Interview with PD KIMURA Yoshitomi

"Promotion of i-Construction" will greatly improve the productivity of construction sites!

Connecting all data items from assessment/survey/design through construction/inspection/maintenance for unified management

Q: The large budget allocated for “promotion of i-Construction” shows that the government and the infrastructure industry have high expectations for the productivity improvement of construction sites. What are the issues that "i-Construction" will solve and specifically, how will they be solved?

PD: In the infrastructure industry, as workers are decreasing and aging, there is a challenge in labor productivity improvement in the whole industry. Therefore, we believe that PRISM's efforts to “promote i-Construction” will contribute to the government's goal of “increasing productivity in construction sites by 20% by FY2025”.

To achieve this goal, we will seamlessly connect and centrally manage the entire process from assessment/survey/design to construction/inspection/maintenance in 3D digital data.

Conventionally at construction sites, there was a lot of 2D information such as paper drawings and verbal instructions, and as a result the communication was not smooth, or discrepancies often occurred. By using 3D digital data to facilitate information sharing among the parties involved, such problems can be solved, and at the same time new ideas can be brought up from various perspectives.

Furthermore, we will add the concept of time to the 3D digital data to expand it to 4D. The maturity of infrastructure gradually increases from the assessment and design stages, and the condition of the structures also changes with the construction process, and after completion, the structures gradually deteriorate as they are in service. It is very difficult to understand what happened to infrastructure in the past with conventional 2D and non-digital information, but 4D information makes it possible to accurately and efficiently understand the chronological sequence of events, which will enhance maintenance as well as quick disaster responses.

Could you tell us about the progress and achievements of each program of "promotion of i-Construction”?

Q: Could you tell us about the progress and achievements of each program of "promotion of i-Construction”?

PD: There are three major progressions and achievements. The first one is development of "(1) MLIT database and platform". We consider the data as a common infrastructure of the nation and connect existing data to it for utilization. On April 24, 2020, we released "the MLIT database and platform 1.0," which has approximately 220,000 national land data items and allows cross-searching, displaying, and downloading using the same interface. Since then, we have expanded the linked data and added an information transmission function.

The second one is about "(2) Laser surveying, 3D design system development". We have been examining standard work methods and preparing various manuals and Rules for Operating Specifications so that high-quality and efficient surveys can be carried out using the latest technologies such as UAVs and laser scanners. Also, we have been examining a project management method that efficiently shares information such as design intentions and construction conditions through utilization of the obtained 3D digital data by BIM/CIM (Building/Construction Information Modeling, Management).

The last one is "(3) Control of construction machinery for realization of unmanned construction sites, conversion of construction data into 3D and development of inspection technology". Utilizing new technologies such as AI and IoT, "the Project on Introduction and Utilization of Innovative Technologies for Drastic Improvement of Productivity at Construction Sites" has been implemented since 2018, and about 100 cases have been tried on-site so far. At the same time, we aim for further social implementation by revising standards and manuals.

Accelerate development by adopting needs-type R&D instead of seed-type R&D

Q: What are the challenges and important points in implementing technologies owned by industry, government, and academia in society through collaboration?

PD: In the conventional seeds-type R&D, technologies developed by industry and academia are used at their own sites, and if they are good, they are gradually expanded, and then reflected in the standards created by the government with its own budget. So, the problem was that it took so long until social implementation was realized. Then, PRISM aims to shorten this time span significantly by raising needs from the government side, inviting new technologies from industry and academia, verifying and improving them through actual use in the sites, and reflecting them in national standards, thereby accelerating social implementation and creating innovation in the construction sites. For example, we hope that advanced technologies such as image processing used in other fields can be used in the construction field as well.

By improving the technological level in the setting of Japan, where there are many natural disasters and construction sites are concentrated in urban areas, enhance international competitiveness

Q: Regarding construction of the MLIT database and platform, please tell us your specific image of efficiency and sophistication of operations by utilizing a large amount of data owned by MLIT, and beyond that, creation of innovations through industry-government-academia collaboration.

PD: Construction of the MLIT database and platform that links a vast amount of infrastructure data owned by MLIT, the private sector, local governments, and other ministries and agencies through APIs and allows them to exchange data on a common platform and in a common database will enable various simulations and analyses. For example, by using next-generation supercomputers for advanced analysis of huge amounts of infrastructure data as well as AI, we can expect open innovation in areas such as automated construction, earthquake response analysis, and asset management for aging prediction.

Rather than dictating how to use data, I think it is important to provide the private sector, universities, other ministries and agencies, and local governments with an environment where data can be used collectively. In such an environment, I believe various people can freely take on the challenge of innovation.

Q: What kind of technological development is required in the construction field in the future, and what are your opinions on it from the perspective of international competitiveness?

PD: I would like to talk in relation to each of the achievements and progress mentioned above. As for (1), data linkage and utilization, AI-based analysis and simulation, and further utilization for automated construction are required. As for (2), it is required to utilize new technologies and tools that are progressing rapidly, and to provide the institutionalization, system, and rules for BIM/CIM. As for (3), development of construction management technology under non-contact conditions, field trials of common supervision and inspection items for major work types such as concrete structures, embankments, and pavements, and revision of standards and manuals, as well as development of BIM-based building verifications and use of BIM for interim and completion inspections are required. Regarding the above, it is also important to encourage development of technologies by domestic private companies, etc., based on trends in similar technologies overseas and institutional aspects. On the other hand, Japan has many disasters, and its infrastructure is rapidly aging. Even under these special and severe conditions, the technologies developed through "promotion of i-Construction" should be steadily implemented in society along with revision of standards and manuals, and as a result, we will be able to enhance our international competitiveness.

Introduction of main measures

Implementation of efficient and effective infrastructure maintenance and renewal

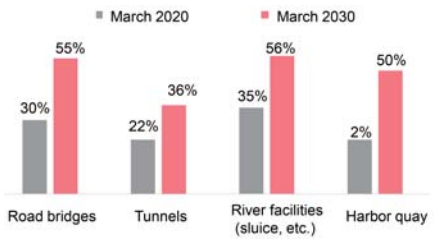
Program Director KAWANO Hirotaka Professor, Emeritus Graduate School of Management, Kyoto University

Original measure: Realization of sustainable infrastructure maintenance through anti-aging measures (MLIT)

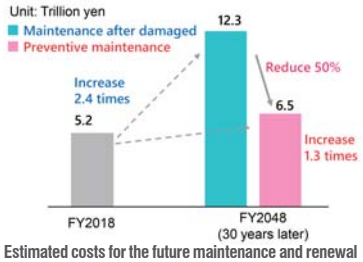
Issues and Goal

Aging of infrastructures and promotion of preventive maintenance

Many infrastructure facilities constructed between the 1950s and 1970s are aging and the damage is getting more severe. On the other hand, many municipalities responsible for infrastructure maintenance are finding it difficult to secure enough budgets and systems for their maintenance and management operations. However, it is important to convert maintenance system to "preventive maintenance", the maintenance system by taking measures an early stage of damaging, for the stable infrastructure. To achieve this conversion, it is necessary to establish efficient and sustainable technologies and systems for maintenance and renewal of infrastructure facilities.



Facilities built over 50 yeas ago



Estimated costs for the future maintenance and renewal

Overview

Implementation of sustainable infrastructure maintenance (original measure)

MLIT has conducted statutory inspections on a five-year cycle, incorporating the achievements of SIP, and has accumulated data on maintenance from the inspection results of approximately 720,000 bridges and 10,000 tunnels. Utilizing these data, etc., we aim to switch to preventive infrastructure maintenance that will reduce maintenance costs by about 50% in 30 years.

Development and utilization of maintenance database and preventive maintenance (PRISM)

Although the first period of the SIP on infrastructure maintenance has been completed, PRISM takes measures to improve the efficiency and optimize the inspection, diagnosis, and repair of bridges and other structures. We integrate maintenance data into the MLIT database and platform, with disclosing its data, and connecting the data to local governments, universities, and private consulting firms. In addition, we are developing paradigm-shift technologies for updating machinery related to sluice gate, using new materials and methods that have never been used before, and improving the measures to diagnose and update facility.

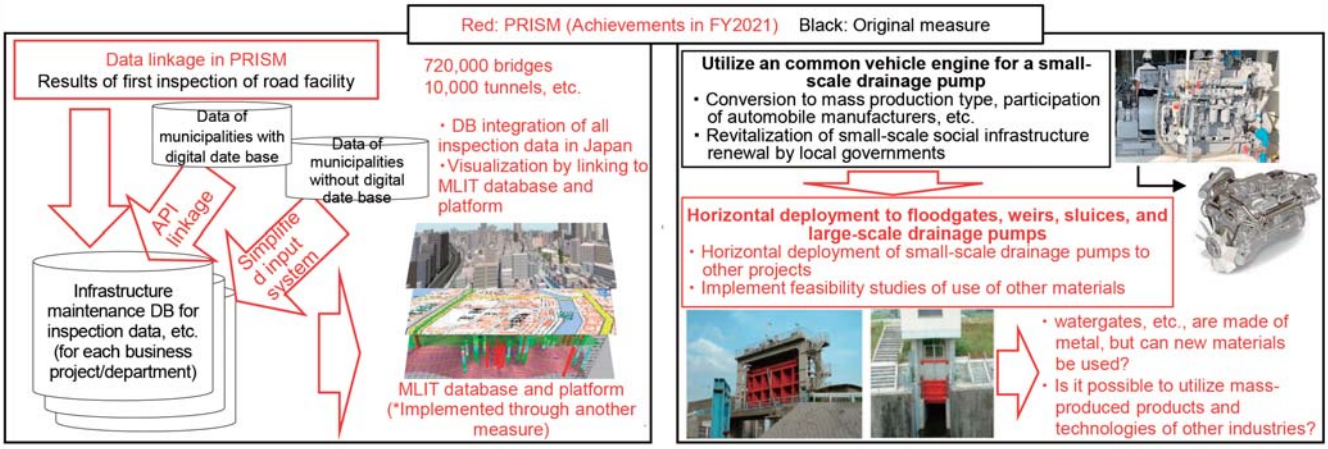
Achievements to date and expected positive ripple effects

Development and utilization of national maintenance database

In FY2020, twelve local governments built infrastructure maintenance databases and integrated them into the MLIT database platform as a trial basis. This project is planned to start nationwide expansion after FY2021. Local governments can identify most preferred methods for repair based on the maintenance data across the country. Moreover, it is expected that universities and private consulting firms accelerate research and technology development.

Development of paradigm-shift type renewal technology (starting at 2021)

When repairing infrastructure machinery and equipment such as sluices and weirs, it is increasingly the case that the parts are old and difficult to be remanufactured and the replacement work is extensive. Then, by promoting development of needs-driven technologies “to make repair and renewal of machinery and equipment easier and less expensive”, entry from new and different industries can be expected. Moreover, private companies will accelerate the innovation such as utilizing inconceivable new materials instead of steel and concrete.



By sharing the database among many local governments referring to the repair method and design of similar structures local governments, it is expected that the maintenance efficiency will be greatly improved, such as shortening the repair time and reducing cost.

Conclusion

In addition to the above, we are developing
- technologies to detect signs of damage in invisible parts of roads/ bridges at an early stage, and repair/retrofit measures, to reduce costs and social impacts
- technologies to manage inspection and repair records of bridge/river facilities using 3D data and make effective use of them
- technologies to detect signs of failure of pumps and other mechanical equipment to prevent unexpected malfunction

In order to develop those preventive maintenance technologies for infrastructure, it is essential to make the most of maintenance data and to proceed R&D rapidly employing collaboration with municipalities as well as private sectors through the PRISM program.