4th 土木 CECAR

Taipei 2007

The 4th Civil Engineering Conference in the Asian Region (4th CECAR)

Working for Asian Sustainability

Special Forum 3

Organized by: Acec

For a Better Quality of Life

Hosted by: Chinese Institute of Civil and Hydraulic Engineering (CICHE) | Department of Civil Engineering National Taiwan University (NTU)

Co-hosted by: ASCE | JSCE | KSCE | MACE

ACECC 4th CECAR Special Forum 3
"Harmonization of Design Codes in the Asian Region", June 27, 2007

Organized by Japan Society of Civil Engineers (JSCE)

For a Better Quality of Life

Venue: **Room 103**, Taipei International Convention Center (TICC),
1, Hsin-Yin Road, Sec. 5, Taipei, 110, Taiwan

Start	End	Program
9:00	9:20	**Introduction of ACECC activities** **Dr. Kenichi Horikoshi (Secretary General, Committee on ACECC, JSCE)**
9:20	9:40	**Necessity of Design Code Harmonization and Expectation in Asian Region** **Mr. Hiroshi Shimizu (CTI Engineering International Co., Ltd.)**
9:40	10:00	**Introduction of the Asian Concrete Model Code and its Contribution to ISO Code** **Prof. Ha-Won Song (Yonsei University)**
10:00	10:20	**Cooperative Structure Toward Code Harmonization in the Geotechnical Field** **Dr. Chung-Tien Chin and Dr. Jie-Ru Chen (MAA Group Consulting Engineers)**
10:20	11:00	**Summaries & Discussions** **Chair: Prof. Yusuke Honjo (Gifu University)**

Organizing member

Dr. Fuminao Okumura (Chair, Committee on ACECC, JSCE)
Dr. Kenichi Horikoshi (Secretary General, Committee on ACECC, JSCE)
Mr. Masao Konno (Secretary, Committee on ACECC, JSCE)
Ms. Emiko Serino (Secretary, Committee on ACECC, JSCE)
Mr. Hiroyuki Yanagawa (International Affairs Section, JSCE)

http://www.acecc.net/

Contents

Special Forum 3

27 June, 2007 9:00-11:00

Harmonization of Design Codes in the Asian Region

Organized by

JSCE: Japan society of Civil Engineers

Chair	**Prof. Yusuke Honjo (Gifu University, Japan)**
Secretary	**Dr. Kenichi Horikoshi (Taisei Corporation)]**

Program

1. **Introduction of ACECC activities *(JSCE, ACECC)***
   Dr. Kenichi Horikoshi
2. **Necessity of Design Code Harmonization and Expectation in Asian Region (JSCE)** *Mr. Hiroshi Shimizu*
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   Dr. Chung-Tien Chin & Dr. Jie-Ru Chen
5. **Discussions**

Background

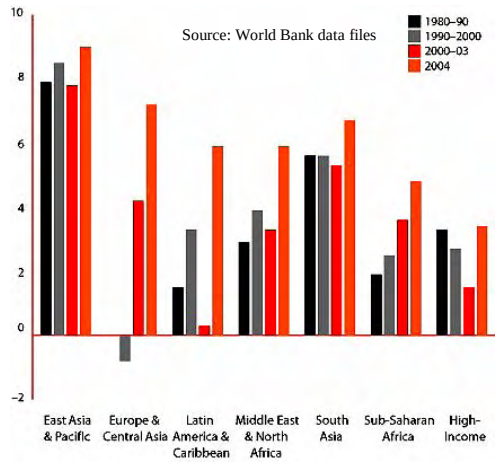
- Rapid globalization, Diversity in a sense of value
- Rapid development of Information Technology
  - No time difference & No boundaries
  - Infinite information to be shared
- More people have more opportunities to join developments
- Unification & cooperation of regional economy
  - EU (European Union)
  - NAFTA (North American Free Trade Agreement)
  - APEC (Asian Pacific Economic Cooperation
- Relatively new design concepts
  - "Limit state design" & "Performance based design"
- Development of Codes in view of Globalizations

Background

Rapid economic growth in Asian Countries

Rapid infrastructure development

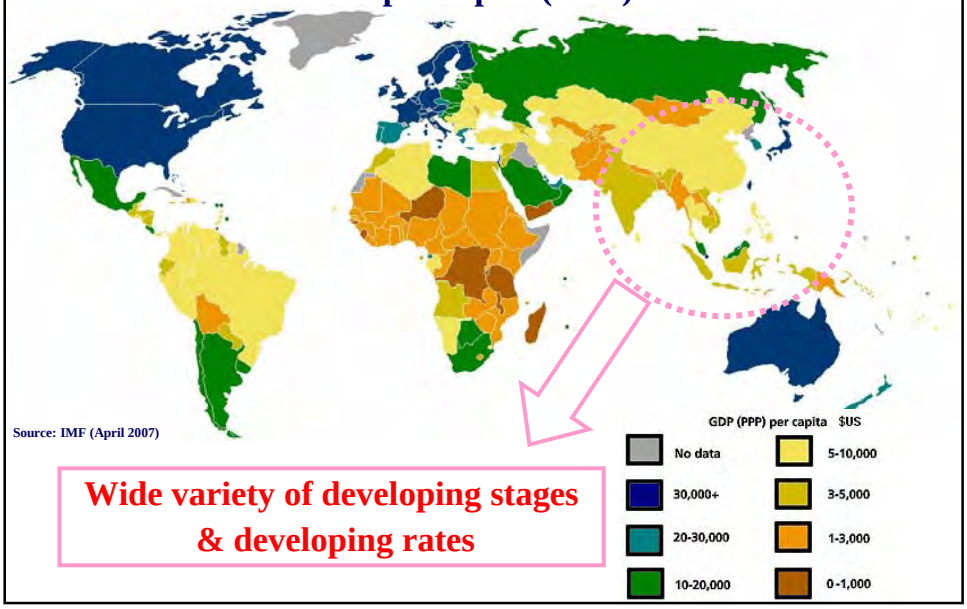
Average annual growth of GDP (%)



Background

Peculiarity in Asian countries

GDP per capita (2006)



Wide variety of developing stages & developing rates

Background

Code Development and related issues

Developing Countries

International projects based on bilateral or multilateral assistance,
Code development cannot catch up with rapid infrastructure development,
Without own code, or Mixture of different overseas codes,
Lack of latest code information source,

Developed Countries

Cooperation for code development as global standard
Cooperation for creation of unified idea of design concept and terminologies

Background

Necessity

Discuss future of code development

Exchange information on code development in each country

Enhance personal network among code writers

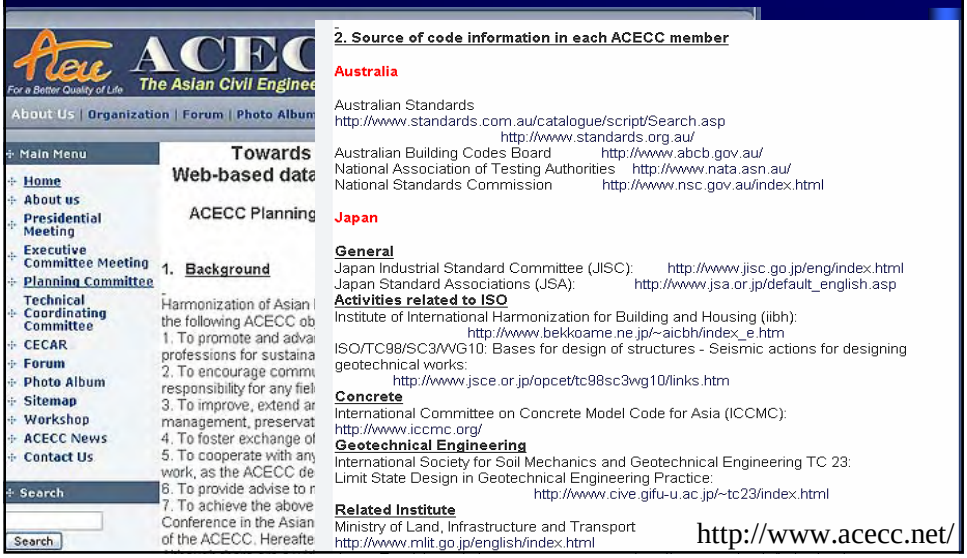
beyond boundaries of nations and fields of study

ACECC Operational task “Code Harmonization in Asian Countries” was assigned to JSCE in 2002.

Int. Forum on Harmonization of Design Codes in Civil Engineering was held twice in 2002 in Hong Kong, and in 2003, in Bangkok. (Prof. Kusakabe)

ACECC Activities

1. “Web-based database on design code” within ACECC members



http://www.acecc.net/

ACECC Activities

2. ACECC Workshop on Harmonization of Design Codes in the Asian Region (November 4, 2006 Taipei)

Participants from Taiwan, Japan, Korea, Vietnam, Hong Kong, Thailand, Singapore, and Ireland with different civil engineering fields

Objectives of the ACECC workshop in 2006

1. To share the information on activities and methodologies for formulating design codes in each country and make use of them for future activities,
2. To discuss the direction for the code harmonization in the Asian region. As well, to provide a place for discussions in the same vocabulary,
3. To transmit to the world the idea about the design code in the Asian region as the Asian voice,
4. To formulate a basis of codes such as Eurocode 0 to comprehend all the codes in each field , and
5. To decide a direction for the discussion at the 4th CECAR.

Workshop Program (November 4, 2006 Taipei)

Opening				
0900-0910	Opening		Prof. Jenn-Chuan Chern	Chair, Executive Committee of ACECC
			Dr. Hou Ho-Shong	Vice Minister of the Ministry of Economical Affairs
0910-0920	Overview		Dr. Horikoshi, Kenichi	Secretary General Committee on ACECC, JSCE
Country Reports				
0920-1025	**JAPAN**			
	0920-0940	Code development activities in Japan	Prof. Honjo, Yusuke	Gifu University
1320-1345	**VIETNAM** The Development of Construction Codes and Standards in Vietnam		Dr. Nguyen Ngoc Ba	Center for Standardization in Construction, Institute for Building Science and Technology
1345-1435	**TAIWAN**			
	1345-1410	Status of design codes in Taiwan	Dr. Yao-Wen Chang	Sinotech Engineering Consultants, Ltd.
	1410-1435	Concrete Building Code in Taiwan	Prof. Shyh-Jiann Hwang	National Taiwan University
1435-1450	*COFFEE BREAK*			
Special Reports				
1450-1520	Towards Harmonization of Design Code in Asia - Structural Concrete -		Prof. Ueda, Tamon	Hokkaido University
1520-1545	Harmonization of geotechnical design in Europe with structural design by means of Eurocode 7		Dr. Trevor L.L. Orr	University of Dublin
1545-1610	Emerging Trends in Seismic Design of Geotechnical Works		Prof. Iai, Susumu	Kyoto University
1610-1625	*COFFEE BREAK*			
Discussion				
1625-1705	Towards Code Harmonization in Asian Regions		Chair: Prof. Honjo, Yusuke Secretary: Dr. Horikoshi, Kenichi	
Closing				
1705-1715	Concluding Remarks		Prof. Jenn-Chuan Chern	Chair, Executive Committee of ACECC
1900-	***Reception hosted by ACECC and CICHE***			The Lu-Ming Restaurant National Taiwan University

Summaries of the ACECC workshop in 2006 (1)

1) Wide variety of design codes exist in Asian countries. Although it seems that harmonization is not easy, we should realize that we have common natural conditions, such as climates, ground types and disasters in the Asian region.

2) As for future activities, we need to differentiate between short-term and long-term targets. As one of the short-term target, creating a glossary of terminology may be a nice step for the harmonization.

3) As for the long-term target, we should learn from the Eurocode experience. The limit state design concept was very new and this concept was a base for their harmonization. Thus a new concept such as 'performance based-design' or 'performance based specifications' can be a base for harmonization. Asian concrete model code can be a pilot model.

Summaries of the ACECC workshop in 2006 (2)

4) It is necessary to exchange information with other professional groups such as concrete and steel institutes, and architectural institute.

5) Eurocodes are the government-oriented projects and they have close ties with European Union. Although the role of the government is very important for harmonization, we should not consider too much about political constrains. It is more important to aim at an ideal code that could be a model for newly developing codes. This will attract more people and give motivations to people working for the harmonization.

6) Flexible framework is necessary for further revisions to avoid conflicts with the latest technology.

7) Creation of future ISO or missing parts of the ISO can be a motivation for code harmonization.

ACECC Special Forum on
Harmonization of Design Codes in the Asian Region
(June 27, 2007 Taipei)

1. **Introduction of ACECC activities (JSCE, ACECC)**
   Dr. Kenichi Horikoshi
2. **Necessity of Design Code Harmonization and Expectation in Asian Region (JSCE)** *Mr. Hiroshi Shimizu*
3. **Introduction of the Asian Concrete Model Code and its Contribution to ISO Code (KSCE)** *Prof. Ha-Won Song*
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   Dr. Chung-Tien Chin & Dr. Jie-Ru Chen
5. **Discussions**

Necessity of Design Code Harmonization and Expectation in Asian Region

from the Viewpoints of Japanese Design Engineer Working in the Asian Countries

Special Forum 3: Harmonization of Design Codes in the Asian Region
4th Civil Engineering Conference in Asian Region

June 27, 2007

SHIMIZU Hiroshi

CTI Engineering International Co., Ltd.
Consulting Engineers

Contents

1. Procedure of Structure Design in the Developing Countries

Preparation of Design Criteria

Contents of Design Criteria for the Project

- **Selection of the Applied Design Codes, Standards and Manuals**
- **Information of the Materials to be used in the Project**
- **Evaluation of Conditions of Construction Site**
- **Determination of Load Combination and Structural Safety**
- **Selection of Method of Analysis**
- **Preparation of Design Drawing Standard**

2. Design Standards

Applied Design Standards for the Project

- **Applied Codes:**
  The National Codes/Standards prior to the others.
- **Alternative Codes:**
  Depend on the Source of Fund.
  - **Local fund : Local and Suzerain Country's Codes**
  - **ODA : Local and Donor's Country's Codes**
- **As a Supplemental Standards;**
  - **International Standards**
    ASTM, AASHTO, AICS
    BS, JIS
- **Local Codes leaned toward the Codes of Suzerain Countries or the Supported Countries for the preparation of Local Codes**

2. Design Standards: Case of Dam Design

Comparison of Dam Design

Load Combination & Required Safety Factor

	United Stats		R. China				Spain		Japan	
	USBR	US Army	1st Class	2nd &3rd	4th & 5th	all	Normal	Earth-quake	Normal	Earth-quake
Normal W.L.	1.5	1.5	1.1	1.05	1.0	-	-	-	-	1.2
Mid W.L.	-	-	1.1	1.05	1.0	-	-	-	-	1.2
Surcharge W.L.	1.5	1.5	-	-	-	-	1.4	1.3	-	1.2
Design Flood W.L.	1.2	1.2	-	-	-	-	-	-	1.2	-
After Completion	1.3	1.3	-	-	-	-	1.2	1.0	-	1.2
Draw Down	1.3	1.0	-	-	-	1.0	1.4	1.0	-	1.2
Earthquake	1.0	1.0	-	-	-	-	-	-	-	-

2. International Design Standards

Comparison of Dam Seismic Design

- Japan:
  - Static Analysis by means of Slices Method
  - Not allow to be damaged under the all load conditions
  - Dynamic Analysis applies as a supplemental confirmation of the dam safety against the earthquake.
- China:
  - Static Analysis by means of the simplified method of rotational slip surface applying the moment ratio.
  - Dynamic analysis will be applied to the dams with more than 150 m high
- USA:
  - Estimation of the deformation of dam body by means of dynamic analysis.
  - Damages after earthquake are specified depend on the magnitude of earthquake
    MCE: The most credible earthquake
    MDE: Probable Maximum earthquake at dam site:
    Main structural will not receive fatal damage by MDE:
    OBE: Maximum magnitude of earthquake during the structural life span
    The structure can be operated after the OBE.

3. Questionnaire to the Engineers Working in the Asian Region

1. On the Applied Design Codes
   1. Applied design codes, standards and Manuals;
   2. Difficulties and Inconvenience to apply the international standards to the project in Asian countries;
   3. The points in mind when the engineer design the structures.
2. For the Harmonization of Asian Code
   1. Necessity of the Harmonization of the Design Codes in the Asian Region;
   2. What the Harmonization of Design Codes in the Asian Countries should be?
      Compared with "EUROCODE".
3. On the Performance Based Design
   1. Actual Conditions of Application of Performance Based Design in the Site of Design;
   2. Applicability of the Performance Based Design to the Design Standard in the Asian Region.

3. Summary of Answers

Basic Information of Answerer

The Answerers:

18 Engineers from four (4) Japanese Consultants Firm

Age & Experience in Overseas Countries

Age:		Experience	:
Less than 30	1	5-10 years	4
31 – 40	4	11-15 years	5
41 – 50	7	16-20 years	4
More than 50	6	More than 20 years	5
Total	18	Total	18

Field of Answerer

River & Sabo	7	Plant	1
Road & Bridge	4	Agriculture	3
Hydro-power	1	Port	1
		Water Supply	1

3. Summary of Answers

On the Applied Design Codes

- All Engineers prepare the Design Criteria for the Project prior to the commencement of structural design through the discussion with Client.
- All Engineers mainly apply the objective countries' Codes.
- As supplemental of the local codes:
  - US Codes such as AASHOT, ASTM, ACI
  - BS and
  - JIS and other Japanese Standard

3. Summary of Answers

Problems on the Structural Design in the Asian Countries

- Problems
  - Standard of Purchased Materials:
    Grade and diameter of Reinforced bars
    Convert from yard-pound system to SI System;
  - Testing Method:
    Spacemen for the Concrete;
  - Design Method:
    Allowable States Design or Limited States Design;
  - Mismatching of Computer Program ;
  - Applied Technical term in English;
  - Required Performance of the Structures.
- These differences will be a cause of Misunderstandings and Human Error.
- The harmonization of Asian Codes will contribute to settle the problems.

3. Summary of Answers

Constraint of Design Code Harmonization in Asian Region

- **Variety of Social & Natural Condition of Each Countries**
  - **Climate,**
  - **Topography,**
  - **Economy,**
  - **Religion**
- **Variety of Technological Capability of**
  - **Government Officials**
  - **Contractors**
  - **Engineers**

Conclusion: for the Better Design in the Asian Region
Points to be Considered and Solution

Points to be Considered for the Harmonization of the Design Codes in Asian Region

- Human-error and misunderstandings due to the various material and testing standards including application of SI System;
- Different performance of structures in one country due to the Mixed-Up Design Criteria; and
- The variety of characteristic of the Asian region such as social economy, natural environment and level of technology giving the difficulties to unify the design codes in the region;

To Solve these Problems,

- Each country shall decide the concepts and structural performance individually.
- The detail design method and the application of States-of-the-Arts including the performance based design shall be discussed project by project among the design engineer and the clients.
- The most important thing is to pay attention to the harmonization with other structures in the country when design engineers prepare the design criteria.

Conclusion: for the Better Design in the Asian Region
Engineer's Expectation to the Harmonization

What we expect from the ACECC activities;

- To unify the Testing Method and Material Standard (ASTM or JIS) in the Asian Region including application of SI System;
- To prepare the Common Terminology of Civil Engineering;
- To prepare the Suggestion Notes for the establishment of each country's design codes just giving the NB on the design of structure;
- To provide Manuals of variety of Design Methods and to update time to time in accordance with the development of technologies and the States-of-the-Arts.
  So that the project owner and engineer can select the design method from this manual and the design codes of each countries will be automatically updated. and
- To prepare the drawing standard giving the notation in the drawings.

End

Thank you for your kind attention

Introduction of the Asian Concrete Model Code and its Contribution to ISO Code

Ha-Won Song
Vice chairman, ICCMC
Chair, ISO TC 71 SC7
Professor, School of Civil and Env. Eng., Yonsei Univ. Seoul, Korea

ABSTRACT

The ACMC is a unified Asian Concrete Model Code developed with continuing effort by members of International Committee on Concrete Model Code for Asia (ICCMC). This paper gives some background information from the ICCMC activities which have been carried out during the last thirteen years to develop the ACMC and this paper also explain their contribution to develop ISO codes on concrete structures. Focus is also made on the activity of the so called 'ISO TC71 SC7' dealing with ISO code development on the maintenance and repair of concrete structures.

Key words: Concrete, Concrete Structures, ACMC, ISO,ICCMC, TC71 SC7

INTRODUCTION

Asia contributes one third of the world construction market, while the remaining two thirds are shared equally by Europe and North America. The cement consumption, which is a good index for construction industry size, in Asia is now well above 50% of the world consumption (Ueda, 2006). Besides the big size of construction industry, it should be noted that there are many international projects for construction industry in Asia. Those facts imply the necessity of international codes for construction industry in Asia. The necessity of international code for construction industry in Europe was realized by the European Commission as well as the European countries of the Member States, so that, in the end of 2004, the 58 different parts which formed the Eurocode set are all nearly reaching the stage of EN (European Norm) and will be implemented, as wished by the European Commission and the Members States, within some years throughout the European Union, the Economic European Area and, also, in a lot of other countries (European Commission, 2003).
With this background, internationalization of code for structural concrete has been paid attention since the early 1990's. An International Committee on Concrete Model Code for Asia (ICCMC) was established in 1994. This paper introduces briefly Asian Concrete Model Code (ACMC) which was developed by the ICCMC and the collaboration between ICCMC and International Standard Organization (ISO) to develop an ISO code on maintenance and repair of concrete structures.

INTERNATIONAL COMMITTEE ON CONCRETE MODEL CODE FOR ASIA (ICCMC)

There are three types of countries in Asia for the code for concrete structures such as countries without national code, countries with national code which was adopted from codes in developed countries and countries with national code which was developed by the country. Direct adoption of codes from other countries or regions such as Europe and North America may not be suitable due to the following differences;

- Material type and quality
- Environmental condition like climate
- Technological level

- Economical level, and
- Social system for construction industry, etc.

Thus, many countries in Asia showed necessity of concrete model code in Asia like Eurocode in Europe and ACI Code in North America. Considering the situation in Asia, a model code in Asia should be developed to consider the diversity within Asia and the code should be developed by Asian countries by themselves with full consensus among them and with harmonization with international codes like the ISO codes if there exists.

In order to fulfil that necessity, the ICCMC was established in 1994 and developed the first Asian Concrete Model Code in 2001 (ACMC 2001). As of November 2006, ICCMC collects over 80 individual members, 6 representative members (representing concrete related institutions) and 10 corporate members from the following 14 countries/economy; Australia, Bangladesh, China, India, Indonesia, Iran, Japan, Korea, Malaysia, Philippines, Singapore, Taiwan, Thailand, and Vietnam. The ICCMC has been organizing more than 20 committee meetings in Asian cities regularly with local institutional hosts mostly utilizing well established international conferences organized by the costs.

ASIAN CONCRETE MODEL CODE (ACMC)

The latest version of ACMC 2006 published at year 2006 after revising the ACMC 2001 contains three parts (ACMC, 2006) as,

- Part1: Design,
- Part 2: Materials and Construction, and
- Part 3: Maintenance,

which covers all kinds of concrete structures (un-reinforced plain concrete structures, reinforced concrete structures, pre-stressed concrete structures, and composite structures with concrete). The most important concept and structure of ACMC are as follows:

- Performance-based concept, and
- Multi-level document structure.

Figures 1 and 2 show the performance based structure and the multi-level structure of ACMC, respectively.

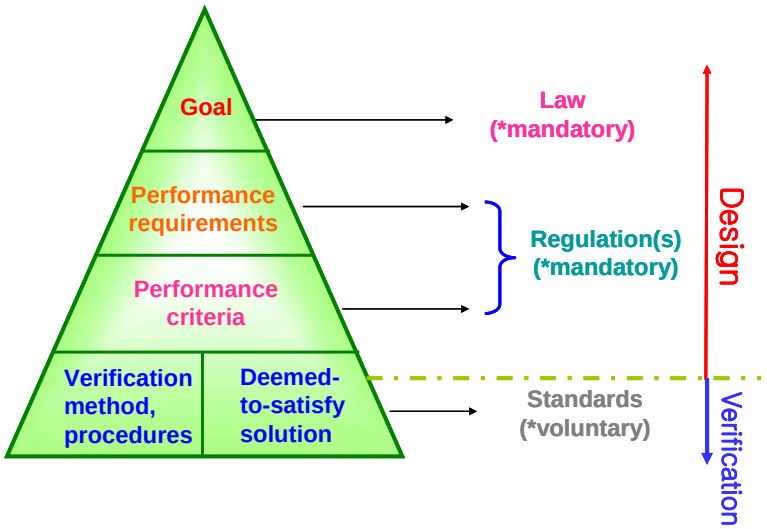

Figure 1. Performance-based concept of ACMC

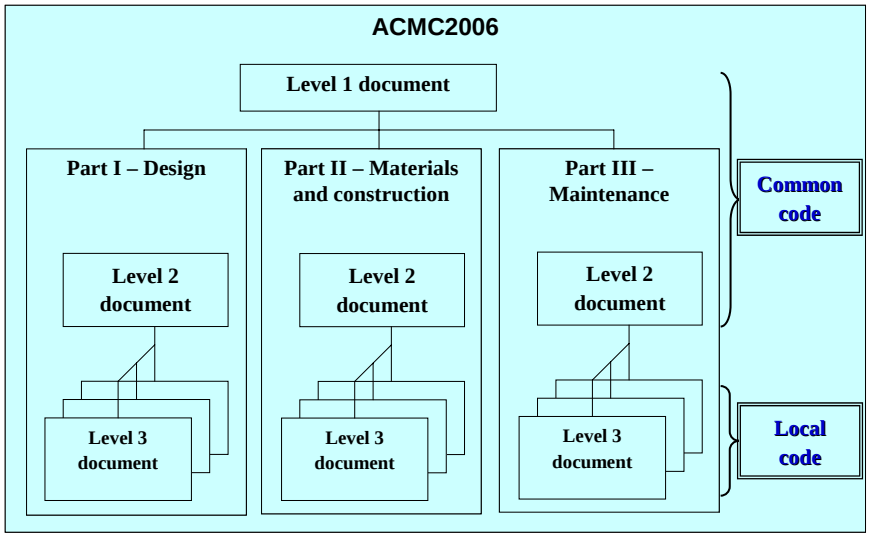

Figure 2. Multi-level document structure of ACMC

As shown at Figure 1, design code on performance-based concept mainly consists of design part and verification part. The performance-based concept only specifies mandatory performance requirements and criteria based on the goal of design in the design part, while verification method for the requirement is not mandatory, meaning that any method or any deemed-to-satisfy procedure can be used once it is proved appropriate (Song, 2007). As shown at Figure 2, the multi-level document structure allows to have documents common to any country/economy and any structure (common code) and documents specific to particular country or particular structure (local/specific code). The Level 1 and Level 2 documents are the common code, while Level 3 document is local/specific code. Both the performance-based concept and the multi-level document structure are suitable for the model code, which deals with the big diversity in Asia.

ICCMC has been issuing Level 3 documents since 2001. There are two types of Level 3 document: national code type and technical report type. The list of published Level 3 documents is as below:

- "An example of design for seismic actions – performance examination of RC building designed according to the Architectural Institute of Japan (AIJ) Guidelines", 2001. (Technical Report)
- "Vietnam construction standard TCXDVN 318: 2004 - concrete and reinforced concrete structures - guide to maintenance", 2004. (National Code)
-"Guidelines for maintenance and rehabilitation of concrete structures against chloride Induced deterioration", 2004. (Technical Report)
-"The standard specification for materials and construction of concrete structures in Japan", 2005. (National Code Type)

Additional Level 3 documents will be published soon for Korea and Thailand, etc.

DIFFICULTIES RELATED TO INTERNATIONALIZATION OF CODE IN ASIA

There are some difficulties with internationalization of code in Asia as follows (Ueda, 2006):

- Volunteer work from limited countries
  : Less experience in code drafting
  : Small motivation for code writing with no direct benefit such as research grant to individual
- Difficulty in being recognized by government
  : Countries where codes are well established show little interest
  : Recognition of ICCMC as a non-governmental body
  : China and Taiwan issue

- Various organizations responsible for preparing codes among different countries, such as non-governmental and governmental organization.
- Situation where civil and architectural structures with different codes are dealt by different organizations.
- Limited financial supports for many Asian countries to participate international collaboration through mainly international committee meetings
- Balancing the technology or unified consensus on the matter that country with more advanced technology may take leadership for code drafting.

The difficulties have been very much recognized during the activities of the ICCMC and the development of the ACMC was possible by overcoming the difficulties through the continuing effort for the consensus by the ICCMC members.

CONTRIBUTION OF ACMC TO ISO CODE

One way to solve the difficulties with internationalization of code in Asia for the ACMC is connecting the activities of ICCMC with relatively well recognized ISO activities. Furthermore, the combined activities can achieve extended harmonization of design code not only for the Asian construction societies but also for the world society. An ad-hoc ISO Task Force team was established inside ICCMC about 5 years ago to study the contribution of the ICCMC to the ISO TC71 (Technical Committee of ISO for the plain concrete, reinforced concrete, and pre-stressed concrete) and to provide input from ACMC to ISO codes systematically. The network in ICCMC with ISO TC71 has been successfully established to disseminate technology in Asia and to enhance the voice from Asia in ISO activities. The recent development in the ISO TC 71 shows successful contribution of the ACMC for the ISO codes.

After the WTO in 1995, the importance of the ISO code were well recognized and the article of the WTO/TBT explain well the necessity of the harmonization of the international code using the performance-based concept as shown in Figure 3 (Song, 2006a). Figure 4 shows the hierarchy of the standard including design codes, specification and national standards, etc., and early development of the ISO codes are indispensable due to the so-called Vienna agreement, which agrees that Eurocode would be the ISO codes if there are no ISO codes available (Song, 2006b).

Article VI : Technical Specifications (WTO/TBT)
[WTO/AGREEMENT ON GOVERNMENT PROCUREMENT]

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.

2. Technical specifications prescribed by procuring entities shall, where appropriate:

(a) be in terms of performance rather than design or descriptive characteristics; and

(b) be based on international standards, where such exist; otherwise, on national technical regulations, recognized national standards, or building codes.

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Figure 3. Article VI of the WTO/TBT

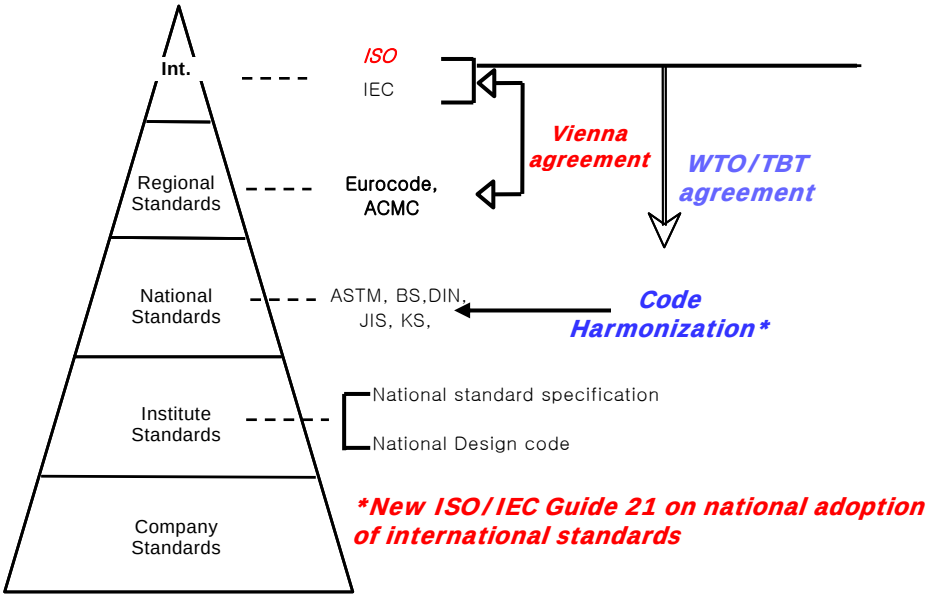


Figure 4. Hierarchy of standards

With the understanding of the importance of the ISO codes, the ISO TC 71 is developing the ISO codes on concrete structures. Figure 5 shows ISO Technical Committees related to concrete and Figure 6 shows subcommittees of the ISO TC71 (Song, 2006a).

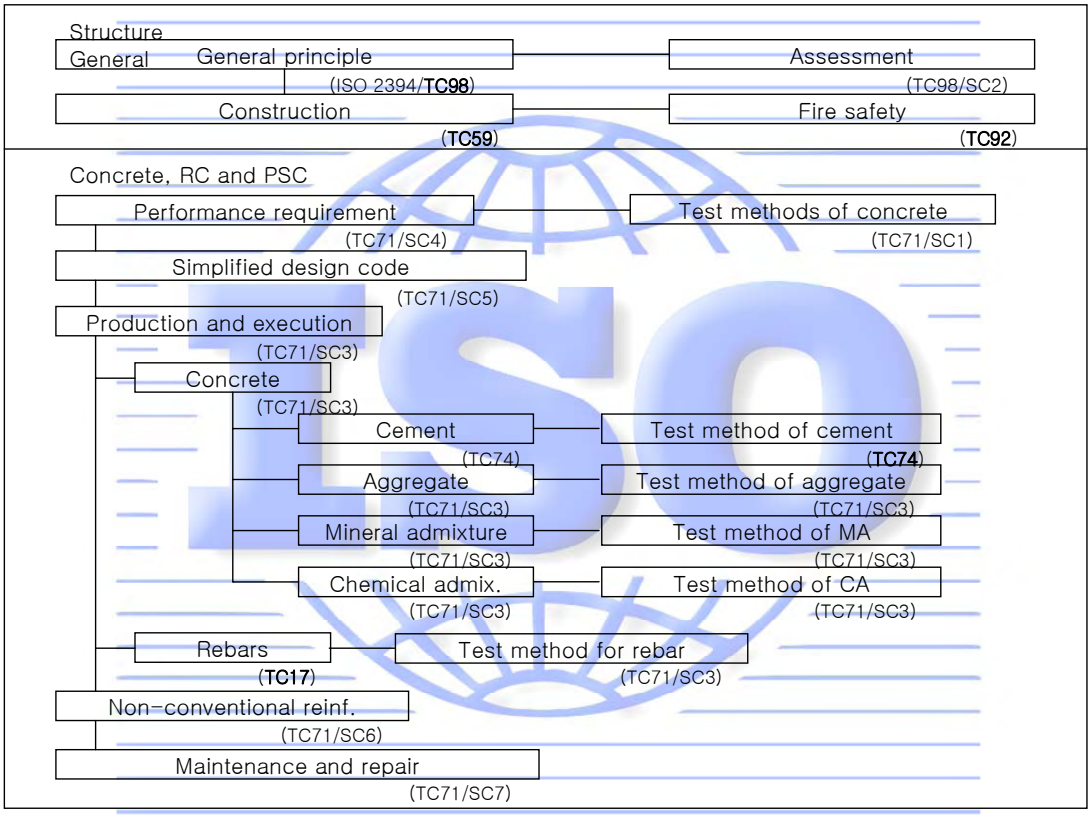


Figure 5. ISO Technical Committees related to concrete

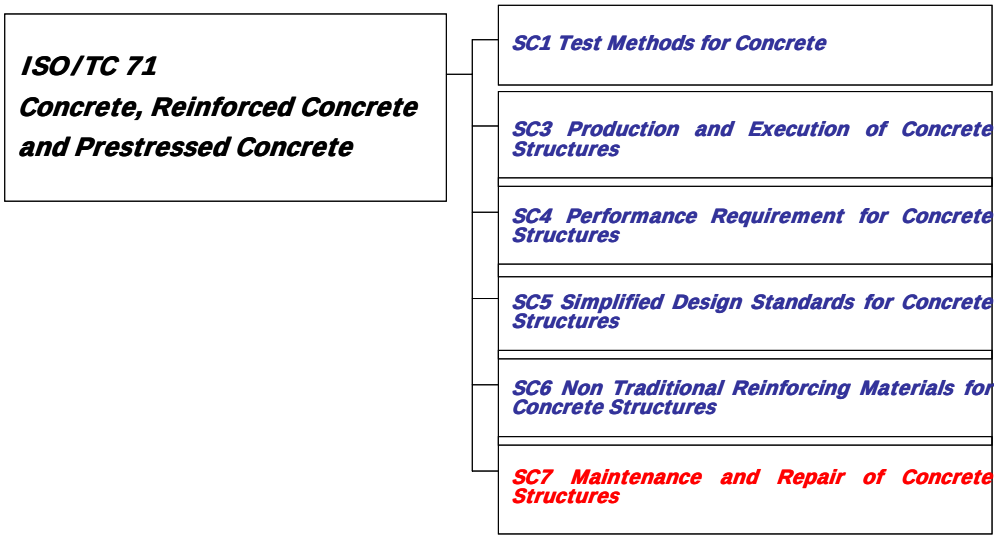


Figure 6. Subcommittees of the ISO TC71

In SC 4 of ISO TC71, there is an Ad-Hoc Task Force Group on performance-based code, which was initiated by members from ICCMC to study how to implement the performance-based concept and regional code like ACMC into the ISO codes and to start a revision of the ISO codes based on the study. The SC 7, proposed by the members from ICCMC for the establishment and became an important subcommittee to develop an ISO code on maintenance and repair of concrete structures, is currently chaired by Korea (Ha-Won Song, Vice chairman of ICCMC) with Secretary from Japan (Tamon Ueda, Chairman of the ICCMC). The SC 7 is now drafting an umbrella code for maintenance and repair of concrete structures based on ACMC (ISO, 2007). Figure 7 shows that the framework and general principle of the ISO codes on maintenance and repair of concrete structures is under development based on Part III of the ACMC, the first maintenance code in the world. In recent ISO meeting of year 2007, it was agreed that the structure of the SC7 consists of 4 major parts as shown in Figure 7. There are 4 working groups in the SC7 and 3 working group leaders (convenors) out of 4 working groups are individual members of ICCMC, which indirectly explains how much the ACMC contributes to ISO codes of ISO TC71.

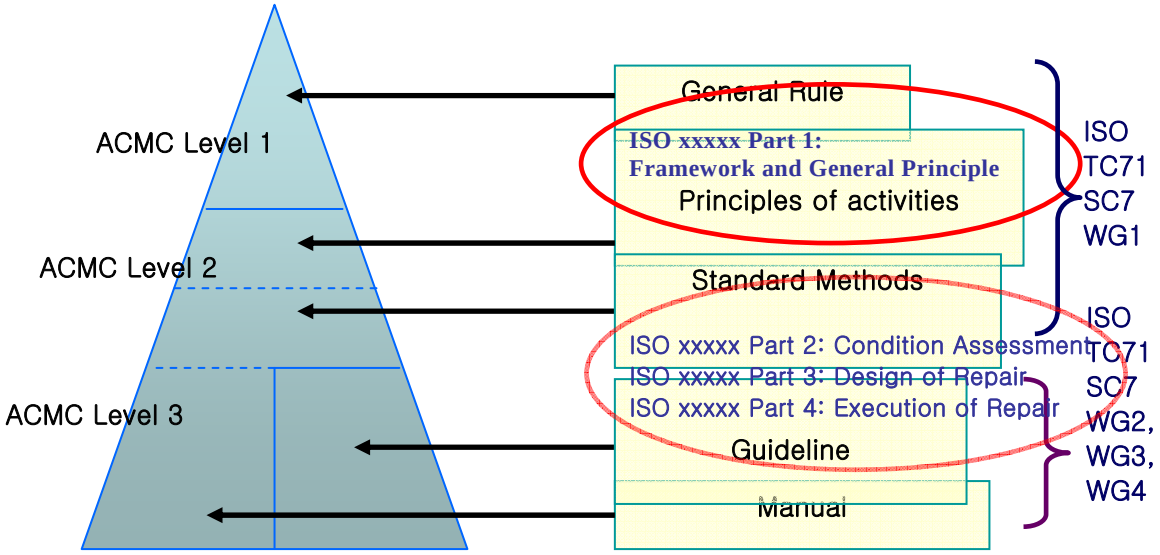


Figure 7. Structures of ISO code by ISO TC71 SC7 on ACMC structures

CONCLUSION

ACMC was successfully developed at year 2001 by the ICCMC and successfully revised to ACMC 2006, which contains the first performance based maintenance code for concrete structures in the world and yet to be basis of ISO code on the maintenance and repair of concrete structures. During the development of ACMC, many difficulties relates to internationalization of codes for Asia has been occurred and some of them solved by the connection with ISO activities. By the harmonization of the ACMC with the ISO codes and furthermore active contribution to develop ISO codes on concrete by the ICCMC members, it is expected that the ACMC will be the first unified regional concrete model code for Asia well harmonized with ISO concrete codes. It has been well understood by ICCMC members that more contribution by the ICCMC to the ISO TC71 has solved some of critical difficulties to develop Asian concrete model code for Asia. The experience that the ICCMC has been acquired during the development of the ACMC can be shared with other areas of construction for the development of the Asian model code in their fields.

ACKNOWLEDGEMENT

The author specially acknowledge the inspiring work of the late Professor Fumio Nishino, to whom this contribution is dedicated and who has been showing the vision of international collaboration for Asia and the outstanding contribution for development of Asian countries. The author also wishes to thank all the members of the ICCMC who have worked with enthusiasm to allow reaching the current stage of ACMC 2006.

REFERENCE

European Commission (2003). “The Implementation and Use of Eurocodes for Construction Works and Structural Construction Products’ in Commission Recommendation, 887 / EC.

ICCMC (2006). Asian Concrete Model Code

ISO TC71 SC7 (2007). ISO xxxxx: Maintenance and Repair of Concrete Structures-Part 1. Framework and General Principle (Version7)

Song Ha-Won (2006a). “ISO Standards of Concrete Structures”, ACMC Workshop, EASEC-10, Bangkok, Thailand, Aug. 3, 2006,

Song Ha-Won (2006b). “ISO Standards of Concrete Structures and ICCMC’s Contribution”, ACF Conference, Bali, Indonesia, Nov. 21, 2006

Song Ha-Won (2007). “Performance Based Design and Evaluation for Durability and Maintenance of Concrete Structures”, Pre-Workshop Meeting of ISO TC71, Salvador, Brazil, May 29, 2007

Ueda Tamon (2006). “Towards Harmonization of Design Code in Asia-Structural Concrete-“, ACECC Workshop on Harmonization of Design Codes in the Asian Region, Taipei, Taiwan, November 4, 2006

Introduction of Asian Concrete Model Code and its Contribution to ISO Code

Ha-Won Song
Vice chairman, ICCMC

Chair, ISO TC 71 SC7
Professor, School of Civil and Env. Eng., Yonsei Univ. Seoul, Korea

1

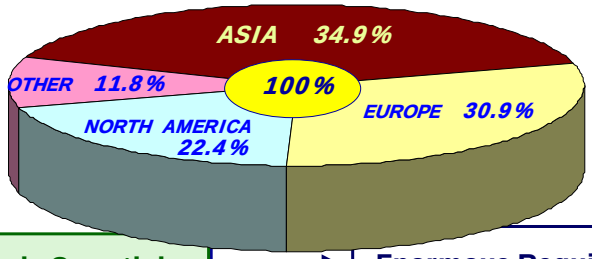
Outline

- Asia & Model Code
- PBD & ACMC
- ISO & ACF
- Conclusion

2

Asia

- **Largest continent**
- **Approximately 60 % of world population**
- **Big construction market**
  - **Over 1/3 of world construction market**
  - **Over 1/2 of world cement consumption**
- **Fastest growing economy on earth**



Economic Growth in Asian Region → **Enormous Requirements for Infrastructures**

Three groups in the world construction market:

a. Europe: 1/3 of World Market

b. America (North/South America): 1/3 of World Market

c. Asia (including Oceania): 1/3 of World Market

There are model codes on concrete structures:

- a→Euro code
- b→ACI code
- *Asia needs one → c.→Asian Concrete Model Code (ACMC)*

Codes and Standards in Asia

- Have no codes yet
- Adopt other countries' codes
- Develop their own codes

Need of development of its own code (1)

- Inappropriateness in codes of Europe and North America (due to difference in material quality, environmental condition, technological level and economical level, etc.)

5

Need of development of its own code (2)

International projects or Mega projects → International team

↓

Codes from various countries are used in one project

↓

Creates confusion and misunderstanding

The best solution is to develop its own code in Asia

6

Model Code is

1) to help the countries to develop their own codes

2) to reduce confusion / misunderstanding in multi-national projects

The Model Code should

1)be flexible in its nature to fit the diversity in Asia and

2) follow harmonization with global trend (e.g. WTO / TBT Agreement)

1)→Multi-level code document structure
2)→Performance-based concept

7

WTO / TBT Agreement

WTO-OMC

Establishment of WTO, 1995→Free Trade Goal

-Content of Technical Barrier on Trade-
"A product tested once and accepted everywhere"
→Harmonization!

Article VI : Technical Specifications
[WTO / AGREEMENT ON GOVERNMENT PROCUREMENT]

.

.

2. Technical specifications prescribed by procuring entities shall, where appropriate:

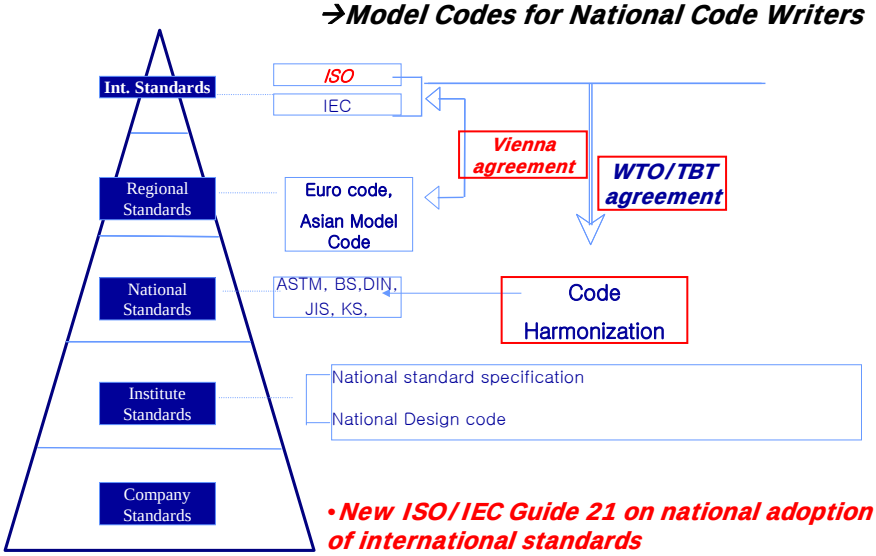
(a) be in terms of performance rather than design or descriptive characteristics; and

(b) be based on international standards, where such exist; otherwise, on national technical regulations, recognized national standards, or building codes.

8

International Standards (ISO code)

→Model Codes for National Code Writers



- ***New ISO/IEC Guide 21 on national adoption of international standards***

9

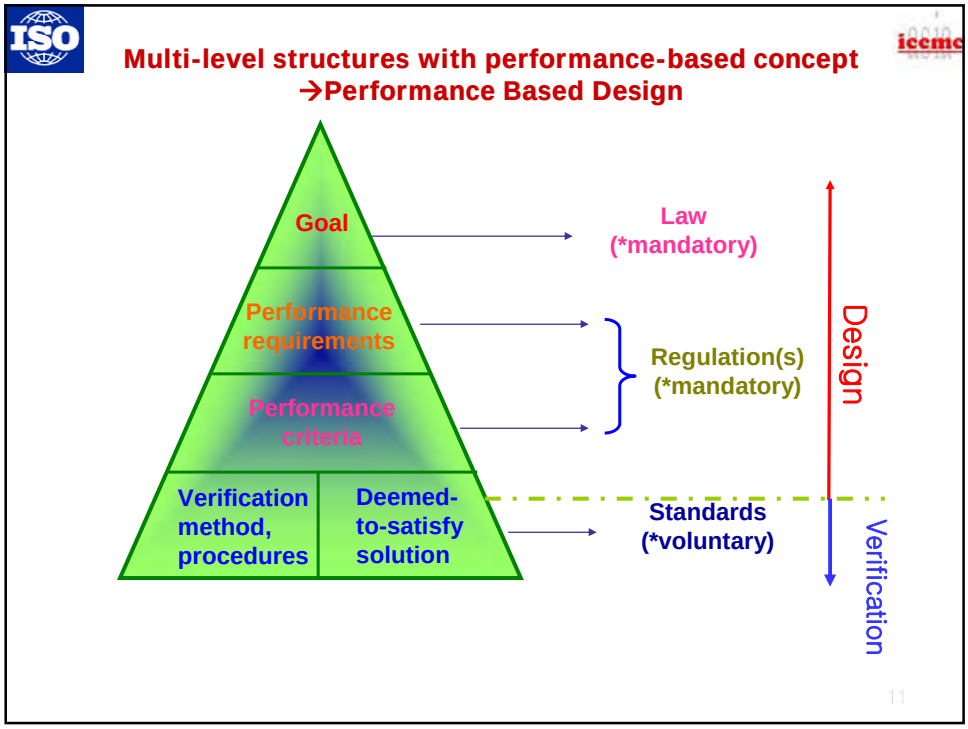
Change in construction industry →Sustainable Infrastructure

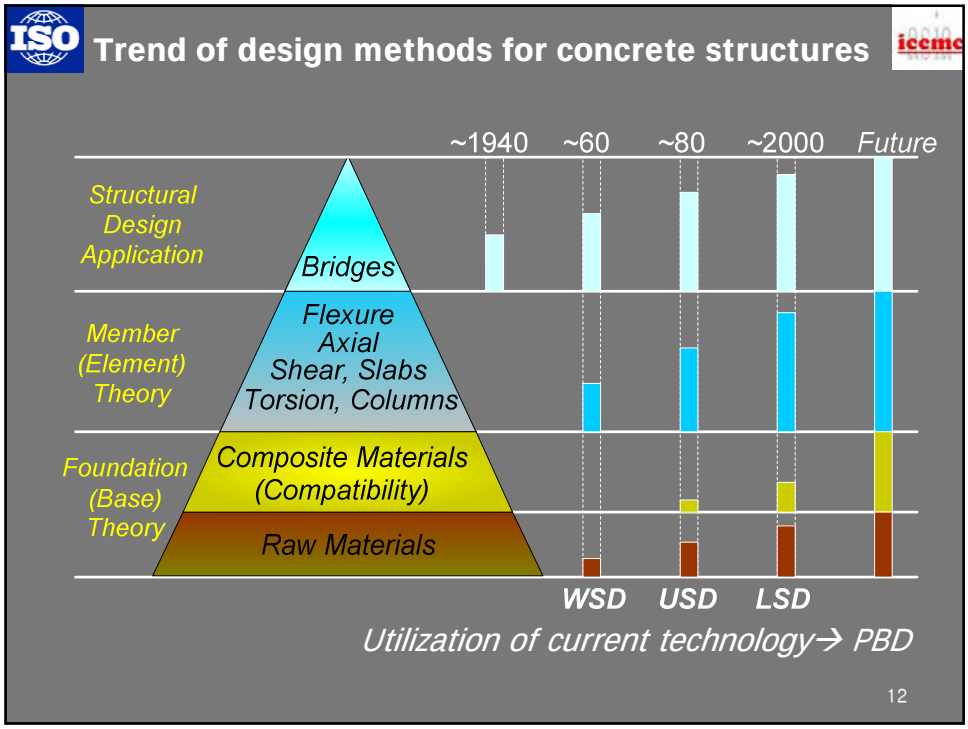
- It should be in "a sustainable way" (4th CECAER, Taipei 2007 "Working for Asian Sustainability")
- Sustainable concrete structures can be obtained

by constructing durable structures
by prolonging service life
by recycling materials and members
by reducing impact to environment

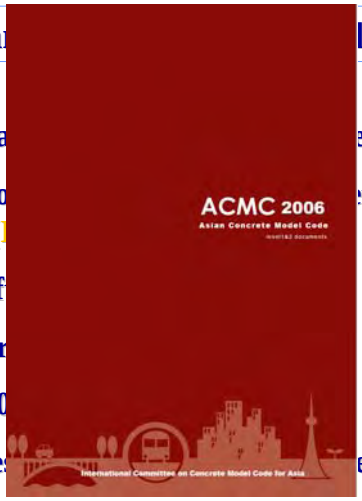
→ Performance of concrete structures (goal) is more important!

10


Multi-level structures with performance-based concept
→Performance Based Design
Goal
Performance requirements
Performance criteria
Verification method, procedures
Deemed-to-satisfy solution
Law (*mandatory)
Regulation(s) (*mandatory)
Standards (*voluntary)
Design
Verification
11


Trend of design methods for concrete structures
~1940
~60
~80
~2000
Future
Structural Design Application
Member (Element) Theory
Foundation (Base) Theory
Bridges
Flexure
Axial
Shear, Slabs
Torsion, Columns
Composite Materials (Compatibility)
Raw Materials
WSD
USD
LSD
Utilization of current technology→ PBD
12

History for Asia… …le (ACMC)



1992: JCI Resea… …ete Model Code

1994: Internatio… …ete Model Code for Asia (…

1998: First draf…

1999: Second dr…

2001: ACMC 20…

2004: Vietname… …e part of ACMC

2006: ACMC 2006 → Chinese-translated version in 2006

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ICCMC-committee for ACMC

Committee members (as of Feb 2007)

- Over 70 individual members
- 8 representative members
- Over 20 corporate members

From 14 countries/economy (Australia, Bangladesh, China, Chinese Taipei, India, Indonesia, Iran, Japan, Korea, Malaysia, Philippines, Singapore, Thailand, and Vietnam)

Committee meetings (as of Feb 2007)

23 Committee meetings in 12 countries/economy since 1994

Local committees in Japan, Korea and Thailand, etc

14

14 member countries/economy

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ACMC 2006

2 Features:

- Performance-based concept
- Multi-level code document structure

3 Parts:

- Structural design, materials and construction, and maintenance

Scope:

- All kinds of concrete structures (plain concrete, reinforced concrete, prestressed concrete, and composite structures with concrete)

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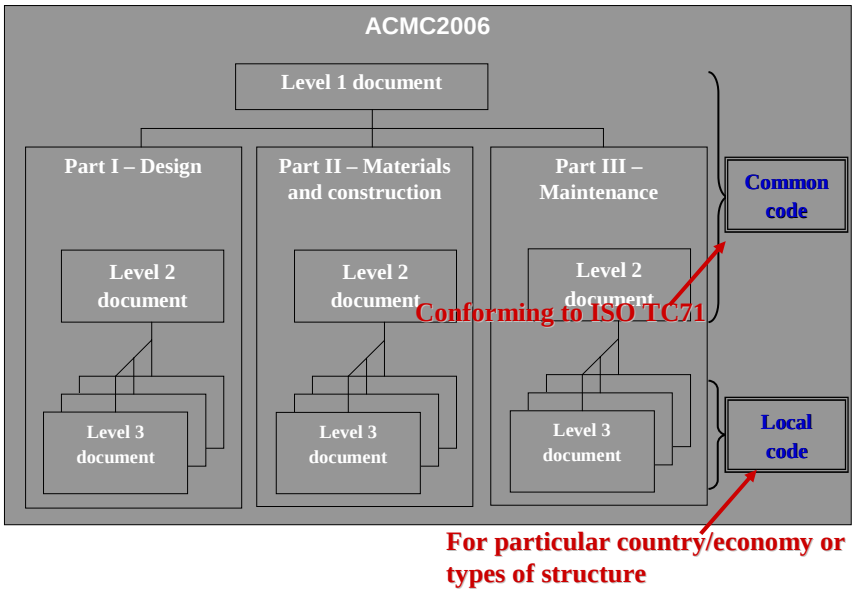
Multi-level Document Structure



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Example of Level 3 Documents

"Vietnam Construction Standard TCXDVN 318: 2004 - Concrete and Reinforced Concrete Structures - Guide to Maintenance", 2004. *(→ National Code)*

·→ **The Standard covers almost all frame contents of Part III of the ACMC 2001 and concretes to the local conditions and construction habit in VN:**

The first Maintenance Standard in VN;

- Written by IBST with the support of ICCMC;
- VN Minister of Construction decided to publish on July 29, 2004;
- The umbrella standard with main frame of maintenance;
- The voluntary standard- will be upgrade into a Code of practice;
- VN will develop some specified standards of maintenance and repair of structures.

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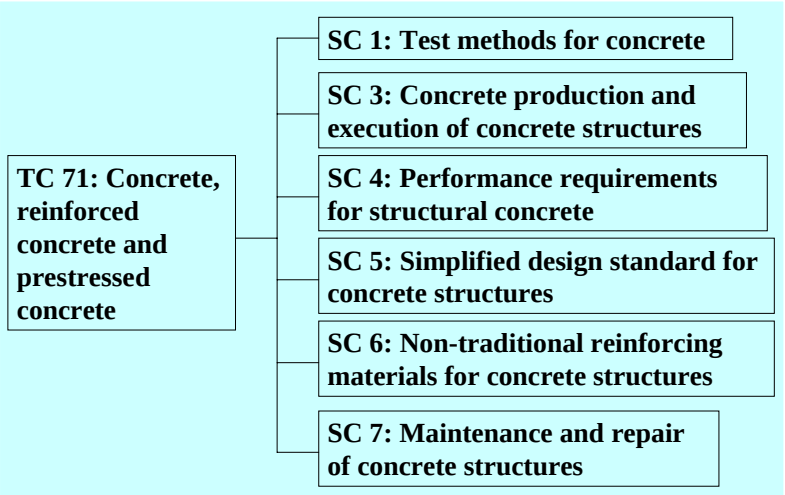
Relation to ISO's concrete code



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ICCMC's contribution in ISO/TC71

- **Enhancement of Asian presence**
  - TC71, SC1, SC3, SC4, SC5, SC6 and SC7 (SC8)
- **Establishment of SC7**
  - SC7 "Maintenance and Repair of Concrete Structures"
  - Chairman from Korea and Secretary from Japan
  - ISO umbrella code to be drafted based on ACMC
- **Initiation of discussion on "Performance-based Concept"**
  - ACMC is a regional code with performance-based concept while ISO codes does not have a system evaluate regional, performance based design code

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Asian Concrete Model Code: Benefit for Asian Countries

For Asian Countries with Own Code

- Dissemination of their technology to be international code in Asia and ISO
- Strengthening their presence in international circle such as ISO through collaboration among Asian countries

For Asian Countries without Own Code

- Developing national codes
- Enhancement of technological level
- Strengthening their presence in international circle

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Asian Concrete Model Code: Difficulties in International Code Drafting

Volunteer work from limited countries

- Unfamiliarity for code drafting
- Small motivation with no direct benefit such as research grant to individual

Difficulty in being recognized by government

- Country where codes are well established shows little interest
- ICCMC is not a governmental body
- China and Taiwan issue
- Etc.

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ISO-TF inside ICCMC

- To establish strategy for the ISO TC71 activities by ICCMC members

- To play major role in code writing function in Asian Concrete Federation (ACF)

- To promote ACMC all over the world efficiently

- To plan ICCMC meeting to minimize expense → utilization of international conference in Asian Region

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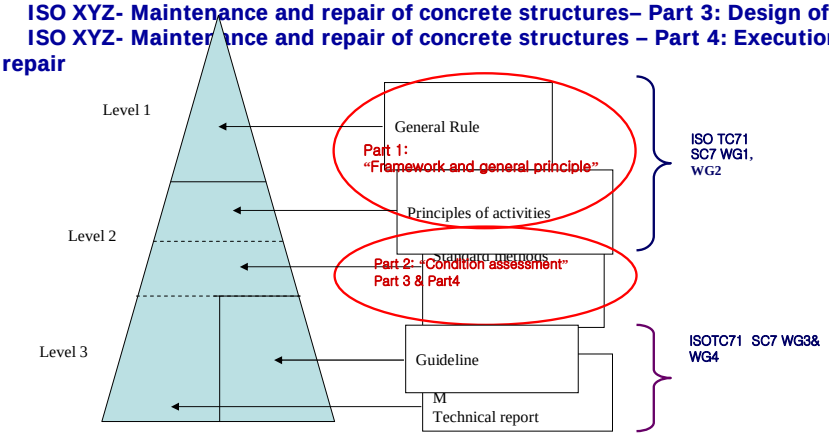
ISO/TC71 SC7

ISO XYZ- Maintenance and repair of concrete structures – Part 1: General (WG1)

ISO XYZ- Maintenance and repair of concrete structures– Part 2: Condition assessment (WG2)

ISO XYZ- Maintenance and repair of concrete structures– Part 3: Design of repair

ISO XYZ- Maintenance and repair of concrete structures – Part 4: Execution of repair



→There are 4 working groups in the SC7 and 3 working group leaders (convenors) out of 4 working groups are individual members of ICCMC

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ICCMC's contribution in ACF

ACF asked ICCMC to produce technical documents for ACF. The ICCMC proposed a proposal for two TGs with ACF's funding at Bali conference on Nov. 2006. Then, two TGs are requested to set up by ACF with 2 years of funding (US$3000/year/TG).

→ 1. TG 1, Prof Oh (ICCMC member and convener of WG3 of ISO TC71 SC7) is the coordinator, is preparing L3 document on Maintenance and Repair for Leakage due to Crack, which is supposed to be an ISO document.

→ 2. The other TG, TG 2 is headed by Dr Dradjat (ICCMC member and convener of WG4 of ISO TC71 SC7) and will prepare L3 document on Assessment and Retrofit for Seismic Damage, which is also to be an ISO document.

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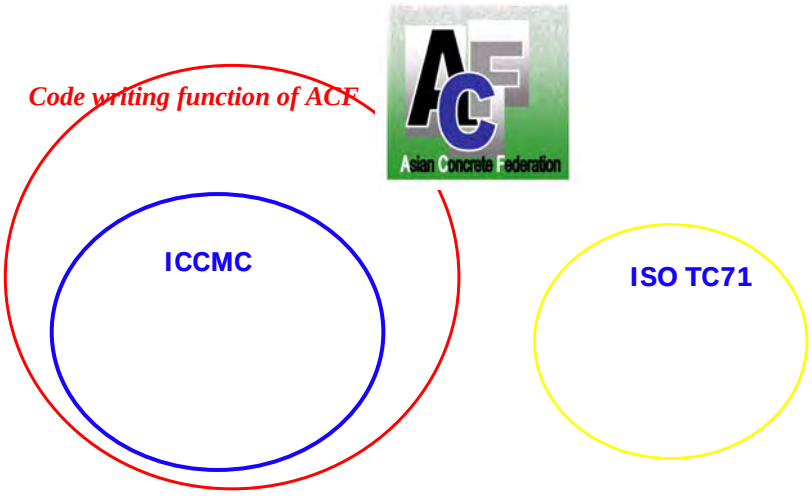
ICCMC's contribution in ACF



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Experience of ICCMC with ISO concrete codes

(1) Harmonization with ISO code is vital to ACMC.

(2) Effort for recognition of ICCMC →ex) A body to send Asian voices to ISO and to lead the development of ISO code on concrete structures.

(3) Dynamic activation of ISO-TF → ex) ICCMC will start to discuss how to contribute a new TC, TC8, on Harmonization of Design Codes in the Asian Region in the ACECC.

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CONCLUSIONS

(1) ACMC 2001 was published in March 2001 as the first model code for concrete structures in the Asia and Pacific region and revised in 2006 as ACMC 2006 harmonizing ISO Concrete code.

(2) It introduces "performance-based concept" for design, construction and maintenance of concrete structures as well as the “three-level document structure” that is suitable for regions where a great diversity in culture, climate, technology and economy exists.

(3) ISO/TC71 SC7 , lead by ICCMC members, is developing ISO umbrella code on maintenance of concrete structures, which will be mostly based on the Part III of ACMC, the first performance-based maintenance code in the world.

(4) ICCMC will play a major role for code writing function in the Asian Concrete Federation (ACF).

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Dedicated to Prof. Fumio Nishino

The late Professor Fumio Nishino (1936 – 2007)

A man who loves Asia...

.....

I miss him very much..

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Thank you for your attention!

Web site for ICCMC

www.iccmc.org

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Special Forum 3 / 4th CECAR

Cooperative Structure Toward Code Harmonization
in the Geotechnical Field -

Development of New Generation Design Codes in Taiwan

Dr. Chung-Tien Chin
Dr. Jie-Ru Chen
MAA Group Consulting Engineers

27 June 2007

Disclaimer

- *This presentation was prepared exclusively for the use of the Special Forum 3 of 4th CECAR. This presentation is incomplete without reference to, and should be viewed solely in conjunction with, the oral briefing provided by the authors*

Agenda

- Background
  - Earthquake design
  - Major project experiences
- Promotion of new generation design codes
  - R&D Group of TGS
  - Seminars and workshops
  - Taipei 2006
- Action Plan

Background

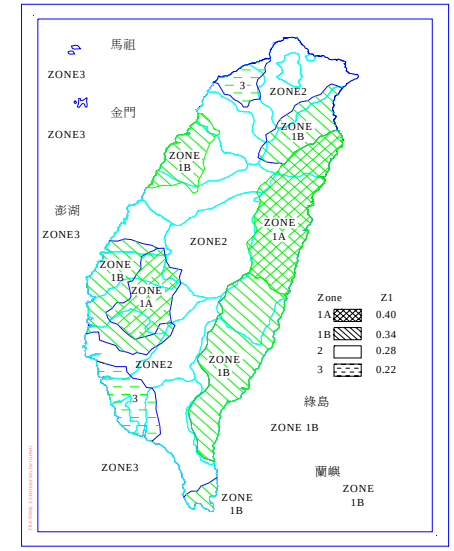
Seismic Design Specified

- Buildings
- Highway
- Railway
- Rapid Transit System (Taipei / Kaohsiung)
- Port & Harbor Facilities
- Taiwan High Speed Rail (THSR)

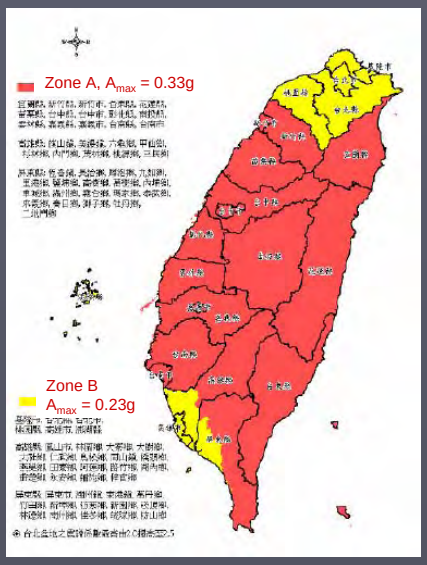
THSR Project

- The largest BOT project in the world: US$15 billion
- Total length: 345 km
- Maximum design speed: 350 km/hr
- Maximum capacity: 300,000 passengers per day

Seismic Zoning Maps



THSR Design Specification



Seismic Design Specification

Earthquake Design Requirements

- **Type I Earthquake – design for repairable damage**
  - Return period of 950 years
  - Design peak ground accelerations (PGA) in horizontal direction are given in different zones
  - (PGA)vertical = 2/3 (PGA)horizontal
- **Type II Earthquake – design for safe operation at maximum speed and no yielding**
  - PGA is one-third of Type I Earthquake

Design Loading Combinations

- Case 1: combination of “normal load” condition
- Cases 2 & 3: combination for “exceptional load” conditions
- Case 4: combination of the”ultimate load” condition
- Case 5: loading combination for verification of settlement criteria

Specified Safety Measures

	Safety Factor		
	Normal Load	Exceptional Load	Ultimate Load
End Bearing Capacity	3.0	2.0	1.25
Skin Friction	2.0	1.5	1.25
Pullout Resistance	No tension force permitted	2.5	1.5

Reflection

“Conventional” Geotechnical Design Basis

- Allowable stress design
- Uncertain parameters considered deterministically
- Empirical factor of safety
- No adequate information provided for achieving optimal design

Structure vs. Geotechnical Design

- Empirical safety factors were used for geotechnical design
- Load factored design may be used to design the structure component
- Reliability levels associated with these two systems could be different

Interpretation of THSR Design

Limit State / Loading Magnitude	Serviceability	Ultimate
Normal	Case 5	Cases 1, 2, 3
Type II EQ	*specified for structural design	
Type I EQ		Case 4

"New generation" of Design Concepts

- **Limit State Design**
  - Design not dominated by a single limit state
- **Performance-Based Design**
  - Concept that design of structures not based on prescriptive means but by outcome performance based on the requirements of society and/or the owners (Geo-code 21)
- **Reliability-Based Design**
  - Achieving total reliability is not possible
  - Ensuring p_f = Prob (Q<F) $\leq p_T$

Performance Matrix

Damage to a Structure

Magnitude of Actions

	Serviceability Limit State	Repairable Limit State	Ultimate Limit State
High freq. Low impact	◎○△		
Medium freq. Med. Impact	◎ ○	△	
Low freq. High impact		◎	○ △

Note: ◎ Important Structure ○ Ordinary Structure
△ Easily Repairable Structure

(Honjo, 2004)

Promotion of New Generation Design Code

Motivation of Code Development

- Need for revision of existing design code
  - Investigation, liquefaction, slope design
- Rational design concept pursuance
  - PBD / LSD / RBD
- International promotion and development of “new generation” design codes
  - Eurocode 7 / Geo-code 21 / AASHTO LRFD Specification / CFEM (ver. 4)
- International / regional code harmonization activities

Initiation

- Research and Development (R&D) Committee of TGS (2005-2007)
- Solicited topic: Development of New Generation Geotechnical Design Code
- Terms of Reference:
  - To promote new generation design concept
  - To evaluate need for new code development
  - To organize/involve relevant activities
  - To identify issues for future study

R&D Committee Members

- Chaired by: Dr. Chung-Tien Chin

- Academia
  - Prof. YW Pan (NCTU)
  - Prof. SS Lin (NTOU)
  - Prof. HD Lin (NTUST)
  - Prof. DW Feng (CYCU)
  - Prof. JY Ching (NTUST)
  - Prof. YM Hsieh (NTUST)
- Industry
  - Dr. CC Liu (Trinity)
  - Dr. HW Yang (THSRC)
  - Mr. TY Ho (CECI)
  - Dr. JR Chen (MAA)

Promotion (2005-2006)

- Special Forum：Global Trend on Development of New Generation Geotechnical Design Code
  - 2005 Taiwan Geotechnical Conference
  - September 8, 2005
  - Organized by R&D Committee of TGS
  - First organized discussion on need of new generation design code in Taiwan

Promotion (2005-2006)

- Workshop on the Evaluation of Geotechnical Engineering Design Codes
  - 2006/3/4
  - Recent Development of Geotechnical Design Codes (Yusuke Honjo)
  - Evaluation of Existing Taiwan Geotechnical Design Code (FC Chen)
- Professional Geotechnical Engineers Association Special Lecture Series: Lecture 1
  - 2006/10/19
  - On Geotechnical Design Code Development from Treatment of Geotechnical Uncertainties (CT Chin)

Promotion (2005-2006)

- Sino-Geotechnics 109: Geotechnical Performance Based Design and Related Concepts (2006/9)

Promotion (2005-2006)

- Workshop on Cross Strait Geotechnical Engineering Risk Management (2006/11/1)
- International Symposium on New Generation Design Codes for Geotechnical Engineering Practice - Taipei 2006 (2006/11/2-3)
- "Harmonization of Design Codes in the Asian Region", ACECC Workshop (2006/11/4)


TAIPEI
International Symposium on New Generation Design Codes for Geotechnical Engineering Practice
2006 Nov. 2～3
Scope :
Communication of design risk within a transparent and rational framework is necessary in view of increasing interest in code harmonization, public involvement in defining acceptable risk levels, and risk-sharing among client, consultant, insurer, and financier. Activities in code harmonization are particularly noteworthy. For the geotechnical engineering profession, additional pressure is brought to bear to undergo significant revamp because structural and geotechnical design are increasingly incompatible. The status of local design codes in view of globalization and their compatibility in view of evolving design philosophies are issues of major concern that do not admit simple solutions. This conference intends to accelerate research and practice on important issues relating to new generation geotechnical design codes. The scope of this symposium is to move geotechnical engineers forward together as a community in response to significant changes occurring at the global level.
Themes of Paper Sessions :
Geohazards and Earthquake Related Topics
Engineering Practice and Case Histories
Code Concept and Harmonization
Geotechnical Uncertainties and Variabilities
Geotechnical Reliability Analysis
Performance-based Engineering
Keynote Lecturers :
Dr. Dennis Becker (Canada) · Prof. Herbert Einstein (USA)
Prof. Yusuke Honjo (Japan) Prof. Trevor Orr (Ireland)
Invited Lecturers :
Prof. Lin H. D. (Taiwan) · Prof. Mesi-Ling Lin (Taiwan) · Prof. Huang H.W. (China)
Dr. Kenichi Horikoshi (Japan) · Prof. C. Hsein Juang (USA) · Prof. Takeji Kokusho (Japan)
Prof. Kok Kwang Phoon (Singapore) · Dr. Bernd Schuppener (Germany)
Organizers :
Taiwan Geotechnical Society · ITC23, ISSMGE · National Taiwan University · National Taiwan University of Science and Technology
Supporting Organizations :
ASCE Taiwan Chapter · JWG-DMR · Taiwan Construction Research Institute · GI-RAM, ASCE · ITC39, ISSMGE
Southeast Asian Geotechnical Society · Taipei Foundation Engineering Institute · Ministry Education · National Science Council
Water resources agency Ministry of Economic Affairs · Office of Science and Technology Advisors
Construction and Planning Agency Ministry of the Interior · China Engineering Consultant, Inc · Public Construction Commission
Symposium Official Website : http://140.118.105.174/taipei2006/
Symposium Contact Person : Prof. Yin-Ming Hsieh E-MAIL: taipei2006@gmail.com

Action Plan

Taiwan Geotechnical Design Code

- It is recognized a significant issue to discuss the current status and future of Taiwan Geotechnical Design Code
- Two areas should be addressed at the same time
  - Revision of existing code and practice
  - Development of codes based on “new generation” design concept
- Task groups have organized to tackle relevant issues

Task Group 1

- Revision of existing code to meet modern practice
  - “Design Code Working Group” formed under TGS (2006)
  - Chaired by：Prof. M.L. Lin
  - Subgroups for three initial topics:
    - Development of site investigation specification
    - Study toward revision on specification of liquefaction analysis
    - Development of guidelines on slope design

Task Group 2

- Development of Taiwan New Generation Geotechnical Code
  - "Working group on Taiwan geotechnical performance based design code" formed under TGS (2007)
  - Chaired by：Prof. H.D. Lin
  - To study toward drafting a Taiwan Geotechnical Code founded on Performance Based Design Concept

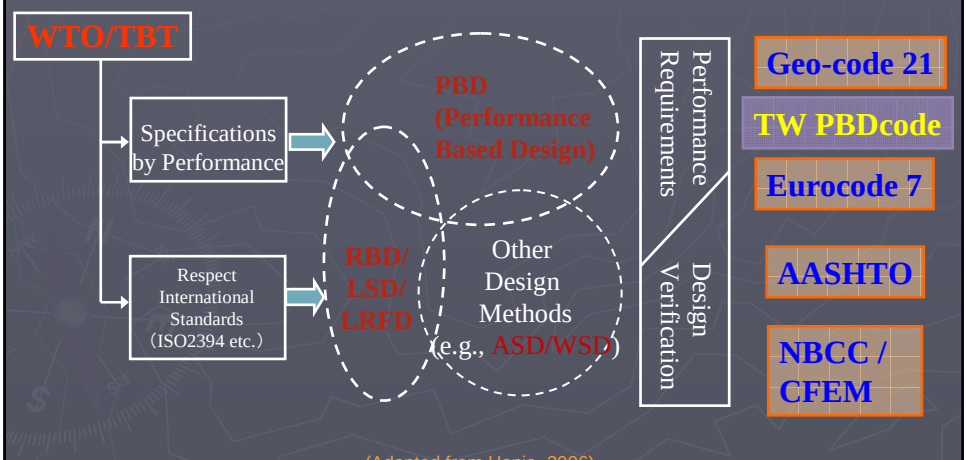
WG on PBD Code

- To act as a pilot group to study issues on Geotechnical PBD
- To prepare a draft PBD code
  - Concept and structure will base mainly on Geo-code 21 and Eurocode 7
- To identify topics for future study

WG on PBD Code

- Kicked off on May 31, 2007
- Regular monthly meeting will be held
- Initial tasks
  - Translate and study Geo-code 21
  - Discuss “performance requirements” and “performance criteria” for Taiwan practice
  - Prepare a proposal to government for drafting the code

Comprehensive Design Code Structure



(Adapted from Honjo, 2006)

Taiwan PBD Code

- To implement a structure that can allow to unify various geotechnical codes in Taiwan
- To provide a base that can assist future International / Regional code harmonization
  - Asia Code
- To enhance development of design verification that can be better harmonized with structural design

Performance based Specification concept and revision of the Technical Standards of Port and Harbour Facilities (2007)

CECAR Special Session 3
Taipei 2007

Y. Honjo, Gifu University
本城　勇介、岐阜大学

Table of Contents

WTO/TBT (1995)

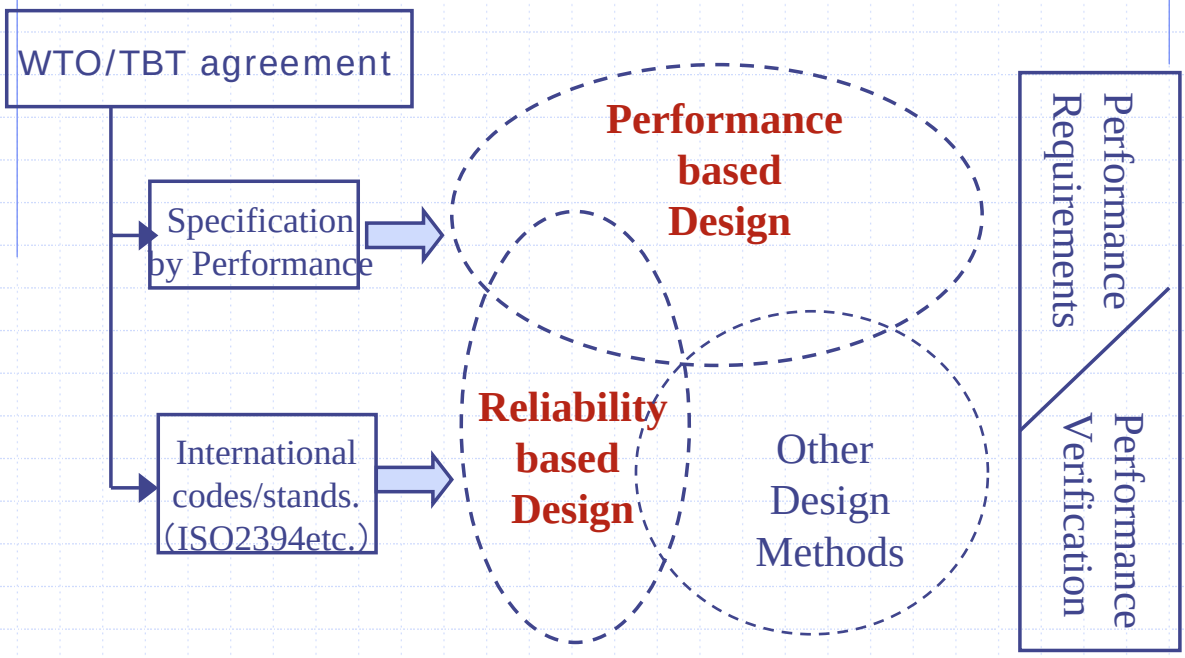
(AGREEMENT ON TECHNICAL BARRIERS TO TRADE)

Article 2: Preparation, Adoption and Application of Technical Regulations by Central Government Bodies

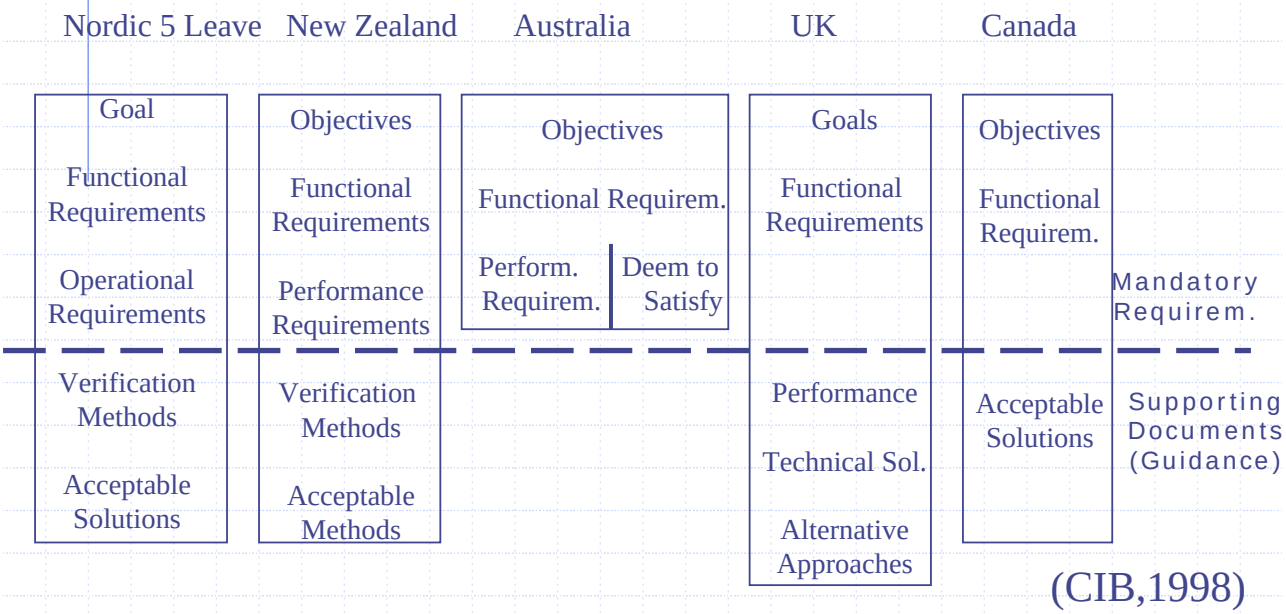
2.4 Where technical regulations are required and relevant international standards exist or their completion is imminent, Members shall use them ... .

2.8 Wherever appropriate, Members shall specify technical regulations based on product requirements in terms of performance rather than design or descriptive characteristics.

WTO/TBT Agreement, PBD and relevant international codes/standards



Performance based regulations in building codes



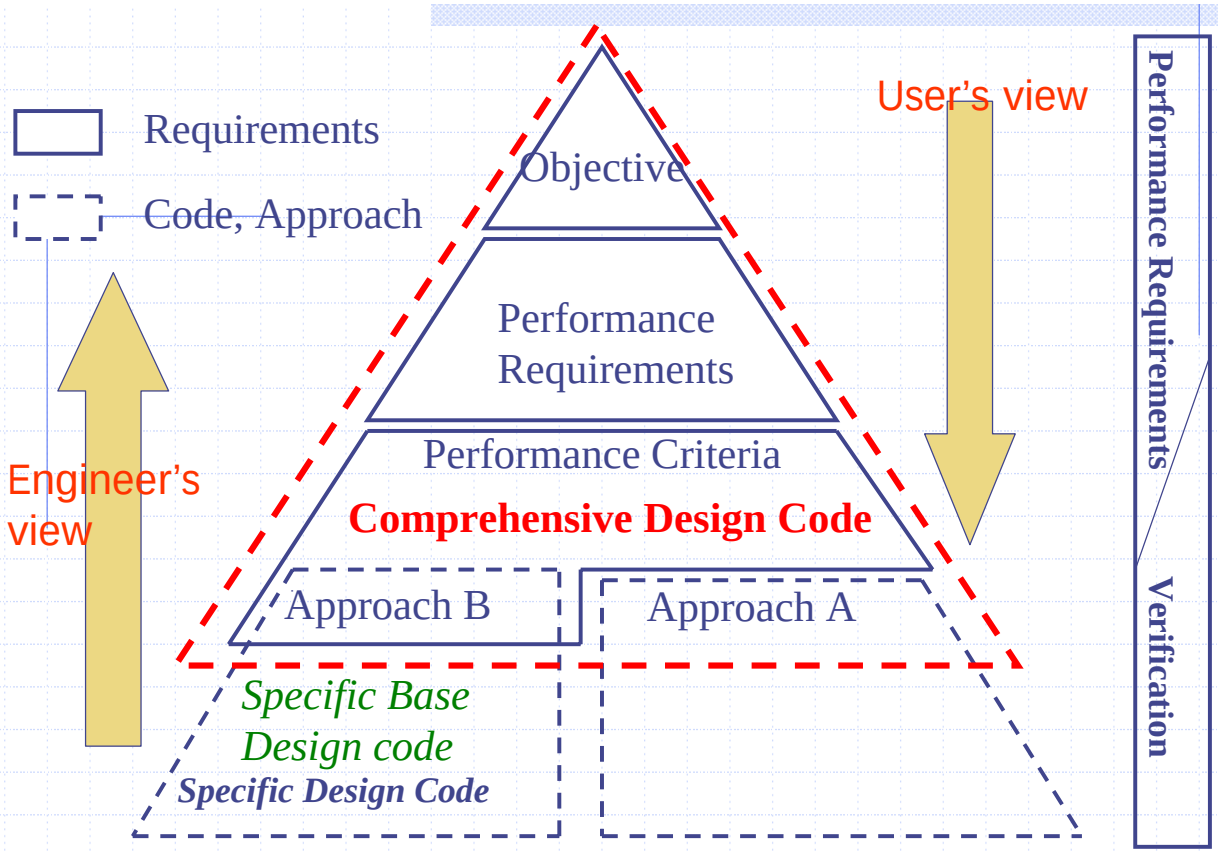
(CIB,1998)

Benefits of Performance Based Design Codes

- Higher accountability and transparency to the users of the codes. Easier to understand the intention of the code writers to the users.
- Easier to harmonize the design codes under different social and legal systems.
- Construction cost reduction is expected by introduction of new technologies?
- Easier to keep consistency of the description of the design code.

Remained Issues of PBD codes

- How to find an interface between the top down approach of users and administrators, and bottom up approach of engineers or code writers.
  (User's thinking vs. Engineers' thinking)
- A social system is required to judge performance of structures based on PBD.
- Judgment for flaw (=defect) in the design when done by PBD.



Hierarchy of Requirements and Verifications

What is Eurocodes

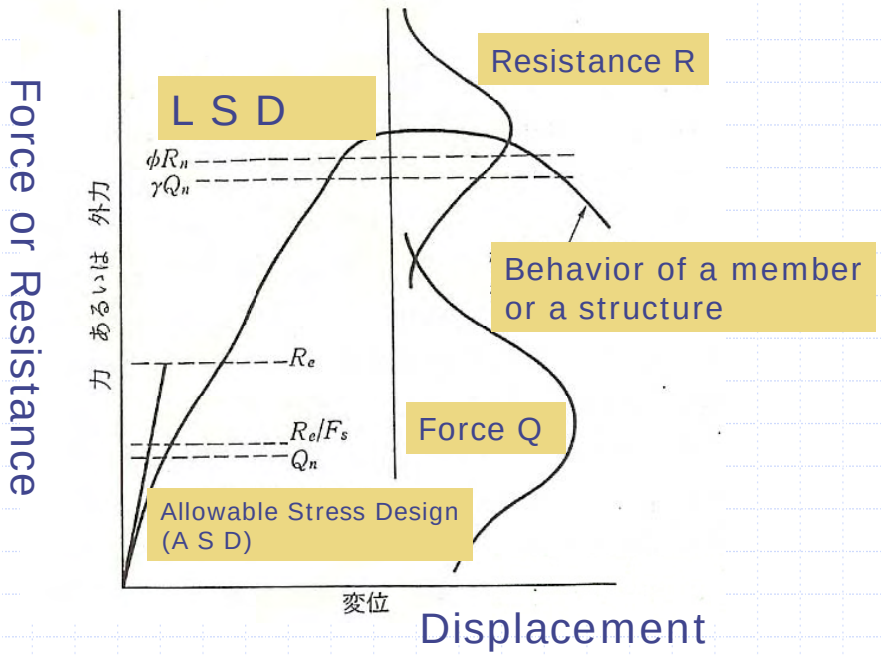
EN1990 Basis of design for structural Eurocodes
EN1991 Actions on structures
EN1992 Design of concrete structures
EN1993 Design of steel structures
EN1994 Design of composite structures
EN1995 Design of timber structures
EN1996 Design of masonry structures
EN1997 Geotechnical design
EN1998 Design of structures for earthquake resistance
EN1999 Design of Aluminum structures

Started their work in 1970's. More than 60 documents.
CEN (European Committee for Standardization), Brussels

Purposes of establishing Eurocodes

- The purpose of Eurocodes is to establish a set of rules for design of civil and building structures thereby eventually replace present design rules that are different from one country to another.
  - promote construction industries with in EU region by unifying the market.
  - Strengthen the competitiveness of EU construction industry against non-EU.

Limit State Design Concept:
The concept Eurocodes are based



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  - Geo-code 21(JGS,2004)
- Revision of the Technical Standards for Port and Harbour Facilities (2007)
- Conclusions

Comprehensive Design Codes Development in Japan

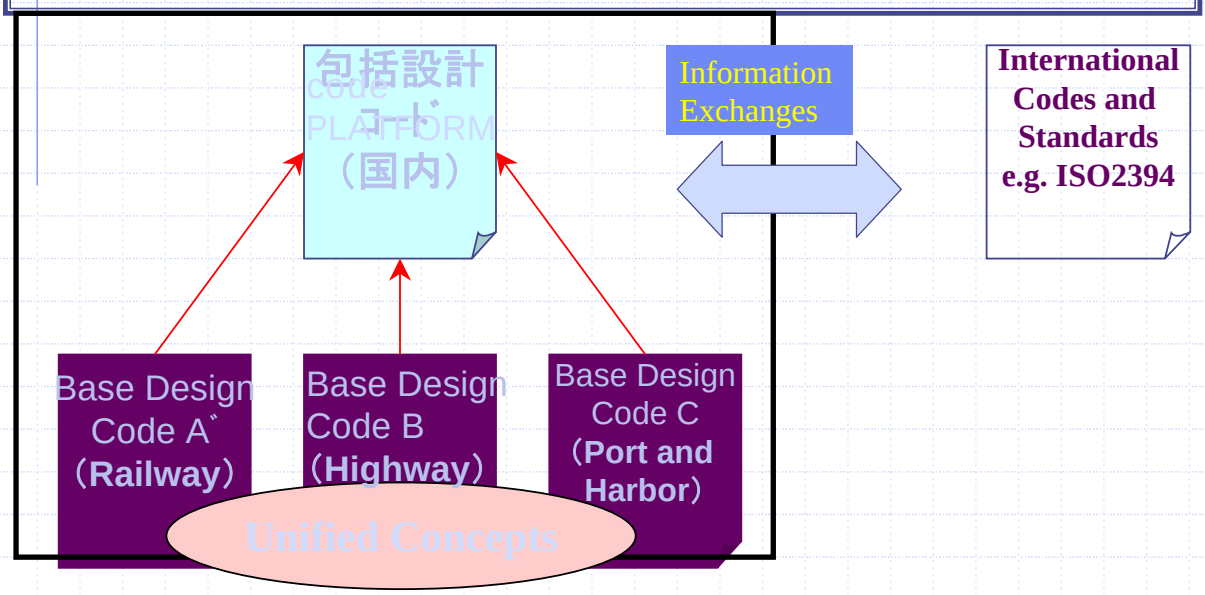
- code PLATFORM ver.1 (JSCE, 2003)
  Principles, guidelines and terminologies for structural design code drafting founded on performance based design concept ver. 1.
  (Japanese Society of Civil Engineers, 2003)
- Geo-code 21(JGS, 2004)
  Principles of Foundation Design Grounded on Performance Based Design Concept
  (Japanese Geotechnical Sciety,2004)

Purposes of Comprehensive Design Codes development

- Propose an ideal design code based on performance based concept.
- Harmonize design concepts and terminologies in major Japanese design codes.
- Dispatch our technology to the world by a single voce.

Comprehensive Design Code

- Describing basic rules of design code, e.g. concepts, terminologies and procedures.
- A code for code writers



Objectives of Code PLATFORM

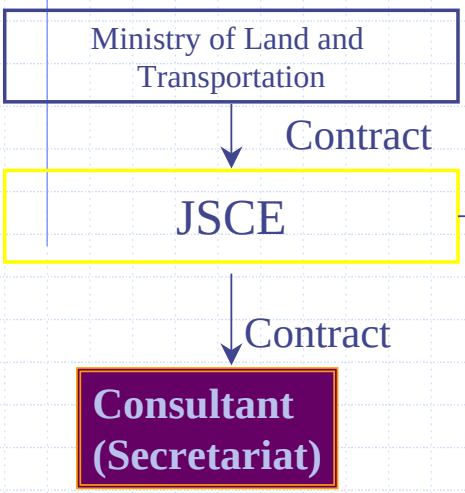
- Provide a framework of a structural design code based on performance based concept.
- Define structure to define performance requirements.

  Objective – Performance Requirements – Performance Criteria
- Define the elements of Performance Criteria

  Limit states – design situations – time
- Performance verification procedure

  by performance concepts vs. by codes

Drafting Body(2001-2002)



Committee on investigating and drafting a comprehensive design code (25 members)

Chair Osamu Kusakabe
General Secretary Yusuke Honjo

Scholars and Engineers from various
field: steel, concrete, geotechnical, seismic, wind, reliability etc.

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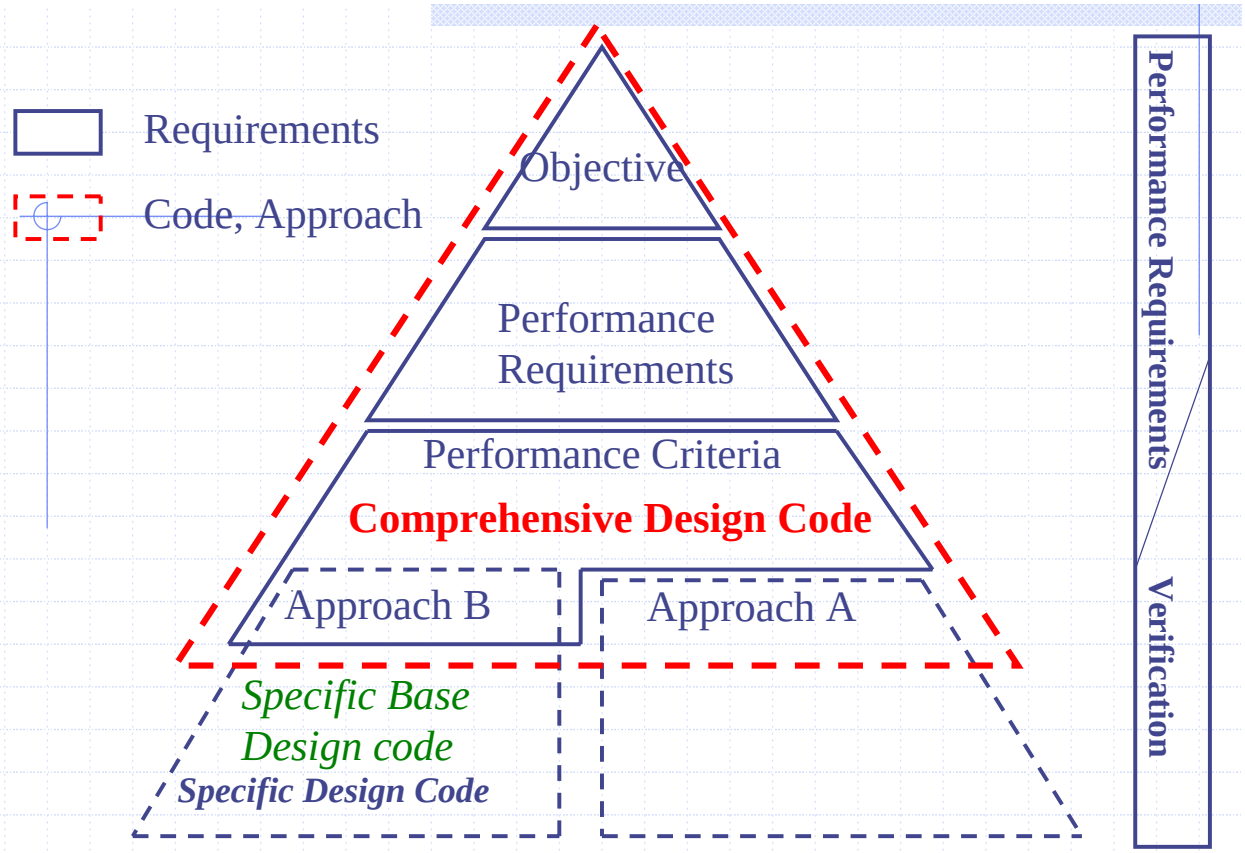
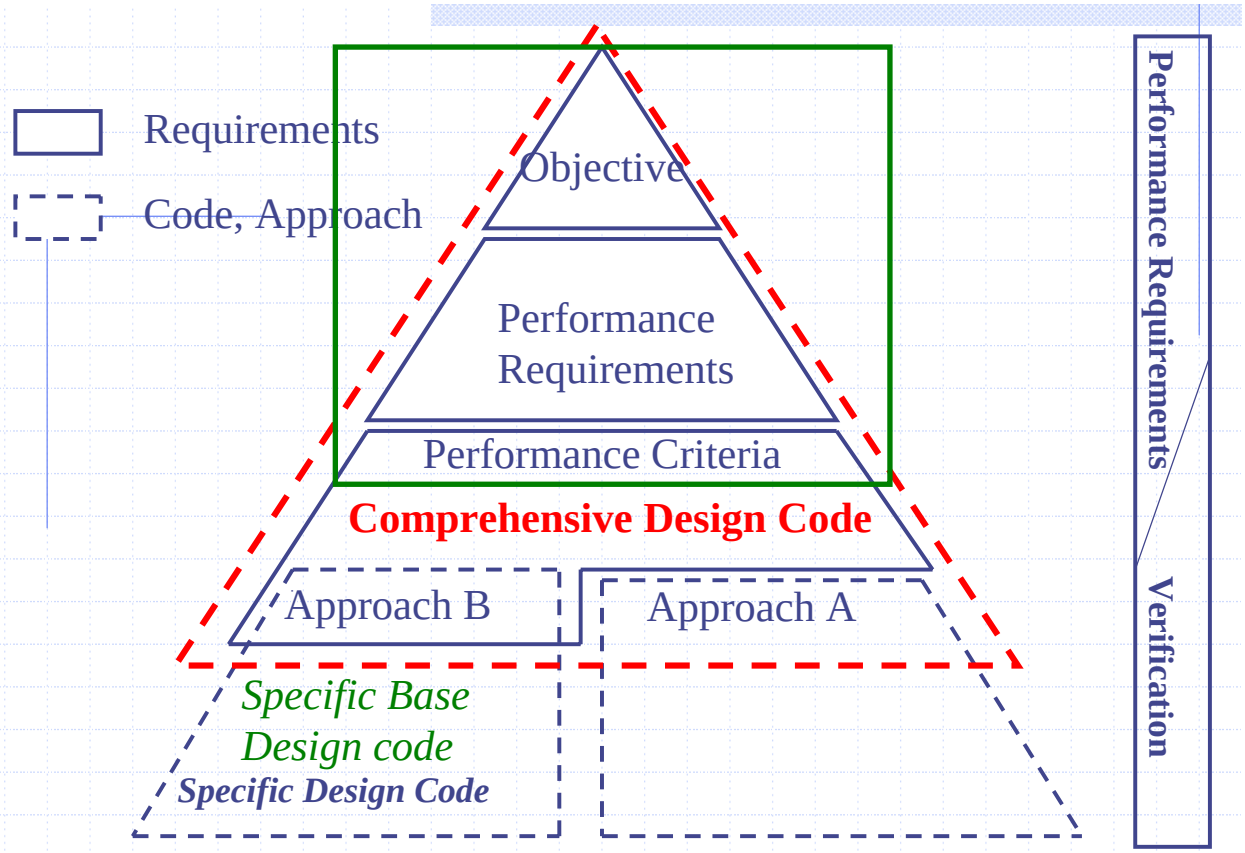


Hierarchy of Requirements and Verifications



Hierarchy of Requirements and Codes

Hierarchy in performance description of a structure (1)
Objective, Performance Requirements and performance criteria

- Objectives: The objective is the final social requirement of a structure with respect to one specific performance (e.g. structural performance) described in the general terminologies.

  For examples, 'buildings shall provide sufficient safety to the residence at the time of earthquake events so that they are preserved from serious injuries and loss of lives' or 'Marginal operation of functions of a structure is preserved'.

Hierarchy in performance description of a structure (2)
Objective, Performance Requirements and performance criteria

- Performance requirements: The performance requirements describes the functions of a structure that should be provided to achieve the stated objective by general terminologies.

  Example: 'A structure shall not collapse during an earthquake' or 'Damage to a structure shall be controlled to an extent whereby marginal operation is preserved.'.

Hierarchy in performance description of a structure (3)

Objective, Performance Requirements and performance criteria

- **Performance Criteria:** The performance criteria specify the details that are necessary to fulfill the functional statements. In principle, they should be quantitatively verifiable in structural design.

Performance Requirements is given by a Performance Matrix

= Limit states + Magnitude of Action + Importance of Structures

Description of Performance Criteria

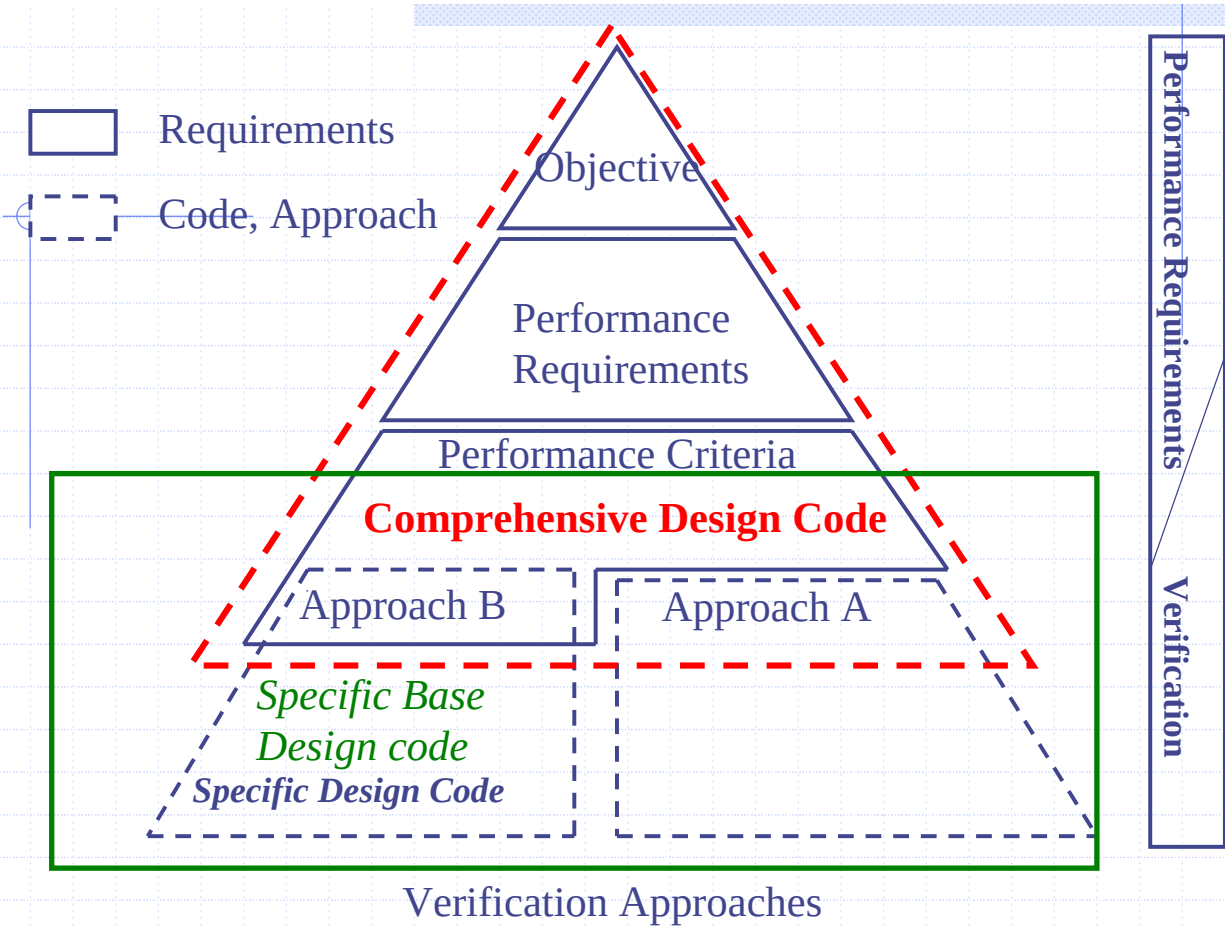
Limit states + Magnitude of Action + Importance of Structures

Damage to a Structure

Magnitude of Actions

	Serviceability Limit State	Repairable Limit State	Ultimate Limit State
High freq. Low impact	◎○△		
Medium freq. Med. Impact	◎ ○	△	
Low freq. High impact		◎	○ △

Note: ◎ Important Structure ○ Ordinary Structure
△ Easily Repairable Structure

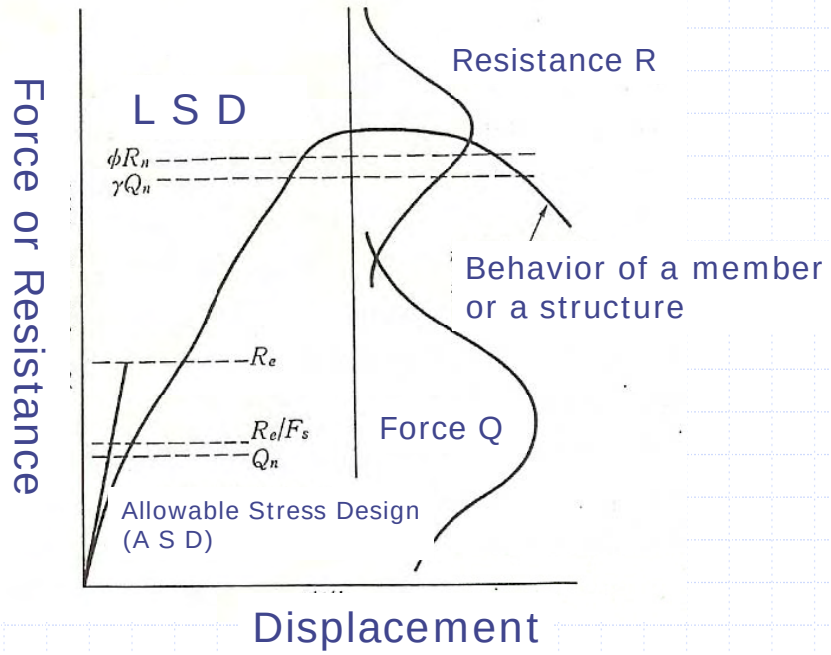


Hierarchy in Verification Methods(1)

- A Comprehensive Design Code that stands on top of both Approaches A and B
- Approach A: Fully performance based design approach.
- Approach B: A code for code writers. Limit State Design (ISO2394)

It is believed that the Limit State Design Method is one of the most suitable method to realize Performance Based Design (PBD).

Limit State Design Concept:



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Government Policy for deregulation (1)

Headquarter for Administrative reform (Head the Prime Minister)
'Three years plan for Deregulation '

March, 1998 the cabinet decision

1) All economic regulation should be eliminated in principle. The social regulations should be minimized. All regulation should be eliminated or deregulated.
2) Rationalization of regulation methods. For example, tests can be outsourced from the private sector.
3) Simplification and clarification of the contents of the regulations.
4) International harmonization of the regulations.
5) Speed up of the regulation related procedures.
6) Transparency of the regulation related procedure.

Government Policy for deregulation (2)

'Three years plan for regulation reform promotion'

March, 2001 the cabinet decision

1) Realization of sustainable economic development by promotion of economic activities.
2) Realization of transparent, fair and reliable economic society
3) Secure diversified alternatives for life styles.
4) Realization of economic society that is open to the world.

Government Policy for deregulation (3)

In order to realize such objectives, promotion of essential and active deregulations in various administrative services should be planned.

In the filed of standards and accreditations, the following basic policy was enforced.

- Essential reviews on standards and accreditations to check the necessity of the involvement of the government.
- In cases the administration involvements are still required, the roles of the administration should be minimized, and self-accreditation or self-maintenance of the standards and the accreditations by the private sectors should be promoted.
- The international harmonization of standards, the performance based specifications and elimination of multiple test procedures should be promoted.

Revision of Port and Harbor Law

Article 56 Item 2-2

(Before revision)

Those port and harbour facilities, such as navigation channels and basins, protective facilities for harbours and mooring facilities, should comply with the law that specifies such matter if such a law exists. In addition, their construction, improvements and maintenance should comply with `Technical standards of port and harbour facilities' that is specified as a ministerial ordinance by the ministry of land and transportation.

(After revision)

Those port and harbor facilities, such as navigation channels and basins (they are termed facilities covered by TSPHF), should comply with the law that specifies such matter if such a law exists. In addition, construction, improvements and maintenance concerning performances of the facilities covered by TSPHF should conform with `Technical standards of port and harbor facilities' that is specified as a ministerial ordinance by the ministry of land and transportation.

Background of Revision

International Standards

・ISO2394 General principles on reliability for structures, (1998)

Comprehensive Design Codes

・Bases for design of civil and building structures (MLT, 2002)
・Code Platform ver.1(JSCE, 2003)
・JGS-4001-2004 (Geo-code 21)

Specific Design Codes

Harmonized and Consistent with the International Codes and the Comprehensive Codes.

Design of Port and Harbor Structures

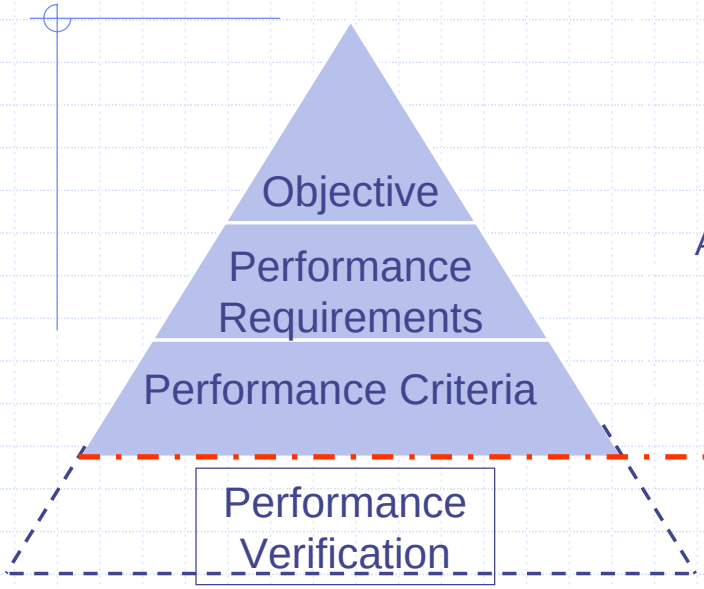
Allowable Stress Design with a Safety Factor (Conventional Design Method) ⇒ Reliability Based Design Dynamic Analyses (New Design Method)

Background in Administrative Aspects

- 'Three years plan for promotion of regulation reform' March, 2001, the cabinet decision
  → For Codes and Standards,
  Harmonized to International Standards,
  Performance based Specification

- Ministry of Land and Transportation,
  Program on Restructuring of Public Works Costs, March, 2003 →
  - Revision of Common specifications for civil works
  - Review of Highway Bridge Specifications
  - Revision of Technical Standards for Port and Harbor Facilities to performance based.

Performance based specification
Structure of Port and Harbor Facilities



Standards: Mandatory

Objectives of the facilities

Accountability

Specifications for Verification

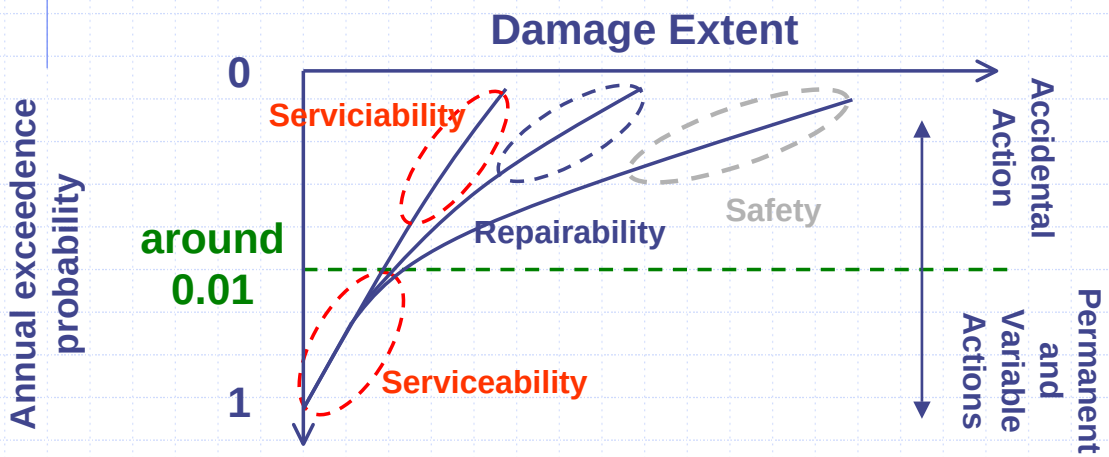
Not Mandatory

Examples of the performance verification methods and common values for design will be presented in the Annexes.

Performance Requirements

		Definition
Basic Requirements		**Performance of structural response (deformation, stress etc.) against actions.**
	Serviceability	**The functions of the facility would be recovered with minor repairs.**
	Repairability	**The functions of the facility would be recovered in relatively short period after some repairs.**
	safety	**Significant damage would take place. However, the damage would not cause any lives loss or serious economic damages to hinterland.**
Other Requirements		**Performance requirements on structural dimensions concerning usage and convenience of the facilities.**

	Definition	Performance Requirements
Persistent Situation	Permanent actions (self weight, earth pressures) are major actions.	Serviceability
Transient situation	Variable actions (wave, level 1 earthquake) are major actions.	Serviceability
Accidental situation	Accidental actions (Tsunami, level 2 earthquake) are major actions.	Serviceability, Repairability and safety



Summary of Basic Performance Verification Methods

Allowable Performance Verification Methods

- Reliability Based Design (RBD) Method
- Numerical methods (NM) capable of evaluating structural response properly.
- Model tests.
- Methods based on past experiences.

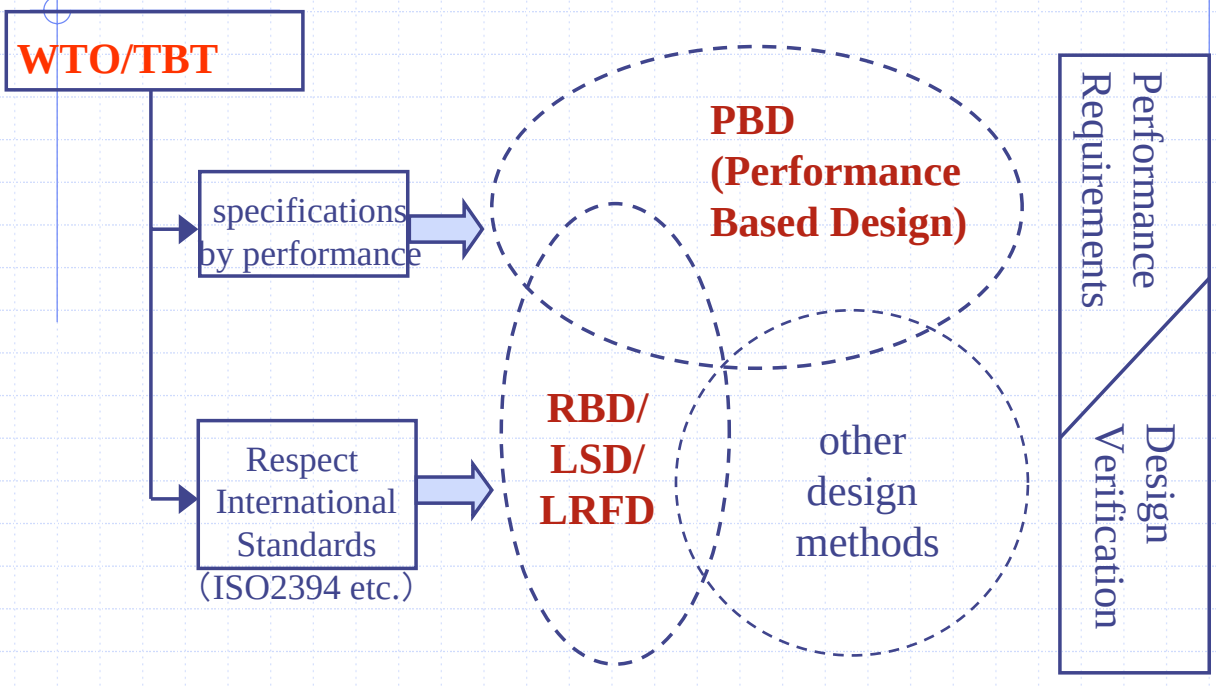
Design situation	Major Actions	Recommended performance verification procedures
Persistent situation and Transient situation	self weight, earth and water pressures, live load, wave, wind, ship etc.	RBD
	Level 1 earthquake	◆Non-linear response analysis considering soil-structure interactions. ◆RBD ◆Pseudo-static procedure (e.g. seismic coefficient method)
Accidental situation	Level 2 earthquake, Tsunami, ship collision etc.	Numerical procedure to evaluate displacements and damage extents.

Conclusion

PBD and RBD are the international standards. (Impact of WTO/TBT)

（1）The design codes are to be based on PBD for describing performance requirements, and the design verification should be based on RBD/LSD/LRFD.

WTO/TBT agreement, PBD and RBD

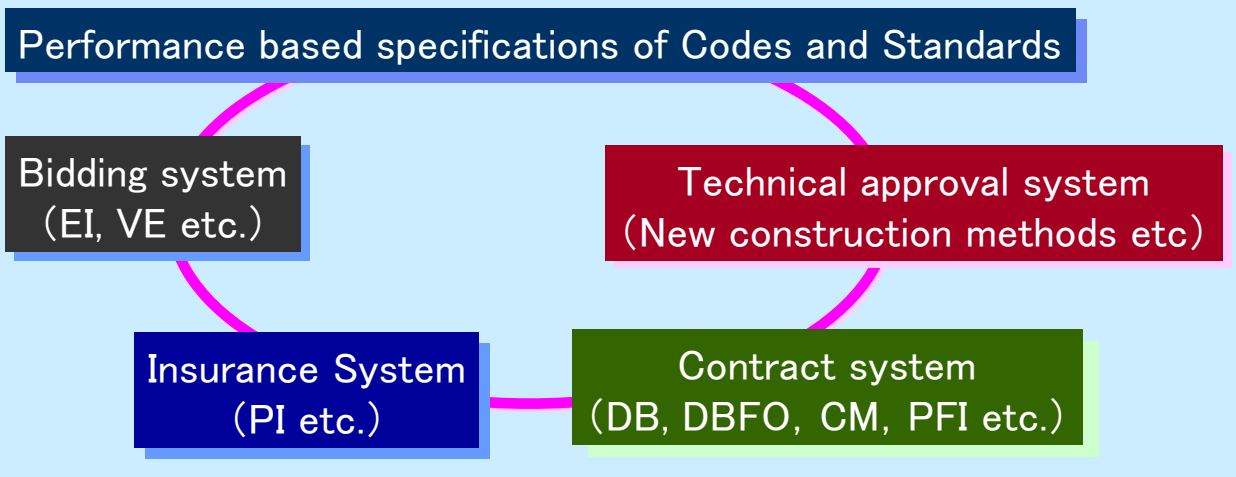


Conclusion

(2) The Technical Standards on Port and Harbour Facilities has been revised April 2007 based on PBS concept and LSD. The comprehensive design codes that have been developed in the professional societies played some important role.

(3) Design codes are just a part that realize performance oriented design of structures. Other parts need to be developed in parallel.

Systems to support PBD



(quoted from Horikoshi, 2005)

Special Forum 3

27 June, 2007 9:00-11:00

Summaries & Discussions

Chair	**Prof. Yusuke Honjo (Gifu University, Japan)**
Secretary	**Dr. Kenichi Horikoshi (Taisei Corporation)]**

Level of Harmonization (1)

Level 1 Share of information beyond boundaries of societies and civil eng. fields (source of code, methodology of code development)

Activities of this level have already been started by ACECC i.e. code information on ACECC website, and ACECC workshop on Harmonization of design codes in the Asian region Nov. 4, 2006

Level 2 Harmonization of basic terminologies used for designs, Harmonization of design concept, such as limit state design, performance based design,

Informative to code writers
Avoid misunderstanding among engineers in practice

Level of Harmonization (2)

Level 3 Harmonized code for basis of design,

Harmonized code for a specific design field, such as concrete, structural engineering, and geotechnical engineering.

Codes to be refereed by code writers in each country
Such as Eurocode 0: Basis of Design,
ISO 2394: General principles on reliability for structures,

Level 4 Harmonization extended to broader area and broader engineering field.

Asian Concrete Model Code activity toward ISO
Asian Voice to the world

Level of Harmonization (3)

Level 1	**Share of information**
Level 2	**Harmonization of terminologies, design concepts**
Level 3	**Harmonization of basis of designs**
Level 4	**Extension of harmonization to broader area**

The higher the level is, the more time-consuming task

Continuous activities at each level are important for harmonization

Through the activity, human network will be created.

Information should be published so that non ACECC societies/institutes can refer.

Discussion Points

Do we really need code harmonization in the Asian Region?

If we need, then what level of harmonization do we need?

What are demands from small and developing countries?

What developed countries should do for harmonization?

Are there any other possible activities towards harmonization?

And so on,

New ACECC Technical Committee on

Harmonization of design codes in the Asian region

Approved by

ACECC Executive Committee Meeting on June 25, 2007

Terms of References of the new TC:

1) Create and strengthen human network on code development through continuous discussions.
2) Provide the latest information on design code in the Asian region, and make it public on the website.
3) Create the glossary of terminology for basis of design, which will be based on a new concept such as performance based design.

Activity period: 2007-2010

TC Chair: **Prof. Yusuke Honjo**
(Gifu University, JSCE)

Secretary: **Dr. Kenichi Horikoshi**
(Taisei Corporation, JSCE)

Other TC members will be decided after the 4th CECAR.

Nomination of TC members from each ACECC society/institution is welcome.

Member from non-ACECC society/institute is also welcome.

For further information, please contact to JSCE.

4th 土木 CECAR

Taipei 2007

The 4th Civil Engineering Conference in the Asian Region