Proceedings of Ninth World Conference on Earthquake Engineering
August 2-9, 1988, Tokyo-Kyoto, JAPAN (Vol.VIII)

SK-C

Session Report
STEPS TOWARDS THE GOAL OF URBAN SEISMIC RISK REDUCTION

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SUMMARY

The major issues discussed during the Special Theme Session on Topic K (STS/K) in the Ninth World Conference on Earthquake Engineering (9WCEE) are summarized. STS/K was entitled "Multi-Disciplinary Integration for Urban Seismic Risk Reduction, -with Emphasis on Public Policy and Implementation-." Following an overview of STS/K and its session organization, the major issues of presentations and discussion are described. Finally, the future perspective drawn from STS/K is proposed.

OVERVIEW

The objective of STS/K is to promote discussion on multi-disciplinary integration for the purpose of urban seismic risk reduction. As the world population has been and will be increasingly concentrated to urban regions, see Fig.1 for some seismically active countries, urban seismic risk reduction is a biggest issue of seismic disaster mitigation. The seismic disaster that can take place in urban regions are characterized by its complexity and multiplicity, which is typically illustrated by Fig.2 (Ref.2,3). The seismic disaster is accounted for not only by physical damage and threat to human lives, but also by various levels of functional damage, and also by its socio-economic effects. It is also pointed out that the seismic disaster has a multi-phase nature that evolves with time as Fig.2 indicates. There are interactions between the physical/functional damage to urban facilities and human behavior depending on their modes of life and demand. It is, therefore, important to analyze the problem as a problem of man-facility combined system.

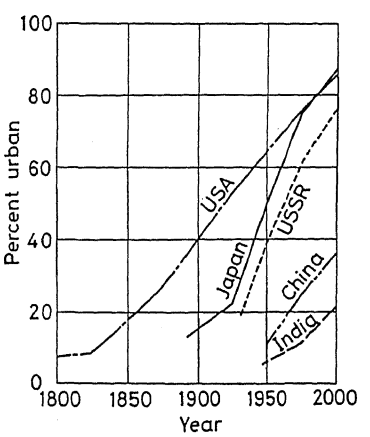

Fig.1 Urban Growth in Seismic Countiries (Ref.1)

Urban earthquake risk reduction requires integration of output from various research areas such as (Ref.3) (1) Seismic hazard assessment: seismicity, ground motion, ground failure, tsunami, etc., (2) Structural problem: structural response, failure and damage of buildings and other civil engineering structures, (3) Lifeline

earthquake engineering: system reliability and post-earthquake restoration of urban infrastructures, (4) Disaster propagation problem: fire following earthquakes, com-bined disasters at industrial plants, etc., (5) Information and behavioral science aspects: evacuation, information management, human behavior in emergency, etc., and (6) Regional planning and socio-economic aspects: econometric effects, urban seismic development and re-development planning, etc. These items are also referred to as basic disciplines by Prof. Shah in his state-of-the-art report (Ref.4).

Based on the foregoing observations, it has been recognized strongly that the issue of urban seismic risk reduction requires cooperation among various fields as well as among various sectors including academicians, practicing engineers, government engineers, as well as non engineering personnels in socio-economics and politics, with a common goal of multi-disciplinary integration. STS/K has been organized in an attempt to realize a forum for pursuing this issue from the engineers' side.

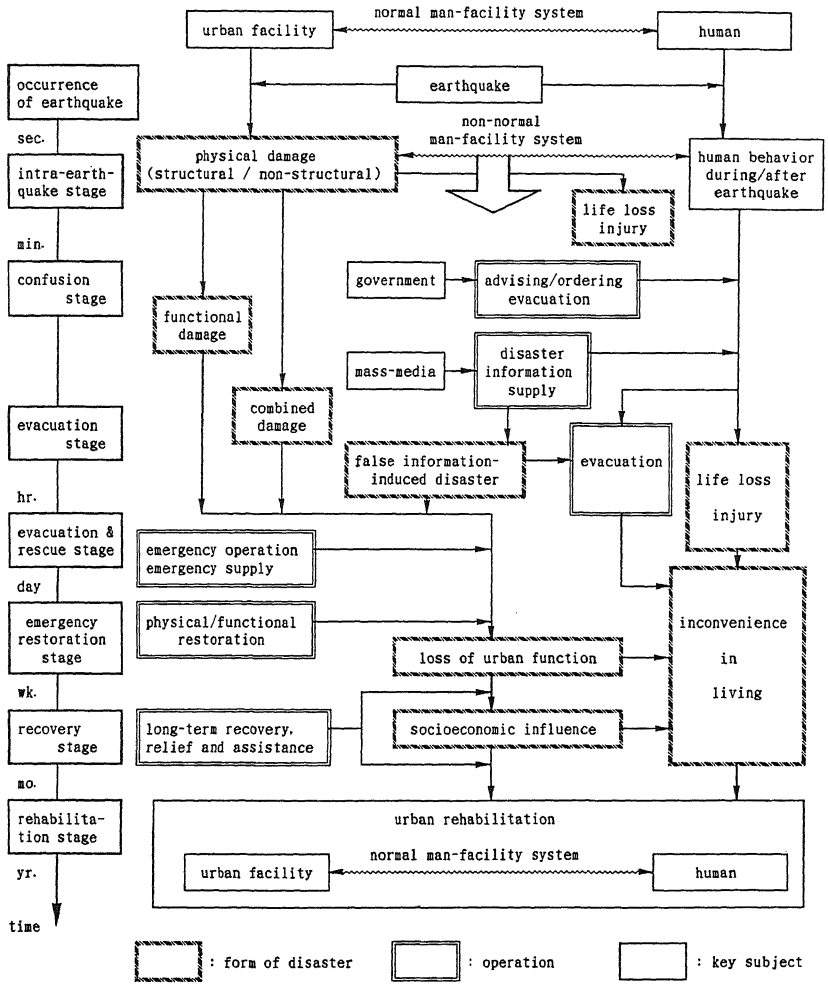

Fig.2 Urban Seismic Disaster as a Multi-Phase Problem

SESSION ORGANIZATION

The program for STS/K has been arranged in a way to promote recognition of comprehensive views of the seismic risk reduction of the urban region rather than the protection of individual urban element or facility. The main topic was to promote interaction among different fields for the development of cooperative relation toward multi-disciplinary integration. In order to develop useful information within the limited time, attention was focused on the role and possible contributions from earthquake engineers toward the development of public policy and its implementation. On this basis, discussion was oriented to identify what should be our future efforts and where they should be oriented.

The outline of the session arrangement was as follows:

Introductory Report by H. Kameda
State-of-the-Art Report (SK-R1) by H. C. Shah
Sub-Theme 1: THEORETICAL BASIS
Presentations by S. J. K. Rao (SK-01), Y. Murozaki (SK-02), and J. Petrovski (SK-03)
Sub-Theme 2: GENERAL POLICY
Presentations by R. K. Eisner (SK-05), and J. Kuroiwa (SK-07)
Sub-Theme 3: CASE STUDIES AND EVALUATION
Presentations by C. Scawthorn (SK-09), Y. Kumagai (SK-10), Y. Ogawa (SK-11), and W.-M. Dong (SK-12)
Closure by T. Katayama

The session was co-chaired by J. Petrovski and T. Katayama.

The Introductory Report was addressed to explain about the background that has motivated to propose STS/K, including what was discussed in the Overview. The main body of the session following it will be summarized in the next chapter.

Out of the twelve presentations originally planned, four for each of the three sub-themes, nine of them as listed above were actually presented during the session. These contributions were made: four from the USA, three from Japan, one from Peru and one from Yugoslavia. This combination, rather biased, is an unfortunate consequence of our being unable to have the authors of the remaining three scheduled presentations attend the Conference: two from China and one from India. This has made the entire session somehow inadequate in providing a truly world-wide view of the problem. Within this limitation, however, the presentations and discussion made during the session were very informative and it is believed that they all have made constructive contributions to realizing the objective of STS/K.

MAJOR ISSUES OF PRESENTATIONS AND DISCUSSION

State-of-the-Art (SOA) While the individual presentations in the STS/K were organized with emphasis on the development of public policy and its implementation, it was essential for the participants attending the session to have certain level of common understanding of the present status of research and development in underlying disciplines and its implication to the multi-disciplinary integration. For this purpose, the SOA report (SK-R1) was addressed by H. C. Shah.

It was emphasized we must remember that the whole area of urban seismic

risk reduction is the process of integrating everything that we know: some of it in engineering, some of it in geology, seismology, governmental actions, politics, economics, behavioral science, etc. Then the current state-of-the-art in the six individual items indicated in the Overview was reviewed carefully. Finally, it was pointed out that the greatest problem that we have is that there is a big weakness in developing our way for integration from which we can draw good options that are implementable for the purpose of urban seismic risk reduction.

Theoretical Basis The presentation by J. K. Rao (SK-01) proposed a methodology for decision making on upgrading different types of hazardous structures. Benefit-cost factors in terms of lives saved per rehabilitation dollars were the main parameters. A case study for the Los Angeles area was shown. Question was asked by G. Grandori on how the marginal cost of saved life is treated. J. Petrovski indicated the difficulty of expressing properly the cost of life and correlating this with other physical conditions.

Y. Murozaki (SK-02) presented a framework of post-earthquake recovery processes for urban regions by identifying the essential items of restorative functions and background. Observations were made by reviewing the recovery processes following actual disastrous earthquakes and big fires, thus providing useful information for decisions on emergency response planning. A simulation study was made for Osaka City.

J. Petrovski (SK-03) proposed an integrated modeling for predictive estimation of regional seismic losses. It is a combination of seismic hazard, vulnerability, risk analysis and optimization. Application to the Montenegro region was presented. Discussion was proposed by C. Scawthorn on a need to consider various possible definitions of seismic loss or cost, direct or indirect.

General Policy R. Eisner (SK-05) presented the policy development and the procedure of implementation, the approach being taken in the San Francisco Bay Region and the Los Angeles/southern California region. In addition to explanation of actual actions taken, key factors in such activities were pointed out, including the effective involvement of public and private sectors and community organizations, importance of developing the planning process properly adjusted to each phase: pre-event phase, shaking phase, response, recovery and construction, etc.

J. Kuroiwa (SK-07) described the national plan of hazard reduction in Peru. The history of its development and recent application in Trifinio region in central America and the Grau region in northern Peru were explained. Microzonation is regarded as a key tool in the regional hazard reduction planning. The contents of the multi-hazard reduction code as well as the procedure of its implementation was made clear.

Case Studies and Evaluation C. Scawthorn (SK-09) presented a comprehensive view on the demand and provision for post-earthquake emergency services with a focus on activities that are common at fire departments in the U.S. They include fire fighting, search and rescue, hazardous materials release, emergency medical treatment, etc. Close observation of San Francisco Fire Department was given as a case study along with an ample historical review as well as comparison with relevant cases at other places.

Y. Kumagai (SK-10) proposed a methodology for critical appraisal of the effects of disaster prevention measures taken in urban regions. The method was developed in connection with the reevaluation of the earthquake preparedness program practiced in Tokyo. The major factor dealt with herein is the time

required for refuge under emergency. Upon the discussion raised by E.S. Georgescu, it was made clear that the use of prive cars are not allowed under earthquake emergency and that the speed of fire spread is normally much slower than the walking speed.

Y. Ogawa (SK-11) presented a framework of earthquake countermeasures for a gas distribution pipeline network, the case of Osaka Gas Co. It consists of preventive measures, emergency measures and restorational measures, which is an integration of structural and geotechnical engineering technology for assessment of earthquake resistance of pipelines, and network and subnetwork evaluation technique for safe and prompt post-earthquake restoration.

W.-M. Dong (SK-12) presented the concept and development of a knowledge-based seismic risk evaluation system (IRAS) which has, at this time, been developed for California conditions. The objective of the system is to put all knowledges that are scattered in different disciplines, such as soil conditions, seismic hazard, building conditions, etc., together in a unified form that can provide information needed for risk management in insurance and investment, expressed in the way non-engineering users can understand. There was a question by P. R. Berke on the interaction with users in the course of development and one by S. Tubbesing regarding categories of prospective users and possible impact of the developed system on the evaluation of real estate. The authors' answer emphasized the possibility of diverse areas of application by indicating specific examples.

Important discussions besides those described above are as follows.

J. Petrovski raised a question on how we can and we should try to create reliable date banks, either on a national or regional basis, for the development of risk information systems so that we can avoid encountering many contradictory interpretations. In this regard, C. Scawthorn pointed out that even data with uncertainties can be used to generate useful information if they are processed using appropriate procedure to handle uncertainties, or "gray area".

There was another point indicated by G. Santana that while many of seismic risk issues can be treated as an insurance problem in highly industrialized societies, they are governmental issues in most of the third world countries, where hazard reduction planning in which zonification and microzonation are the main tool of development like what was presented by J. Kuroiwa and a similar project going on in Costa Rica.

Closure In the closure speech addressed by T. Katayama as a Co-chair, following two items were proposed as our tasks at hand.

(1) Development of basic concepts practically meaningful: There are several keywords that were used commonly during STS/K, such as "implement", "integrate", "preparedness", "planning", "socio-economic", and so on. However, it seems that these words have not yet been well defined from practical points of view, or specified with a real world concept. As engineers, we should not be cut of from our practioners in the philosophical development as well as in dealing with specific subjects.

(2) Standardization of the concept of "loss": This is the time to clearly answer the question "what is loss?", particularly "indirect loss." Otherwise, it is difficult to discuss socio-economic issues.

There did exist a possibility to resolve these agenda if more time had been allowed for discussion, as individual presentations contained materials that should be useful for this purpose. Many of the participating audience were also

qualified authors of papers on relevant topics in other sessions. Although there was not enough time for discussing this matter during STS/K, it is hoped that these items proposed will motivate our continuing efforts.

FUTURE PERSPECTIVE

From what was talked about throughout STS/K, we can draw items that should be important issues in our future activities for urban seismic risk reduction. Following is a list of them based on the writer's observation.

(1) Development of methods for multi-disciplinary integration: This an area where good communications between different sectors and different professions as well as international ties are really important.

(2) Definition of seismic loss and cost as a common tool: This is a key parameter that links engineering and socio-economic issues to put them together in a multi-disciplinary integration.

(3) Development of reliable database and seismic risk information system: This will include proper method of data collection, processing and interpretation as well as development of useful information system.

(4) Development of methods for project assessment and reevaluation: It is important to obtain a tool with which we can observe the effects of urban seismic risk reduction projects and their impacts on the seismic safety of urban regions.

ACKNOWLEDGMENT

Organization of this session was coordinated by T. Katayama, S. Takada, H. Kawakami, and the writer. The coordinator group would like to express their deep appreciation for the time and effort spent by Prof. Haresh C. Shah for preparation of a most informative state-of-the-art report. Excellent leadership of Prof. Jakim Petrovski as a Co-chair is gratefully acknowledged. The writer would like to thank Dr. Charles Scawthorn for his constructive comments during the development of the basic concept of STS/K. Extensive discussion with the members of the Coordinating Committee for Special Theme Sessions, 9WCEE, Chairman: Dr. Takuji Kobori, was very useful for elaborating the session organization. Excellent contributions by the presenting authors and active participation from the audience during the discussion period are highly appreciated, as they were essential for the success of STS/K.

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