# Training of core engineers who lead road structure maintenance and management

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## 1. Introduction

Road structures, such as bridges, tunnels, earthworks, and pavements, support a safe, secure, and productive society by providing road functions. Since road structures will soon enter the deterioration phase in the near future, regular inspections have been increased since FY 2014. The inspections found that 11% of bridges (about 42,000 bridges) and 44% of tunnels (about 2,000 tons) urgently need prompt repairs.

The Road Structures Department is developing technologies to diagnose, repair, and reinforce these road structures as the second stage of maintenance to support proper management and efficient renewal (see "Close-up" at the beginning). The training of core engineers who support the maintenance and management is also essential. We are also working on this aspect by accepting personnel, providing training, and sharing knowledge with them. The NILIM research policy that was revised last year also positioned the improvement of on-site technology as one of the four main activities. This paper discusses the training of engineers.

## 2. Acceptance of personnel

One of the characteristics of the NILIM is that many researchers have experience working in government. In terms of research, they are reflecting their work experience in the Ministry of Land, Infrastructure, Transport and Tourism, Regional Development Bureaus, and local governments in their research activities and producing practical outcomes. Meanwhile, a certain number of engineers with experience working in research facilities are working at the actual sites of maintenance and management through personnel reshuffling between these worksites and NILIM.

Photo: On-site investigation after the onset of a natural disaster

The research activities of NILIM are observed from the perspective of human resource development through OJT. At NILIM, researchers are conducting research through experiments and inspection data analyses and preparing drafts of technical standards based on the outcomes of the research and analyses. They are also conducting on-site investigations and providing technical assistance in case of a natural disaster or the onset of defects as shown in the photograph. These activities provide valuable opportunities for them to gain hands-on experience and an understanding of the destruction and damage to actual structures and to become involved with the proposal of specific measures to respond to the damage. After improving their skills through these experiences and returning to on-site assignments, they are then able to provide technical assistance in their assigned work and to other organizations as experts.

## 3. Support in trainings

The maintenance and management of road structures involve a wide range of operations, including legally required regular inspections and repairs and reinforcement. Engineers assigned to these operations must have the necessary knowledge and skills to perform them. Thus, NILIM has established a training system in cooperation with the Ministry of Land, Infrastructure and

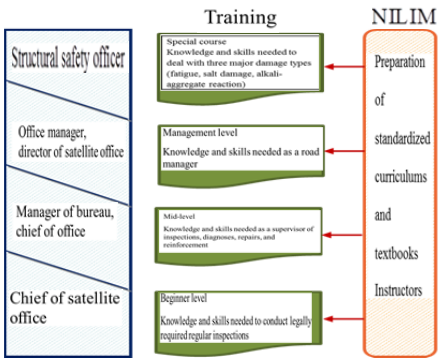


Figure 1 Training on the maintenance and management of bridges

Transport and training facilities.

As shown in Figure 1, bridge maintenance and training include the following three levels depending on the positions: beginner level, where engineers become able to perform legally required regular inspections; mid-level, where engineers become supervisors of inspections, diagnoses, repairs, and reinforcement; and management level where engineers make decisions of what to do as road managers including traffic restrictions. In addition, there is a special course to respond to fatigue, salt damage, and alkali-aggregate reactions that may result in more serious damage. NILIM supports the training by preparing a standard curriculum and textbooks and dispatching instructors along with proposals.

Among the training levels, the goal of the beginner level training is to train 5,000 people in five years from FY 2014. More than 1,000 participants attend more than 20 training sessions offered every year. Training textbooks used in the training sessions are made available to the public as NILIM references. In addition, test problems from achievement tests and points of practical tests are posted on NILIM websites so that the participants can refer to them in actual work settings after they complete their training.

4. Technical support

NILIM supports the challenges that engineers encounter at the actual sites by providing advice from the position with the knowledge of technical standards and actual operations. While support is offered to overcome actual on-site problems, it is also an opportunity to transfer the technologies and skills of the NILIM to the actual sites.

Most road structures are under the management of local governments. Some road structures require urgent responses using advanced technologies. The Ministry of Land, Infrastructure and Transport supports the local governments in such cases as directly managed diagnoses. NILIM participates in the directly managed diagnoses as the technical group for road maintenance and offers proposals for investigations and proposals for the method of soundness diagnoses, repairs, and reinforcement methods. Directly managed diagnoses have been conducted at ten facilities since FY 2014, and many have been repaired by the Ministry of Land, Infrastructure and Transport in place of local governments.

NILIM also provides technical support through on-site investigations and meetings when requested in case of the onset of defects or natural disasters.


Figure 2 Maintenance learned at actual sites

5. Sharing of knowledge

NILIM organizes the knowledge gained through technical support. The organized knowledge is shared by regularly hosting meetings of people assigned to specific structures, such as bridges, tunnels, pavements, and earthworks.

In addition, as shown in Figure 2, NILIM shares the knowledge in the column titled “maintenance learned at actual sites” in the civil engineering technical reference in which NILIM cooperates in the preparation. This column not only shares the results of diagnoses and the details of repairs but also discusses the technical points and precautions to keep in mind when one encounters a similar incident. It is like a doctor describing the thinking process for the decision to use a certain examination or treatment rather than simply introducing the treatment and prescriptions the doctor provided.

This column started in FY 2009, and more than 20 cases have been described here. Articles that passed more than one year after the publication are posted on the NILIM website for many people to see.

6. Summary

A TV program on NHK introduced NILIM as the special doctor of the land in Japan who protects infrastructures with passion three years ago. It is not the technology but engineers who protect the infrastructures. We will continue to support the improvement of technologies used at the actual sites and work together with many engineers who are involved in this process.