Sub-committee to Research the Construction of Systems to Link Design and Maintenance Management for Social Infrastructure Facilities

Chairperson: Hiroshi Yokota (Hokkaido University)
Secretary: Yasuhiko Sato (Hokkaido University)

In order ensure the required performance of concrete structures for a long period of time, it is necessary to construct an outstanding system to strongly link design, construction, and maintenance, which in the past have been separated, so that they can function as a unit. The 2012 revision of the Standard Specifications for Concrete Structures and other documents already indicate a framework for a linkage between design and construction through various criteria (Fig. 1), but the linkage between design and maintenance or between construction and maintenance is still undeveloped. It is considered that there is a similar situation worldwide.

In the design of structures, the basic concepts for ensuring its performance (hereafter referred to as “scenarios for ensuring performance”) must be indicated, taking into consideration the various conditions in which the structure is placed, the structure and material properties, and the degree of difficulty of inspection, diagnosis, and maintenance construction, etc. On the other hand, normally there is a deviation between the results of design using accumulated assumptions and the status and achieved performance of the actual structures. Therefore it is necessary to carry out verification and evaluation of the validity of the scenarios for ensuring performance during maintenance management actions, make repeated corrections, in order to maintain the performance of the structure with the ideal scheme, and provide feedback to design.

Based on the recognition of these facts, in this research firstly a survey and analysis of the state of linkage between design and maintenance for various organizations was carried out. The results showed that although in the case of roads and railways there was a certain amount of transmission of the necessary information through the flow of operations from design through construction to maintenance, there was no system established to provide feedback from maintenance to design. In port facilities also, although there is a mandatory advanced system for facility providers to prepare a maintenance management plan and communicate it to the facility operator, there is likewise no system of feedback to design. Also, as an example of a project in which the concept of preventative maintenance was developed from the time of construction, the maintenance management guidelines based on the durability design for the New Kitakyushu Airport Marine Bridge was introduced. An example of implementation of maintenance management through a tie-up with the local residents was also introduced, as a system of linkage between design and maintenance in regional cities, towns, and villages where it is difficult to secure a sufficient number of engineers. From analysis and research of these examples, it was again recognized that it is necessary that the engineers or organizations responsible for design and maintenance share a common understanding of the design concept and maintenance of the structure, and that it is necessary to construct a system to link them. To establish a system to link maintenance management and design, systematization is necessary not only from the technical point of view, but also from the organizational point of view. Information on the present status of this aspect was collected from both within Japan and overseas, analyzed and investigated. Also, in order to more reliably establish the continuity between design and maintenance, it is essential to quantitatively evaluate the performance achieved by the structure in maintenance. At present sufficient knowledge has not been accumulated to evaluate the performance of existing structures, but investigations are in progress to establish this knowledge by experimental and analytical approaches. Also, initiatives to establish monitoring technology for this purpose are also in progress mainly by the Ministry of Land, Infrastructure, Transport and Tourism. Based on these initiatives, it is expected that it will be possible to realize not only effective and rational maintenance, but also to determine whether or not the assumptions, structural models, and

design equations can really be applied at the time of design, and it will be possible to evaluate the validity of the design equations, etc.

Based on the results of the sub-committee it is expected that this survey and research work will be continued, new linkage systems will be introduced into standards and recommendations, such as the Standard Specifications for Concrete Structures, etc., and systems for coherent design, construction, and maintenance will be incorporated into the process for developing social infrastructure facilities.

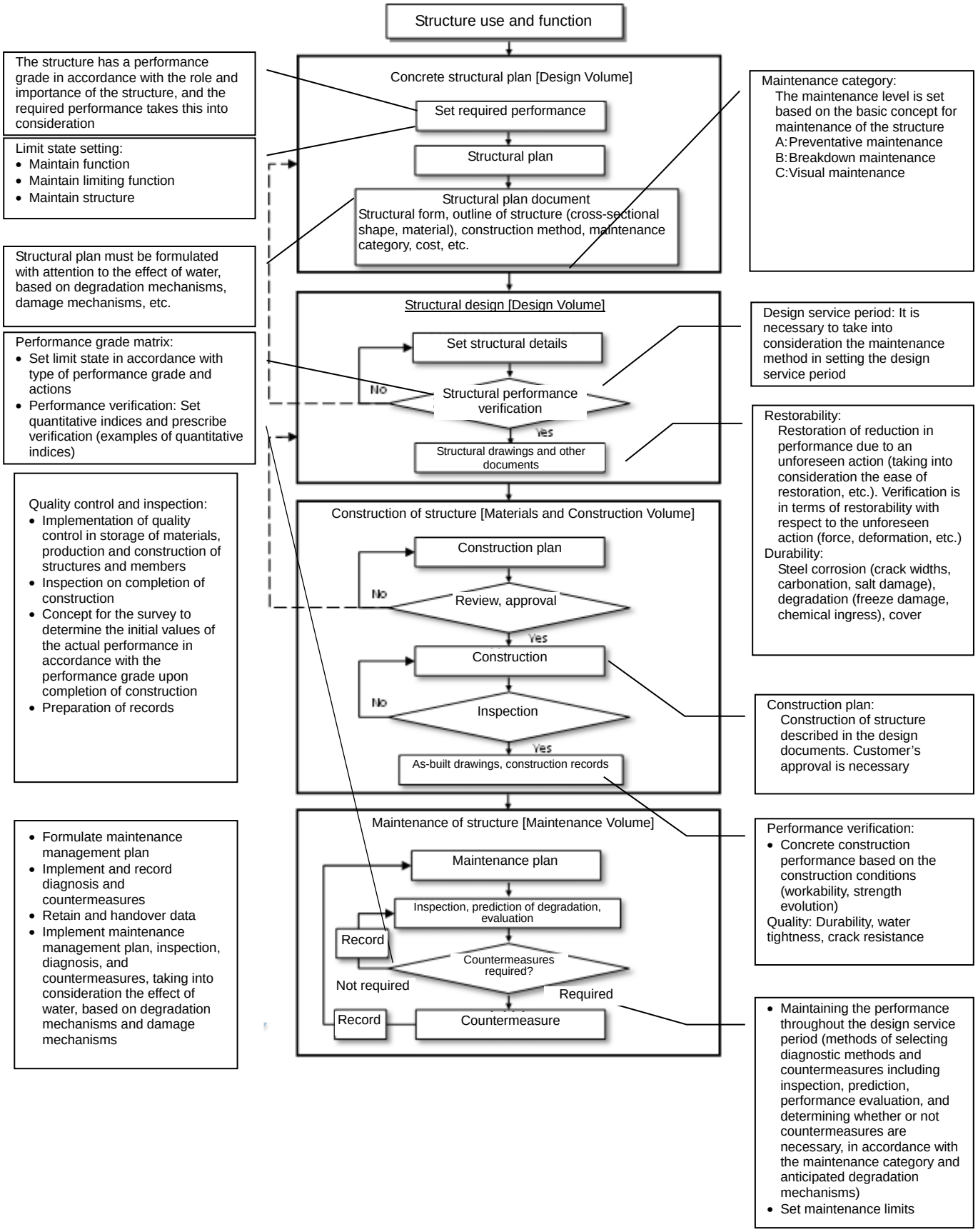

Fig. 1 Flow of design, construction, and maintenance in the JSCE Standard Specifications for Concrete Structures