# Development of a Perfomance Evaluation Test Method Based on Nondestructive Investigations of a Concrete Bridge

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## 1. Introduction

Structures supporting the social infrastructure are deteriorating, and the importance of maintenance is increasing. Nondestructive examination technologies are being developed to improve the inspection level by complementing short-range visual inspections and a hammering test. The subject of this research is nondestructive examination technologies used to check the internal damage to concrete and the conditions and quality of an implanted part of a post-installed anchor bolt. In order to use the technologies in an inspection appropriately, we examined the method of the performance evaluation test that was designed for the unified and objective evaluation of the sensing capability and error characteristics of the technologies.

## 2. Outline and Results of Joint Research

NILIM conducted joint research with the Public Works Research Institute and private companies that had nondestructive investigation technologies and examined the test methods that were designed to evaluate the performance of the technologies, using the partners' technological devices, including nondestructive investigation devices. In this joint research, NILIM prepared a variety of test specimen that had different degrees of difficulty in the detection of internal damage to concrete or a failure in an embedded anchor bolt (Photo 1), reselected the test items required for the performance evaluation of the nondestructive investigation technologies based on the results of nondestructive investigation conducted, and proposed a test method to confirm them.

Photo 1: Nondestructive investigation underway

## 3. Outline of Performance Evaluation Test Method

Based on the results of the examination of applicability of a series of nondestructive investigation technologies conducted in this joint research, we have made it clear that the items that need attention when conducting a performance evaluation are repeatability of the values in a catalog, the scope of application of nondestructive investigation technologies, and applicability to real structures. On that basis, we propose performance evaluation methods for these items.

First of all, to verify the repeatability of the values on a catalogue, a test using nondestructive investigation technologies shall be conducted using comparatively simple test specimens with which the test condition and the arrangement of bars exert less of an influence on the test result. Next, to clarify the scope of application of nondestructive investigation technologies, a test shall be conducted using specimens that have almost the same arrangement of bars as the actual components used and multiple internal damage simulated, and the influence of the test condition, existence of adjacent damage, and arrangement of bars on the result shall be confirmed (Photo 2). Last, to confirm the applicability to real structures, a test shall be conducted using a specimen with components that have been damaged over time in reality, and the influence of the complicated surface properties of a real component and time-related deterioration of materials on the result shall be checked (Photo 3).

Photo 2: Example of the test to check the scope of application

Photo 3: Example of a test to check applicability to an actual structure

Based on the results of the above tests, the performance of nondestructive investigation technologies is evaluated, taking into consideration such conditions as the damage that is expected in the real subject of an investigation, the environment on the site, and the conditions of the components.

## 4. Conclusion

When the proposed test method is used, it is expected that devices are utilized according to their capability and characteristics of errors. From now on, we are going to use the test method in real practice on a trial basis and extract and improve the issues found.