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Concrete Model Code for Asia - Concept to National Implementation

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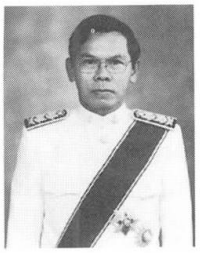

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Summary

Concrete Model Code for Asia is necessary since the region has shown great potential for construction by volume and complexity. Achievement of the "First Draft" in 1998 has proved some unification among codes of practice in each country. Ultimate achievement can be obtained if this model code is adopted into the national code and then implemented and practiced amoung professional engineers. Current codification modular of ACI, CEB/FIP(fib), and some Asian countries will be compared procedure, then each country modifies it to suit their need. The engineering institute in each country will be the most important organisation to adopt the national code which is compatible with the current code of conduct, government regulation and social acceptance. The ultimate goals of the Concrete Model Code for Asia are high performance of structural concrete in strength, serviceability and durability. The success will depend on each individual engineer, professional institution and co-operation among the organisations.

1. Introduction

Structural concrete is considered as a major construction material for infra-structures such as bridge, building, dam, port, habour, tunnel and off-shore structures etc. Potential of construction industry in Asian countries is quite large by means of construction volume and its complexity. The projects become gigantic, involve different partners, and lead toward international contracts. The needs to develop the concrete Model Code for Asia are quite essential and the ultimate goals can be achieved only if the national code is adopted and implemented conformingly. The principal objective of the Concrete Model Code is the high standard of structural performance and public safety concerning natural and social environments.

Achievement of the "First Draft, Concrete Model Code for Asia" in 1998 has proved some efforts in technical co-operation among engineers in the region through the International Committee on Concrete Model Code (ICCMC) with the action support of Japan Concrete Institute (JCI) and some other national engineering institutes. The important task is to collect industrial standards and codes of practice in each country to unify and develop a model one for all Asian Countries. The code contains design, construction and maintenance in which they can be converted and adopted into the national one of the same framework.

Implementation of the model code would be more effective if the code has convergence of the differences in technical background of practical standard and relevant regulations. Codification process of some major organisations such as the American Concrete Institute (ACI), Comite Euro-International du Beton (CEB), and Federation International de la Preconstrainte(FIP), should be considered as a module for development, adoption and implementation. National code adoption is the first step for the implementation process. This paper introduces some typical approaches that engineering education, professional practices, and natural and social environments co-inside in the process. For legal aspects, the national code must be incorporated into the local jurisdiction process which becomes more complicated especially in some countries. The engineering institutes or similar institutions must take some active roles in policy making, strategic planning, intensive operation, specific monitoring and proper control. The ultimate goals of the Concrete Model Code implementation are the high performance of structural concrete.

2. Concrete Code Modular

Normal engineering practices in Asia, national code is already a part of the Building Control Act or a part of the regulation. Then the implementation process must be concentrated in legal aspects rather than the technical one. On the contrary, some national codes may be adopted from international model codes such as ACI or CEB/FIP, or duplicated from some other national codes. The achievement in development of the Concrete Model Code for Asia, will liberate the national code adoption and the implementation process. Several modulars have been studies and it is found that differences in scientific background, technology development, practical standard, and legal aspect, would lead to the best practice developed by their own professional institution. A module introduced in this paper can be adjusted to satisfy the local conditions of natural and social environments.

Modular A: Code of practice is coherent of research work and practical experience (Fig. 1). This module is initiated by academic institutions by means of research to improve or develop technology for better performance of the existing structures. The research and development may be financed and supported by governmental bodies or private sectors. However, the outcome will normally be reviewed by technical committee of the conference, seminar or congress. Then some of those problems may be proposed for change by the code committee. The procedure will take place after the proposal is accepted by the code committee. The merits to change are normally related to safety, serviceability, cost reduction, simplicity and clarification. Legally binding will be incorporated in jurisdiction process of the city or municipality. This process is quite sound and inclusive amoung academic, professional, and official institutions. Revision of the code can be done periodically every 4-8 years. This module is particularly applied for the ACI-Building Code Requirement for Structural Concrete.

Modular B: Code of practice is a convergence of different practices in design, construction and maintenance, in model code development. The international organisations such as CEB, FIP or European Communify (EU) will provide forum for practitioners to share their problems, knowledge, experience and expertise, by means of meeting, colloquium, symposium, or congress. The solutions of the problems can be obtained at broader views of common interests. The model code can then be developed internationally with the group efforts, and legal aspect has less impacts. Some research activities may be required to support or confirm the model. Those researches can be formulated by the working commission, then they may be carried out by academic institutions, and supported by the industries. The model code will be synthesized and

academic institutions, and supported by the industries. The model code will be synthesized and simplified for national code adoption to specific implementation as a code of practice required by professional institutes or societies. Public law or regulation will automatically be recognised by official authorities since the code normally harmonised professional practices, legal aspects, and industrial standards. This module (Fig. 2) seems to be one of the most effective implementation processes whose revision or changes have to be done periodicly every 6-10 years.

Modular C: Code of practice as part of the building regulation is formulated to regulate social functions, public safety and environmental issues in one single model (Fig. 3). As the regulation, the module is rather difficult to change, then it is always far behind advanced technology and current development. Some variations have been observed that they are influenced by the relationship among the governmental bodies, professional institutions and educational institutions. This module will be more effective for small countries where all functions can be centralised in a single system. However, the system is rather weak for implementation process, since advanced technology and practical problems are never considered as an important function of the code. The engineering education, research and development, and professional practices can play only passive roles for code implementation.

In Asia, combination of the three modulars with some modifications should be appropriate for each country. The implementation process with strong supports in technical aspects from professional and academic institutions as which legal issues can be incorporated with jurisdiction process with which social functions and environmental issues are concerned.

3. National Code Adoption

To adopt national code would be more difficult than the model code already under development. The process will involve several aspects, practical standards, local conditions and legally binding. It will be essential to determine principal variations such as aspects of the model code in technical and official issues. It should be noticed that the model code should fully deal with the technical issues while the national code should concern practical standards and legal aspects. The local conditions as natural and social environments can be taken into account either technical or official issues. Advanced or currently developed technology must be considered in the process. The engineering institute will take a major role in adoption process since the code must conform to the professional practices, comply with the law and regulation, and satisfy natural environment and cultural heritage. Adoption process introduced in Fig.4 can be modified to appropriate utilization. Several aspects have to be considered as follows:

Practical Standards: Principal objectives of professional practices normally deal with quality assurance, public safety and environments. Then the major issues are technology and the public. The process involves engineering education, industrial standards and professional development. The most important factors in engineering education are academic background of basic science, engineering core courses, and engineering disciplines. Industrial standards are influenced by material manufacturing, fabrication and maintenance. Professional development can be done through research and development for new technology, improvement of standards, and cost reduction in design, construction and maintenance.

Legally Binding: Social impacts on construction industry are public concerns, such as environmental impacts, and human resource development. For structural concrete, professional practice will provide public safety, life quality, and environmental conditions. On the other hand,

the governmental bodies such as city or municipality, would incorporate the technical issues to be the official one. Some extents of official control mainly depend upon the interaction between professional institution and governmental offices. Strengths of engineering education and profession development can lead toward minimum control by the public if the quality assurance in professional practice can be established.

Local Conditions: The local conditions can be categorised into natural and social conditions. The geographic, climatic and environmental phenomena are parts of the natural issues, while the culture, life style, or social function are the social or public issues. Both factors can be treated as technical issues by research and development for advanced technology. The enteraction between natural action and human responses can become the social issues such as diaster prevention, and diaster relieves. In such cases, law and regulation will be very important in professional practice or the model code. The cultural pride, or national heritage can also be reflected in the national code if proper treatment can be made. The professional institute in each country has to establish the differences between technical and social issues so that legally binding can be incorporated properly.

4. Implementation Process

Even the social and legal structures in Asian countries are completely different from other continents such as Europe and America, but the implementation process for concrete model code will not be so much different if the module is well prepared. The module as synthesized in Fig.5 can be conducted in the most effective way if the professional institute can guide national policies in social issues, economics and technologies. Structural concrete as one of the most important construction industry and engineering services in the region has taken sharing around 20-35% of the GDP. Then the impact could be tremendous not only in economic consideration, but the social, technology and the environment would also be taken into account.

Implementation of the concrete model code may be separated in two stages; first to adopt national code and the second to implement the code in professional practices. Flow chart shown in Fig.5 indicates initial stage of institute actions in planning and co-operation among involved organisations. Since the code of practice is the interaction among engineering education, industrial standard, and professional development, then the code adoption would require contribution from those groups. The second stage is to implement the code in construction industries and professional practices, which require various forms of supports for advanced technology and construction techniques.

The engineering institute must establish the objective and strategic plan to adopt the national code. Some related regulations in human resource development, professional engineers, and construction industries, must be reviewed and analysed to accommodate the most appropriate outcome to the code of practices. The code may be a part of the regulation or may be incorporated in the jurisdiction process as legally binding of the city or municipality.

The implementation process in each country will be somewhat different by local conditions and legal aspects. The interactive measures monitored from advanced technology and practical standards through social functions and environmental issues should be incorporated in the process. Feedback from construction industries and structural performance in professional practice by means of assessment and evaluation would push forward to up-dating and improvement. Research and development in materials, structures, and technologies can be

adjusted periodically in the implementation process. The engineering institutes or related societies should take their lead for the change and improvement.

5. Conclusion

The implementation of the Concrete Model Code for Asia is done by means of national code or application code and professional practices. The ultimate goal of high performance of structural concrete should be pursuit as follows:

1) Professional institute must take its important role to establish the objectives and stragetic plan to adopt the national code.
2) Module for implementation can be the combination of various outstanding models to suit the technical and social functions in each respective country.
3) National code adoption must consider engineering education, professional practices, local conditions and legally binding to the most acceptance by industrial and social preferences.
4) Implementation process can be effective only when educational institute, profession practice and public acceptance through high performance of structural concrete are incorporated without any failure.

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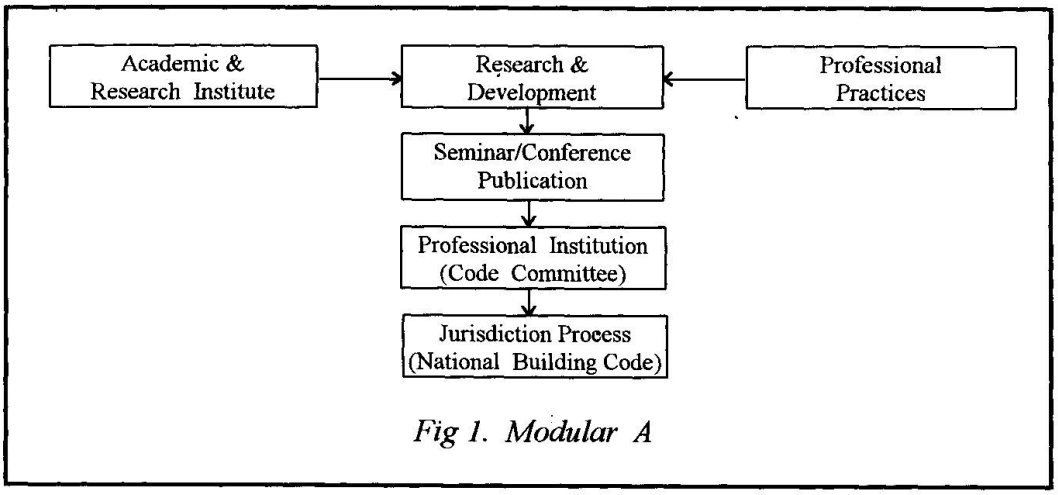

Fig 1. Modular A

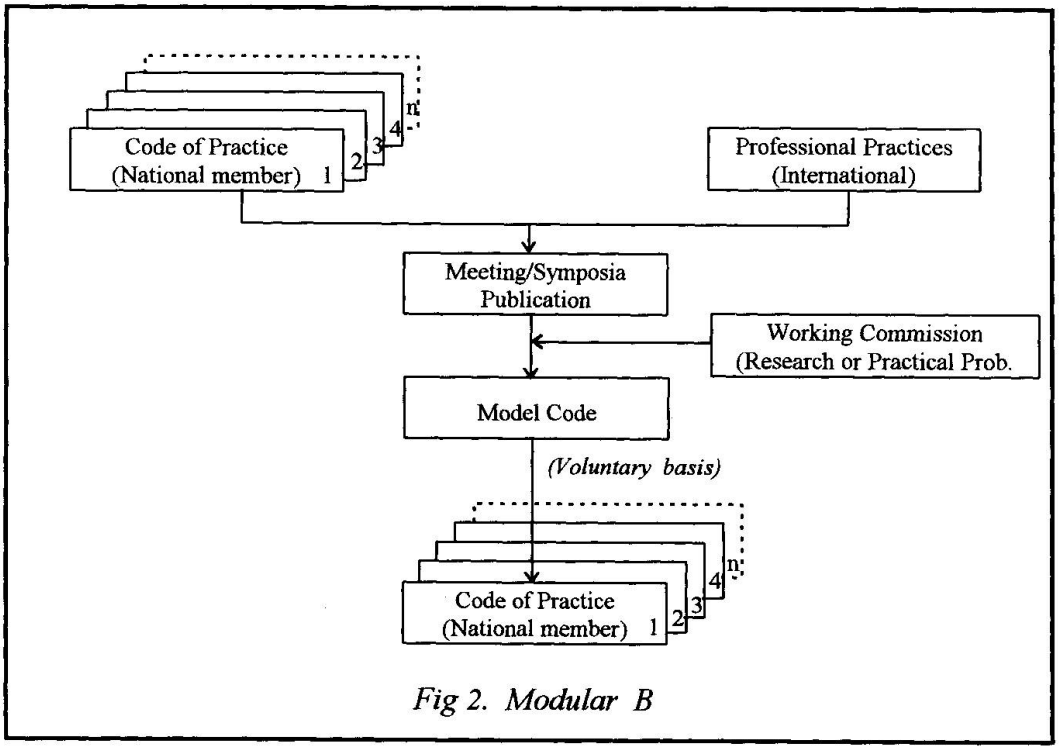

Fig 2. Modular B

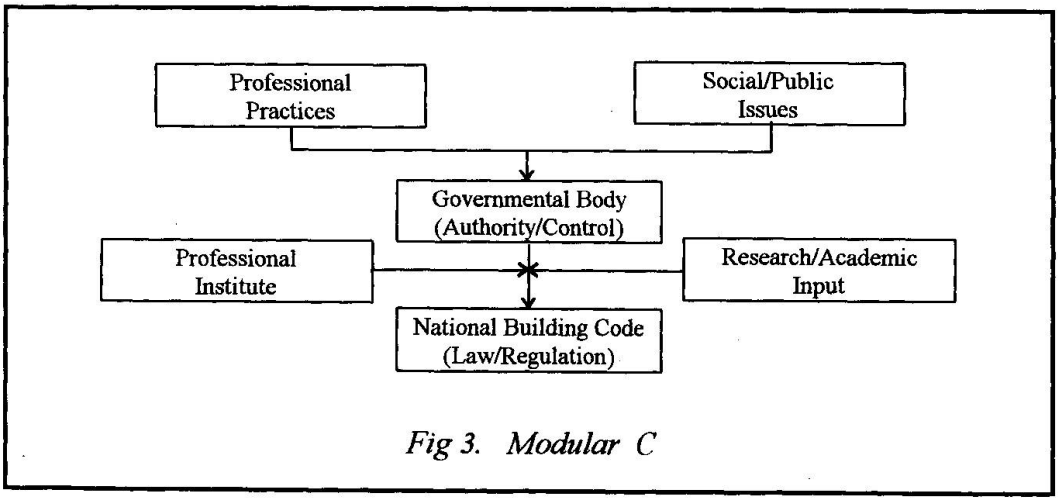

Fig 3. Modular C

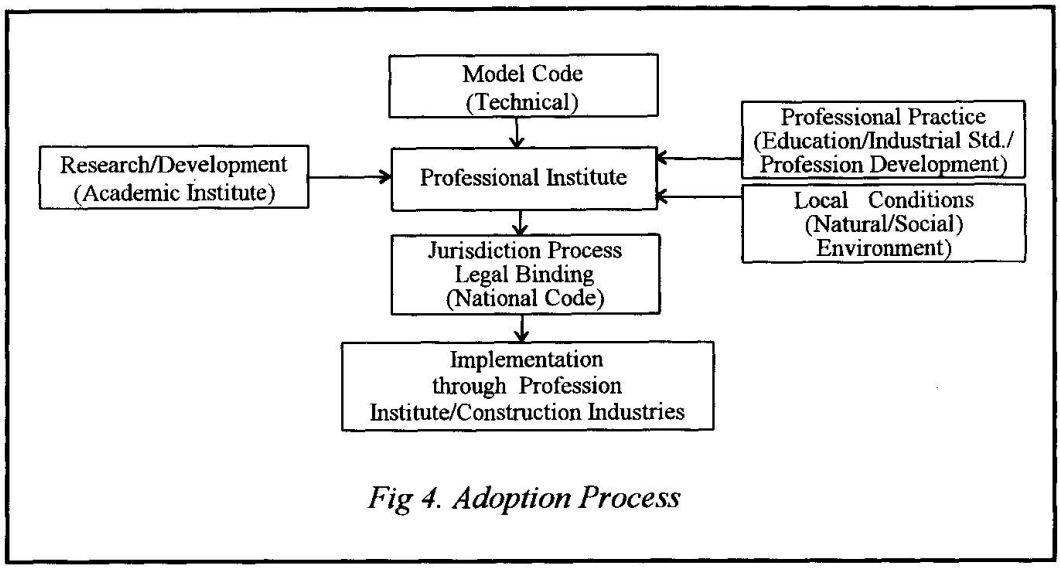

Fig 4. Adoption Process

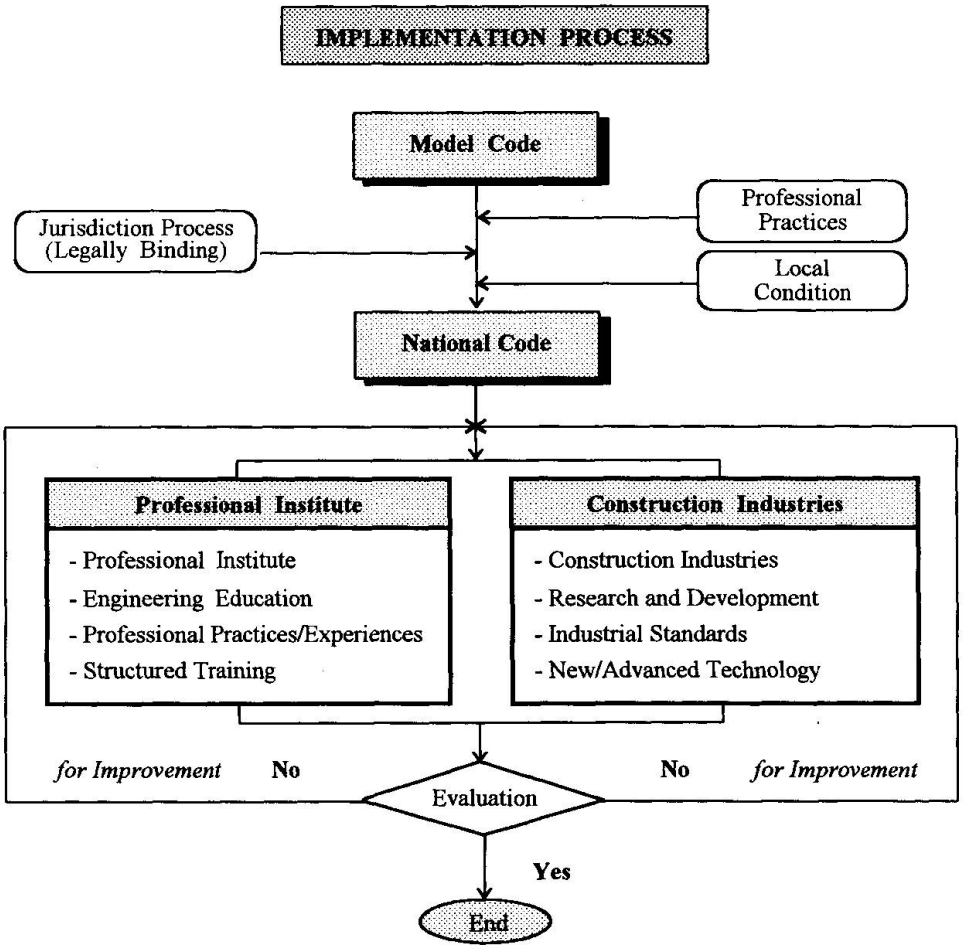

Fig 5. Implementation Process