

CONSTRUCTION AND STRUCTURAL ENGINEERING

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Summary

An overview of construction and structural engineering is presented following the chapters included under this topic one by one.

1. Introduction

Construction and structural engineering is the engineering of constructing structures. A structure is constructed and opened to the public through the processes of planning - design - construction - maintenance. Construction and structural engineering covers all these areas, and each area can be said rather wide. In this chapter the topics that should be covered are explained briefly one by one and are followed by a detailed description.

Planning

Generally speaking, planning is the process to give a specific shape to the consideration or the idea to achieve something. Planning contains technical and economical reality, and in this respect planning is different from imagination or daydream. In an engineering sense, it is the process to determine outlines of structures that will be included in the considered system and to predict roughly the necessary cost and period to be completed. The planning process includes, for instance, determination of a specific route of highway or railway, a specific structure or a group of structures on the route.

Design

In the design process, selection of structural types and selection of structural materials are some of the most important tasks to realize a structure that achieves the purpose of the structure with adequate safety and durability as well as minimum cost. In the design process, the task is included to confirm whether the structure will have satisfactory resistance against various physical and chemical processes influencing from the outside world.

Construction

After the design is completed, the method and procedure to construct the structure are considered. This process is called construction-planning process. The construction process is the process to realize the designed structure, and the structure is constructed according to the construction planning.

Design codes

In the above-mentioned processes, Codes and Practices play very important role. The roles of design code are in investigating the results of design with objectivity to ensure structures of same kind with uniform margin of safety. These codes are extremely important when the designed structure is a public facility. In the olden times when the design codes did not exist, design used to be done by an expert in design, and the design details used to be left to his discretion. In this case uniform safety and cost cannot be expected. Preparation of design code shifted responsibility for the design from the individual designers to design codes. Usually design codes are prescribed separately according to the kind of structures or materials to be used.

The design codes have been prescribed in the form of specifications. That is, all matters that are needed to achieve the required performances of the structure are specified in detail. The matters include properties of materials, structure of a section, assumptions to calculate load carrying capacities, equations to calculate the capacities on the premise that the specified structural details are satisfied, and so forth. The design codes tend to specify the matters much more precisely and strictly. This tendency limits designers' discretion and freedom, and obstructs development of engineering. Nowadays the codes that prescribe mainly required performances have received considerable attention. This kind of code is so-called performance-based design code. Performance-based design code has in some respect such background that it has developed to unify domestic design codes internationally. Beside the background it can be pointed out that performance-based design code will contribute to development of construction and structural engineering. At the same time it has merits such as easier explanation to the public, easier adoption of new materials or new construction methods, and so forth. On the contrary it has to be pointed out that in order for the code to demonstrate the merits, engineering levels of all engineers who engage in the processes to construct a structure must be higher than a certain level.

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Biographical Sketch

Atsuhiko Machida is a Professor, a former dean of faculty of engineering and a former vice president at Saitama University, Japan. He received his B. Eng, M. Eng and D.Eng from the University of Tokyo, Japan in 1963, 1965 and 1976 respectively.

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