委員会報告 Report on the Activiites and Achievemets of the International Committee on Concrete Model Code

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ABSTRACT: This report presents the activities and achievements of an International Committee on Concrete Model Code initially established as a research committee by the Japan Concrete Institute in May 1992. The model code being drafted by the Committee is intended to serve as a basis for application in the Asian region taking into account the differences in natural and social environments in each country.

1. INTRODUCTION

A Research Committee on Concrete Model Code for Asia was set up by the Japan Concrete Institute in May 1992 under the chairmanship of Prof Jun Yamazaki of Nihon University to study the feasibility of having a model code for the Asian region. The study revealed that academicians and engineers in the region recognized the need for and supported the idea of having a model code which would be based on the Asian context, i.e. applicable to differences in economical, climatic and cultural environments of the region [1]. A survey on the design and construction practice in concrete work in the Asian region served as background for the framework of the model code [2].

In 1994 the Committee under the chairmanship of Prof Hiroshi Noguchi of Chiba University evolved itself into an international committee independent of JCI though JCI continues to give financial support through the local committee. In this report activities and achievements of the committee are introduced.

2. COLLABORATED INSTITUTIONS AND INDIVIDUAL MEMBERS

Current membership of the Committee consists of representatives from Australia, Bangladesh, Cambodia, China, Chinese Taipei, India, Indonesia, Japan, Korea, Pakistan, Philippines, Singapore and Thailand. The committee activities have also been recognized by the following organizations:

- Association of Structural Engineers of the Philippines (ASEP)
- China Civil Engineering Society (CCES)
- Engineering Institute of Thailand (EIT)
- Indian Concrete Institute (ICI)
- Indonesian Society of Civil & Structural Engineers (HAKI)
- Japan Concrete Institute (JCI)
- Korea Concrete Institute (KCI)
- Sri Lankan Standards Institution (SSI)

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3. MEETINGS

The International Committee executes its business mainly through correspondence. Two meetings per year have been scheduled generally in conjunction with planned events in the member countries. By doing so the committee can introduce the concepts of the model code to academicians and practical engineers participating in such events and at the same time receive their suggestions and comments. Since its formation, the international committee has met on 7 occasions. The details of each workshop are summarized below.

3.1 FIRST WORKSHOP (Tokyo, April 1994)

The Committee held a one day workshop in Tokyo in April 1994 to conclude the first stage of its investigation and discuss its future task. Nearly 100 participants which included international and local members took part in the symposium. A framework for the model code was drawn up.

3.2 SECOND WORKSHOP (Bangkok, December 1994)

During the Second Workshop at Chulalongkorn University, Bangkok, Thailand in December 1994 which was organized by the Engineering Institute of Thailand the concepts for the code were discussed and the following 3 working groups were set up:

WG1: Design
Coordinator: Prof Toshimi Kabeyasawa, University of Tokyo, Japan
WG2: Materials and construction
Coordinator: Dr Takafumi Noguchi, University of Tokyo, Japan
WG3: Maintenance and management
Coordinator: Dr Sudhir Misra, Indian Institute of Technology, Kanpur, India

Each working group consists of members from both the international and local committees. The groups were asked to revise the proposed framework and contents of the model code for presentation at the next meeting.

3.3 THIRD WORKSHOP (Tokyo, March 1995)

The third workshop was held at the Tokyo Metropolitan University in March 1995 at which future tasks of the committee and the time frame for drafting and implementing of the model code was discussed and agreed upon (Table 1).

Table 1 Time frame for drafting and implementing of the model code

Year	1995	1996	1997	1998	1999	2000
Preliminary work	→					
First draft		→				
First draft-revised		→				
Draft I			→			
Draft I-revised			→			
Draft II				→		
Adoption				→		
Final draft					→	
Implementation I					→	
Implementation II						→
Implementation III						→

Note: The above time frame was slightly revised from the one originally approved at the Third Workshop

3.4 FOURTH WORKSHOP (EASEC-5, Gold Coast, July 1995)

The East Asia-Pacific Conference on Structural Engineering and Construction (EASEC) meet every other year. At EASEC-5 a special session was assigned to the committee and six papers concerning its activities and the current situation of concrete codes in Asia were presented. At the committee meeting the committee discussed the WG reports and the necessity to involve formal organizations in each member country and region in the committee work.

It was also agreed that future committee meetings, when possible, should be arranged to coincide with EASEC as it serves as one of the best occasions for the committee to discuss its activities among a wider audience.

3.5 FIFTH WORKSHOP (Jakarta, March 1996)

At the Jakarta workshop organized by the Indonesian Society of Civil & Structural Engineers committee members were requested to present papers relating to the Great Hanshin Earthquake (buildings, SRC buildings and bridges); high-rise buildings in the Asian countries and durability of civil engineering structures. The first drafts of the model code were presented by respective coordinators of the 3 working groups.

3.6 SIXTH WORKSHOP (Dalian, October 1996)

The Dalian workshop was organized by Dalian Institute of Technology in October 1996. Besides presenting papers on the recent research activities on concrete engineering in civil engineering in their respective countries, committee members discussed the Revised Draft I of the model code presented by the 3 working group coordinators.

Up to this workshop the committee was able to obtain recognition from formal institutions mentioned in Chap. 2 above.

3.7 SEVENTH WORKSHOP (Hyderabad, March 1997)

This seventh workshop was organized by JNT University, Hyderabad to coincide with an International Conference on Maintenance and Durability of Concrete Structures, March 4-6, 1997. A special session has been allotted to the committee in which the committee Chairman introduced the activities and future tasks of the committee. Progress reports on the drafting of the model code were presented by the 3 WG coordinators.

At the meeting Prof Taketo Uomoto of the University of Tokyo, Prof Ekasit Limsuwan of Chulalongkorn University and Prof Yew-Chaye Loo of Griffith University were elected Chairman and Vice Chairmen of the committee respectively.

3.8 FUTURE WORKSHOPS

August 1997	Jakarta, Indonesia
January 1998	EASEC-6, Taipei
August 1998	IABSE Colloquium, Puket, Thailand

4. PERMANENT BODY

The concept of having a permanent body responsible for the model code was discussed. The

body which may be called the "Asian Model Code Committee" shall consist of an advisory committee, an organizing committee and task groups. Its main office can be in Japan (JCI) or in any other country with branch offices in each country and region.

5. FINANCIAL SUPPORTS

The committee receives financial support from the following sources:

- *The Japan Concrete Institute (JCI).* Since its establishment in May 1992 to March 1997 JCI has been providing a budget of ¥1.5 million annually.
- *The Ministry of Education and Culture of Japan.* An annual grant of ¥3 million under the category of international cooperative research project was approved by the Ministry for the period 1994-1997. The Ministry continues to support the committee activities by approving a second 3-year grant for the period 1997-2000.
- *The Overseas Contractors Association of Japan (OCAJ).* Starting April 1997 OCAJ will provide, through JCI, a total grant of ¥10 million for a 5-year period.
- *Respective organizations in member countries/region.* At each meeting of the international committee respective organizations in the host country/region supported financially.

6. CONTENT OF THE DRAFT MODEL CODE

6.1 GENERAL

The draft model code consists of three volumes which are *design*, *materials and construction*, and *maintenance* of concrete structures. The three volumes provide specifications clonogically for three different stages of concrete structures, namely stages before, during and after construction. The draft model code is being prepared in three different levels which conform with ISO/TC 71. *Level 1* document provides the framework and basic concepts of the model code which is a performance-based code. *Level 2* document is practical codes which clearly specify all the required performances or items necessary to obtain the performances, and which are common to any country/region where the model code is applied. *Level 3* document is practical guidelines which provide verification or acceptable solutions considering local conditions in a country/region where the model code is applied. Currently the volume for design of the model code is being drafted with Level 1 and Level 2 documents, while the volumes for materials and construction as well as maintenance are with Level 2 document. Level 3 documents may be prepared by each country/region considering Level 1 and Level 2 documents of the model code.

6.2 VOLUME 1 - DESIGN

Level 1 document of the volume for design indicates clearly the main concept of the model code which is the performance-based design. The required performances are classified into three major categories as follows:

- *Serviceability* : The ability to provide adequate services under effects of considered actions
- *Restorability* : The ability to avoid damage under effects of considered actions
- *Safety* : The ability to assure no casualty of its users under effects of all possible actions

Actions considered in the model code are not only physical actions, such as traffic loads and seismic actions, but also environmental and chemical actions which influence durability of structures. In order to examine whether the required performances are attained or not, the following formula is adopted:

$$PI_R > PI_S \quad (1)$$

where PI_R is the performance index expressing the reliable capacity related to the required performances, such as flexural capacity and allowable crack width and PI_S is the performance index expressing the effects related to considered actions during construction and/or in service, such as bending moment and crack width. The performance-based design concept also introduces the evaluation of performance. Eq. (1) only assures the minimum performance. The evaluation of performance can provide the level of the performance which the designed structure possesses. The performance index may be used for the evaluation of performance. The table of contents of Level 1 is as follows:

1. Scope
2. General Principles
3. Requirements
4. Materials
5. Actions
6. Analysis
7. Verification of Criteria
8. Evaluation of Performance

Level 2 document specifies the performace indexes together with actions to be considered for all the required performances. The document contains three parts for three major actions as listed below since the analysis necessary for calculating the performance indexes, PI_R and PI_S is different among these actions.

- *Design for Loads in Normal Occupancy Use*
- *Seismic Design*
- *Durability Design*

6.3 VOLUME 2 - MATERIALS AND CONSTRUCTION

In order to enable the model code to be widely used independently of the environmental conditions, the types of resources and the level of construction technologies in countries/regions, Level 2 document is drafted considering the following conceptual phrases [3]:

- *Performance-based Code*
- *User-friendly Code*
- *NAD (National Application Document)-friendly Code*
- *Environmental-friendly Code*

Level 2 document clearly indicates necessary items to assure that designed structures would possess the required performances, which contains six chapters as follows:

1. General
2. Basic Requirements
3. Formwork
4. Reinforcement
5. Prestressing
6. Concrete

Chapters 3 to 6 consist basically the same sections as below:

1. Scope
2. Basic Requirements
3. Materials
4. Workmanship
5. Quality Control and Assurance
6. Records

6.4 VOLUME 3 - MAINTENANCE

Level 2 document is drafted for the maintenance volume which compiles various methods to maintain constructed structures as designed. The methods are categolized into i) for preventive maintenance, and ii) for corrective maintenance. The document includes selection of materials and methods for maintenance works. Level 2 document consists of nine chapters as follows:

1. Introduction
2. Maintenance and Monitoring
3. Estimation of Deterioration Rates
4. Inspection
5. Evaluation Using Nondestructive Testing
6. Remedial Action
7. Repair
8. Strengthening
9. Maintenance of Records

7. CONCLUSIONS

With formal recognition of leading institutions in the region, the International Committee on Concrete Model Code has been actively working towards the implementation of the model code which introduces a new concept of the performance-based code.

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REFERENCES

1. Yamazaki, J., Noguchi, H., Kabeyasawa, T. and Ueda, T., "Towards Model Code," Proceedings of the Fourth East Asia-Pacific Conference on Structural Engineering and Construction, Seoul, Sept. 1993, pp.481-486.
2. JCI Research Committee on Concrete Model Code for Asia, "Report of Research Committee on Concrete Model Code for Asia," Proceedings of JCI Symposium, April 1994
3. Noguchi, T., Yamazaki, J., Uomoto, T. and Ohtsuka, K., "Model Code for Materials and Construction of Concrete Structures," Proceedings of the Fifth East Asia-Pacific Conference on Structural Engineering and Construction, Gold Coast, July 1995, pp.2345-2350.