CHAPTER 1 GENERAL

1.1 Scope

(1) Chapter 1 to Chapter 12 of this Specification (Standard Specifications for concrete structures – Materials and Construction) provide the basis for durability verification of concrete structures, verification for the crack initiation during construction, design of mix proportion, production of concrete, criteria for selection of ready-mixed concrete and reinforcing materials as well as procedures for construction, inspection, maintenance and data recording.

(2) Chapters from 13 to 24 discuss regulations related to the construction and the production of special concrete structures or concretes. In these chapters, details on the requirements for material, performance, production method and structural type are provided.

[Commentary] This Standard Specifications for Concrete Structures [Materials and Construction] consists of two parts – one part provides the general principles for concrete construction and the other part deals with special structures or kinds of concrete.

The first half of this document (Chapter 1 to Chapter 12) provides general principles when undertaking construction. Therefore, this part applies for not only general plain concrete or reinforced concrete structures, but also for the production of special kinds of concrete as well as the construction of special structures in most of the cases. Although ready-mixed concrete is supplied as a product of fresh concrete, its materials, production method and quality shall, in general, satisfy regulations stipulated in this Specification.

The other part beginning from Chapter 13 provides the general principles for production and construction of concretes using special materials or having special functions (such as high-strength concrete, expansive concrete, light weight aggregate concrete, steel fiber reinforced concrete and continuous fiber reinforced concrete, etc.), concretes with special construction methods (such as underwater concrete, prepacked aggregate concrete, shotcrete and self-compacting concrete, etc.) and concretes with special production methods or structure types (such as prestressed concrete structures, composite structures and factory products, etc.)

Topics treated as special topics in the 1996 edition like hot and cold weather concretes, mass concrete, concrete used in marine structures, watertight concrete and plasticized concrete, can be now treated similarly to general concrete, except in particular circumstances.

Thus, these subjects are now addressed at appropriate places in the first half of document from 1999 edition (plasticized concrete added form this edition). It should be borne in mind that this Specification only provides general principles. Separate standards must be drawn up for each project on based on these principles.

Figure 1.1.1 shows the principle work sequence for a concrete structure: design, construction planning, manufacture, construction, and maintenance.

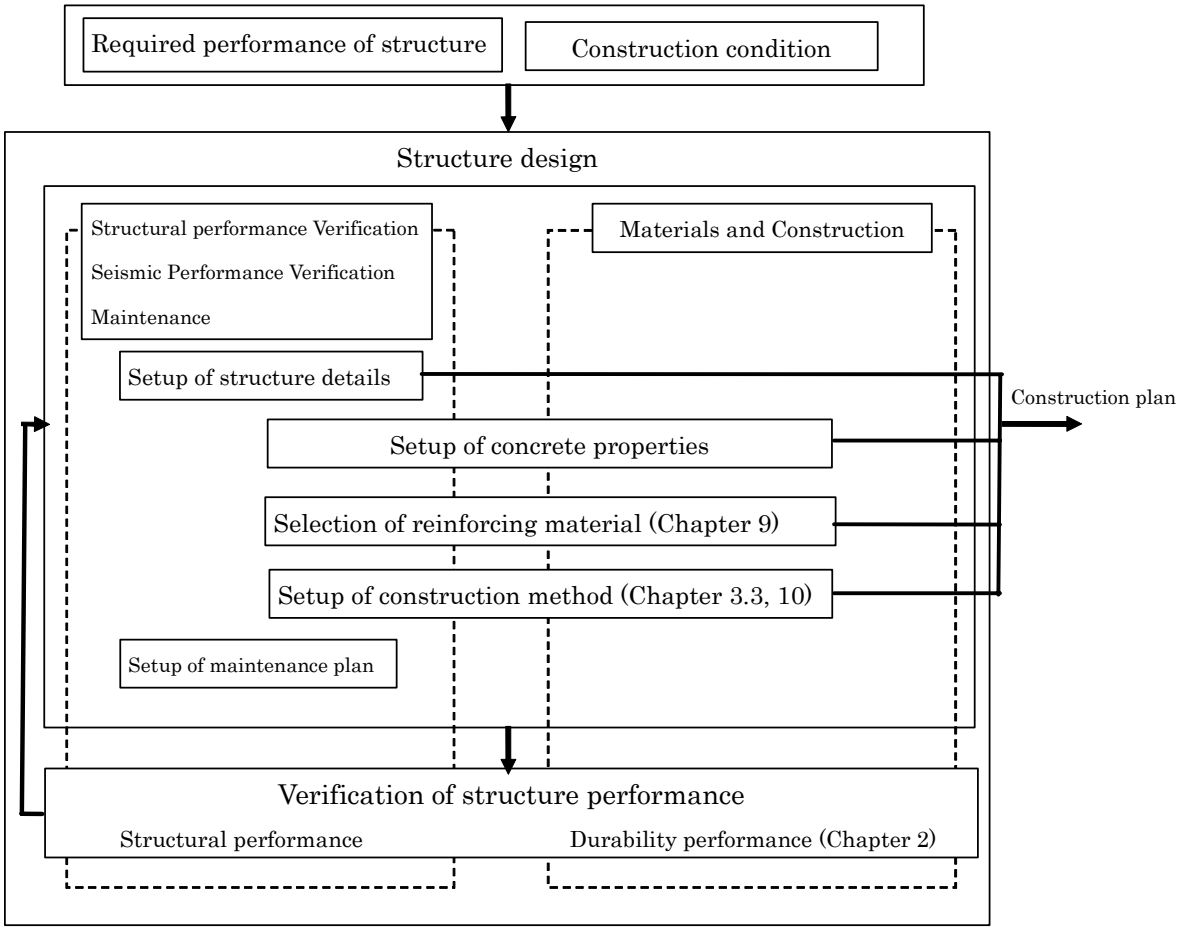

Fig. C1.2.1 Design stage

However, structural details (such as shape, dimensions and reinforcing bar arrangement) also involve in the construction executability and durability verifications in Chapter 2 of [Materials and Construction]. Therefore, the design process must be carried out properly considering in advance the required performances at construction stage.

Once the construction is completed, it is difficult to repair, strengthen or renovate concrete structure, so thorough investigation at the beginning stage of design, accurate prediction for possible problem in service life and future maintenance are of great importance. Standard Specification for Concrete Structures – Maintenance provides basic knowledge for the maintenance of concrete structures.

The performance over time of concrete structures is determined by concrete performance, construction method and structural details such as the thickness of cover concrete. In this Specification, to simplify the durability verification, the construction is assumed to be carried out using certain construction methods as in 3.3 of Chapter 3. This enables the durability verification of the whole concrete structure just by performing experiments on testing specimens. When establishing a construction plan, the construction method is selected based on structure conditions and construction conditions so that the performance of actual concrete performance is at least equal to that of concrete when the method assumed at the design stage is adopted.

The parameters laid down for the performance verification of concrete structures in this specification are those whose determination by direct inspection on actual structures (given in Chapter 11) may be considered inappropriate.

In order to ensure that the performance of structure actually meets the specified requirements, it is desirable that appropriate inspection on the actual structure be undertaken if possible and reliable. However, direct inspection of the performance over time of structure or the possible occurrence of cracks during construction cannot be undertaken unless the concrete has been cast and the structure is in some stage of completion. The exercise of carrying out direct inspection on the actual structure after its completion is of limited significance even when the inspection reveals that requirements are not satisfied.

For the structure durability and the cracking at the construction time, it is realistic that the verifications is carried out at the time of design and construction planning, and finally confirmed at the construction stage to ensure that concrete structure will satisfy the performance requirements.

The performance requirements of fresh concrete, such as workability, pumpability, etc., can be ensured through appropriate tests for the acceptance of concrete before placing, while final checks on the structure shape and appearance can be carried only after the structure has been cast.

1.3 Designed Service Life

The designed service life of a concrete structure shall be determined considering its required service life, maintenance method, environmental condition, performance over time and economic considerations.

[Commentary] When designing a concrete structure, it is necessary to determine its designed service life based on its intended purpose, utilizing period, which is estimated from economical efficiency, environmental condition and performance over time. If high durability or high fatigue resistance are required, designed service life will be set longer. Commonly, from life cycle cost point of view, the longer the better for the designed service life of a structure.

1.4 Safety factors

Appropriate safety factors shall be selected in order to take into account the accuracy of the predicted values of material properties, differences in the material properties in actual structures and those of testing specimens, the accuracy of the design values related to durability characteristics of structure, importance of the structure, etc.

[Commentary] Figure C1.4.1 shows the relationships between factors used in the [Structural Performance Verification] and those used in this specification [Materials and Construction].

In considering the ultimate limit state, characteristic value is usually chosen between either of the following options: (a) the probability for that value actually being smaller (or larger), is very small, or, (b) using the expected maximum (or minimum) value likely to occur during a certain period.

On the other hand, in considering the serviceability limit state, characteristic value may be chosen on the basis that the value (an expected value) has a 50% probability of being actually smaller or larger. When considering the environmental impact in the verification of durability, the expected value of the design service life of the structure should be used.

Specifically, limit values, such as the limit carbonation depth (in examining the corrosion