Guidelines for Assessing the Performance of Existing Structures

Japan Society of Civil Engineers
Research Subcommittee for the Advancement and Systematization of the Assessment Techniques used to Determine the Health of Existing Structures

As societal infrastructure requires appropriate maintenance, assessments of structural health are conducted, primarily by grading health based on the results of visual inspections. With this method, the accuracy of the assessment is dependent on the capability of the engineer conducting the assessment. Moreover, the strong implication of the assessment results is that they are the results of a primary screening, and therefore it is difficult to make a determination of the specific health of the structure based on those results (in other words, to assess the structure's performance). In addition to this problem, the decision of corrective action is made by the grades for structural health and not based on the structural performance, so that the restoration may not be carried out effectively. With the current severe financial crunch, more and more structures will be identified as needing corrective action, and in order to appropriately determine the degree of priority and implement corrective action effectively, the development of assessment methods that can determine the health of structures more accurately and in greater detail is an essential and urgent task. For this reason, in the "Study of the Advancement and Systematization of the Assessment Techniques used to Determine the Health of Existing Structures" which was recommended by the Concrete Committee of the Japan Society of Civil Engineers and adopted as one of the Priority Research Issues for FY 2019, the JSCE has prepared Guidelines for Assessing the Performance of Existing Structures. These Guidelines integrate, advance and systematize the performance assessment methods noted in the Maintenance volumes of the various Standard Specifications published by the JSCE, and they are intended for use by structure managers in assessing the health of structures.

To study this problem, a subcommittee (Research Subcommittee for the Advancement and Systematization of the Assessment Techniques used to Determine the Health of Existing Structures) (Subcommittee 231) was set up within the Concrete Committee, and members from the Committee on Hybrid Structures, Committee on Steel Structures and Committee on Structural Engineering participated in the work of preparing guidelines. Within the subcommittee, a Grading working group and FEM working group were established to determine performance assessment methods for steel, concrete and hybrid structures and compile assessment case studies for each type of structure. The performance assessment methods are summaries of the regulations relating to "performance assessment based on changes in external appearance" (with primary emphasis on assessment of structural performance) and "performance assessment by means of non-linear finite element analysis" (for more detailed and quantitative determination of structural performance) indicated in the Maintenance volumes of the Standard Specifications for Hybrid Structures, Standard Specifications for Concrete Structures and Standard Specifications for Steel and Composite Structures published by the JSCE. The idea of integrating the content from these three Specifications was a new one and, together with the effort to compile common specifications for civil engineering structures, it is expected to help to achieve standardization of specifications at JSCE. In addition, an effort was made to clarify in detail the concept of "performance assessment based on changes in external appearance" since the explanation in the Specifications was inadequate for reference purposes, and case studies of methods for

applying the Specifications to the assessment of structures were presented. Furthermore, for "performance assessment by means of non-linear finite element analysis," the procedure for conducting non-linear finite element analyses for existing structures was explained, and case studies of assessments conducted for various types of structures were presented. It is our hope that these guidelines will be reflected in the procedures, etc. used by structure managers, with the result that more rational maintenance based on detailed assessments of existing structures will be achieved.

Finally, we would like to express our gratitude to the assistance provided to the subcommittee by the Concrete Committee. We would also like to express our deep appreciation to Executive Director Manabu Ikeda and the other committee members for assistance in subcommittee administration and the preparation of guidelines. In particular, we would like to thank Grading WG General Manager Mitsuyasu Iwanami and Assistant General Manager Hisao Nishida, as well as FEM WG General Manager Satoshi Tsuchiya, Assistant General Manager Ryosuke Takahashi and subcommittee members Takeshi Maki and Tadatomo Watanabe, for their valuable assistance in the compilation of guidelines.

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Priority Research Issues for FY 2019
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