-u.ac.jp](mailto:suzuki@zeisei.dpri.kyoto-u.ac.jp)

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Grant-in-Aid for Scientific Research, Monbusyo (1999-2003)



**Fig.2 Illustration of the Project Framework (Japan Program)**

- (4) Section 4: High Performance Infrastructure Systems for Destructive Urban Earthquakes
- Project 4-1: Criteria for Performance-based Design and Management of Infrastructure Systems / PI : Norio Okada, Disaster Prevention Research Institute, Kyoto University; [okada@imdr.dpri.kyoto-u.ac.jp](mailto:okada@imdr.dpri.kyoto-u.ac.jp)
- Project 4-2: Risk Analysis and Advanced Technologies for Infrastructures / PI: Takashi Okimura, Research Center for Urban Safety and Security, Kobe University; [okimura@kobe-u.ac.jp](mailto:okimura@kobe-u.ac.jp)
- (5) Section 5: Comparative Study on Urban Earthquake Disaster Management
- Project 5-1: Urban Earthquake Disaster Process Modeling and Real Loss Estimation / PI: Yoshiaki Kawata, Disaster Prevention Research Institute, Kyoto University; [kawata@drs.dpri.kyoto-u.ac.jp](mailto:kawata@drs.dpri.kyoto-u.ac.jp)
- Project 5-2: Assessment of Post-event Management Processes Using Multi-media Disaster Simulation / PI: Kimiro Meguro (Phase II), Institute of Industrial Science, University of Tokyo; [meguro@iis.u-tokyo.ac.jp](mailto:meguro@iis.u-tokyo.ac.jp)

The framework of the project is illustrated in **Fig.2**. It shows that the project has been designed to be a multi-disciplinary projects encompassing structural and geotechnical engineering, systems and

lifeline engineering, and social sciences. It covers issues of disasters as physical events as well as social events. This notion leads us to a concept that this is an attempt to integrate solutions for pre-event mitigation and post-event response.

## **PROJECT MANAGEMENT**

While an essential requirement was that individual projects to be successfully conducted, it was regarded as an important issue as to what message would be drawn collectively from this program for the enhancement of urban earthquake disaster mitigation strategies and methodologies. In order to facilitate activities of individual projects as well as to promote development of integrated outputs from the entire program, an Executive Committee was organized. As part of the Executive Committee, International Coordination Committee played an important role for project managements with US counterparts. The Japan-side Executive Committee consisted of the following members:

Japan Executive Committee (affiliations at the time of appointment, 1999):

- \*Program PI: Hiroyuki Kameda, Disaster Prevention Research Institute (DPRI), Kyoto University
- \*Coordination Committee Chair: Shunsuke Otani, Graduate School of Engineering, University of Tokyo
- \*Advisors: Tsuneo Okada, Shibaura Institute of Technology, and  
Kenzo Toki, Graduate School of Engineering, Kyoto University
- \*Secretary General: Tadanobu Sato, DPRI, Kyoto University
- \*Secretary for International Affairs: Masayoshi Nakashima, DPRI, Kyoto University
- \*Public Relations Committee Chair: Yoshiyuki Suzuki, DPRI, Kyoto University
- \*Evaluation Panel: Yozo Fujino, University of Tokyo; Hiroshi Kagami, Hokkaido University;  
Takeharu Kokusho, Chuo University; Fumio Yamazaki, University of Tokyo; and Yoshio Kumagai,  
University of Tsukuba
- \* PI's of the ten designated projects

The committee met at least three times a year where important issues relevant to operation of the entire program were decided, including planning workshops, plans to assist sending young researchers to US counterparts, information exchange on progress of individual projects, etc.

While the academic community is funded by MEXT, Building Research Institute was engaged in activities based on its own budget under the framework of the US-Japan Cooperative Research with NSF-funded US counterparts. Under this circumstance, BRI was invited to major events such as workshops planned by the Executive Committee of the MEXT project group.

US-Japan Joint Grantees' Meetings / Coordination Committee Meetings were held three times in the US and once in Japan.

## **OUTPUTS AND SIGNIFICANCE OF THE PROGRAM**

The outputs of the Japan side program have been published in 11 volumes of the official final reports from the Executive Committee (in Japanese) and each of the ten designated projects (in English). For access to these reports, contact the secretariat through [sato@catfish.dpri.kyoto-u.ac.jp](mailto:sato@catfish.dpri.kyoto-u.ac.jp), or the PI's of the individual designated projects. Besides the official reports, most of the designated project groups

have published proceedings of workshops they held during the course of the project period. They may be obtained via contact with respective PI's. The final report from the US view can be found in the NSF report (Liu and Weber, 2004)

While the readers are advised to get detailed information from these documents, following is a description of what was recognized as significant features of the US-Japan program.

1. A multi-disciplinary research framework encompassing geophysical science, engineering and social science was designed on the basis of complex urban disaster experienced both in the US and Japan.
2. Within the Executive Committee for the Japanese program, the International Coordination Committee was organized for the purpose of coordination with the US side whose counter part was Joint Technical Coordination Committee. Efforts were taken to enhance effective execution of the program. Realizing best matching among the US and Japanese researchers was an important part of the coordination activities.
3. Efforts were taken to understand the comprehensive nature of the program and to develop an integrated concept of urban earthquake disaster mitigation. While the issue was discussed at the US-Japan meetings, the Japanese group held two workshops to discuss this subject.
4. In order to enhance the opportunities for next generation, as many young researchers including junior faculties and graduate students as possible were dispatched from the both countries to their counterpart organizations. The support for the Japanese researchers were offered on one-month basis by the Executive Committee, some of them extended or added via individual project budgets. Including these all, thirty-four Japanese young researchers were sent to US counterparts. Fifteen US young researchers were sent to Japanese counterparts.

In March 2001, the First Workshop by the all Japanese groups was held in Kyoto to discuss the overall issues of the US-Japan Program, where a consensus was achieved to recognize the following accomplishments as particularly based on the US and Japan collaboration.

- Accelerated research accomplishments on subjects of common interests where US & Japan lead the world (1-1, 1-2, 2-1, 2-2)
- Supplementary contributions from US & Japan through areas of their expertise (3-1, 3-2)
- Opening doors to new areas (4-1, 4-2, 5-1, 5-2)
- Training opportunities for young researchers to override “old-established researchers” (all)
- First systematic mechanism in the academic community for US-Japan collaboration for earthquake disaster mitigation

These notions hold as they are thus ending the program successfully.

## **ACKNOWLEDGMENTS**

We would like to express our deep appreciation for the efforts taken by many friends and colleagues to make the US-Japan Cooperative Research on Urban Earthquake Disaster Mitigation successful. The efforts of all participating researchers are gratefully acknowledged. Prof. Mete Sozen as Chair of the US Joint Technical Coordination Committee and other JTCC members have inspired us in many ways for promotion of this valuable bilateral project. We would like to highlight with greatest appreciation the leadership of Profs. Kenzo Toki and Tsuneo Okada on the Japan side and Dr. Si-Chi Liu of NSF on the US side who contributed to launch the program in such an appropriate manner.

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