FOREWORD

Two Issues Concerning Trends of Civil Engineering in Japan

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Establishing Qualifications for Civil Engineers

At the end of the twentieth century, Japan is undergoing structural reforms in all areas. Many of these changes will affect the field of civil engineering, including the restructuring of central governmental agencies and decentralization of authority that are close at hand, university reforms, restructuring of businesses in the private sector, and the issues that are arising as a result of globalization, such as technical standards, greater cost competitiveness, and mutual recognition of engineer qualifications.

Last year, some accidents occurred that could diminish the faith of the general public in science and technology, including an accident involving falling chunks of concrete on a Shinkansen line, and an accident at a nuclear facility. There has been a renewed recognition that science and technology have an extremely large influence on society, and that engineers have an enormous responsibility.

For our civil engineers to fulfill this duty and build an outstanding social infrastructure at low cost, it is essential to raise the technical level of the civil engineers who play such an important role in this area.

At present, in response to the creation of the APEC engineers' qualification and the move toward mutual recognition of engineer qualifications in Europe and North America, Japan is also making progress toward improving its consulting engineer system and establishing certification for university education programs.

Because of these developments, the Japan Society of Civil Engineers (JSCE) is studying the certification of university education programs for civil engineers, as well as continuing education. For greater effectiveness, we believe that it will be necessary for JSCE to certify the qualifications of civil engineers.

This will contribute to the development of society by making it possible to build a system to promptly reflect the latest results of research on the work site, while continuously raising the technical level of active civil engineers.

If JSCE will begin certifying the qualifications of civil engineers, it will be necessary to consider at least the following points.

(1) For qualifications in other countries, engineers are generally required to have completed a generally recognized university education program. In Europe, the standard length of study in an engineering university is five years, which is said to be equivalent to a master's degree in the U.S. The chairman of the American Society of Civil Engineers (ASCE) stated in his inaugural address at last year's general convention that he would like to have the master's degree become a requirement for civil engineers. With consideration for future development, JSCE needs to consider the recognition of graduate educational program for master's degree.

(2) There are various types of qualifications in Japan and overseas. In order to begin mutual recognition, civil engineer qualifications will need to be classified into several levels. The lowest level could be membership in the Society of Civil Engineers, while fellows in the Society of Civil Engineers would be ranked at the highest level.

(3) It is necessary to consider different types of qualifications, including both highly specialized types and types with a high level of generality. The conditions for each type of qualification would correspond to the recognition of educational programs.

It is important for these qualifications to be included, as necessary, in various standards and specifications. This would make it possible for civil engineers to fulfill their responsibility to build an outstanding social infrastructure at low cost. It is also necessary to adopt a system for renewal of these qualifications at certain intervals. This would make it possible to promptly reflect the latest results of research on the work site, while continuously raising the technical level of active civil engineers.

Transition to Performance-Based Design Codes

The mission of civil engineers is to build good infrastructures and facilities, at low cost, for people and for society. However, building at low cost is not so simple. In addition to the costs of building the facilities, one must also consider the costs of maintenance, repairs, recycling, and environmental burden in order to determine whether or not it is low in cost. There is an urgent need for research to find ways to quantify these factors.

Codes and specifications play an important role in the economical building of outstanding social infrastructures. However, there are restrictions due to the technological level at that particular time when the code are written. In other words, even if there is insufficient knowledge at that point in time, the codes and specifications and instructions should be used effectively as an aid to building good facilities at low cost. "Standard Specification for Design and Construction of Concrete Structures" (Construction) was issued in January of this year allows quantitative evaluation, after a fashion, of the durability of a concrete structure.

I believe that a performance-based system of design codes will be the one to be accepted by many countries as an international standard in the next century. An active contribution from Japan is needed

in this regard. Under a performance-based system, so long as the performance requirements are met, there are no particular regulations on the specific methods used. Technologies will be evaluated objectively with regard to the construction of good infrastructures at low cost, and this will give an impetus to introduce new materials and new technologies.

It is not easy to devise a good system to evaluate performance. It will be necessary to develop individual techniques to allow the quantitative evaluation of performance. It will also be essential to develop a good inspection system. I believe that these problems will be seriously addressed by many engineers and researchers.

In developing a performance evaluation system in the future, we will need to consider the great progress that is occurring in the computational environment and techniques of numerical analysis. In the field of concrete structure, it is already possible to accurately predict the response of a structure and the mechanical state of its structural elements with regard to arbitrary mechanical actions. Progress is also being made on the development of techniques of numerical analysis for aspects ranging from concrete formation to its deterioration under the effects of arbitrary environmental influences. There is still much room for improvement in these techniques, either in individual models or in overall consistency, and I believe that they will require further generalization and sophistication. However, with the development of these kinds of techniques, pre-evaluation of concrete quality and structural performance under arbitrary initial conditions and environmental conditions will not be an unattainable dream. I am confident that in the near future, these will become effective design support techniques.

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