JSCE Launches Global Expansion of Infrastructure Maintenance Technology and Systems

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1. Background

Much of Japan's infrastructure was constructed during its period of rapid economic growth in the 1960s and 1970s. With this aging infrastructure now deteriorating, the country is confronting the challenge of this societal problem by stepping up research and development efforts in the areas of maintenance technology, including inspection, diagnosis, repair, and data analysis, as well as developing systems to implement them.

The Japan Society of Civil Engineers (JSCE) has taken over the activities that for the five years from 2014 to 2018 were undertaken under the Infrastructure Maintenance, Renovation and Management[1] theme of the Cabinet Office's cross-ministerial Strategic Innovation Promotion Program (SIP). During the period of the program, Hokkaido University and the University of Tokyo were responsible for the overseas expansion of SIP project activities. They carried out related investigations and research on deploying Japan's maintenance expertise overseas, primarily in the Asian region, and held joint seminars with governments and universities in Thailand, Vietnam, Myanmar, and other countries to expand the network for overseas expansion. Moreover, the JSCE was also working with the Japan International Cooperation Agency (JICA). In 2017, JICA and the SIP entity exchanged a memorandum concerning mutual cooperation. The memorandum led to a number of activities: JICA supported the overseas deployment of technology developed by SIP; SIP supported the implementation of short- and long-term training programs by JICA; Japanese universities enrolled maintenance engineers from the countries involved as overseas students; and Japanese universities participated in JICA projects. When the the SIP project was completed, JSCE took over the activities after the exchange of a memorandum with JICA in 2019.

To move ahead with efforts that were previously part of the SIP project, JSCE set up the Committee for Promoting the Application of New Infrastructure Management Technology. A subcommittee for overseas expansion is responsible for the overseas activities.

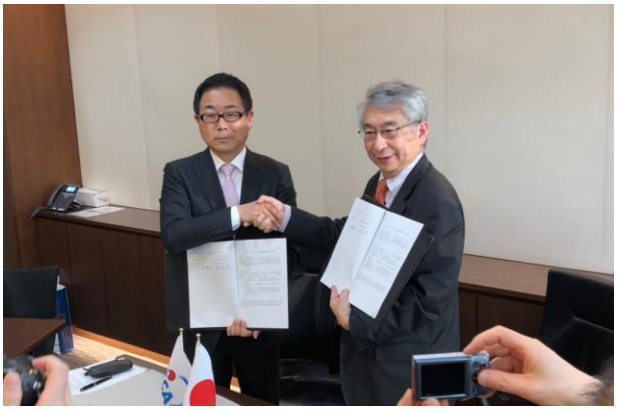

Figure 1. MoU signing between JICA and JSCE (March 5 2019)
Kazuhiko Koshikawa, JICA Executive Senior Vice President and Kiyoshi Kobayashi, JSCE President.

Figure 2. SIP seminar and inspection demonstration in Cambodia.

Figure 3. Investigation of damaged structures in Asian countries.

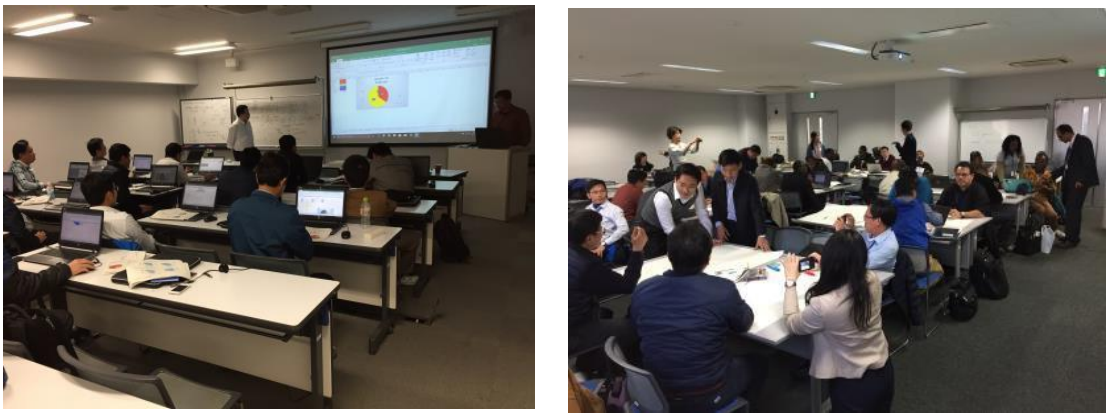

Figure 4. Training program at the University of Tokyo for maintenance engineers from various countries.

2. Overview of JSCE Activities

The following activities began in 2019.

a. Research grants for overseas expansion of infrastructure maintenance technology

A new research grant system was initiated with the aim of supporting research that enables Japanese maintenance technology to be applied to infrastructure in other countries, such as research involving work with local governments and universities, Japanese companies, etc. aimed at monitoring and repairing deteriorated structures. Beginning in October 2019,

researchers will spend one and a half years studying the ten funded themes (Table 1). We are hoping that researchers, particularly younger ones, will work with deteriorated infrastructure in other countries and thereby gain motivation to expand the technology overseas in the future.

Table 1. Research grant themes (2019)

	Representative	Institute	Title of research	Target country	Target infrastructure
1	Tetsuhiro Shimozato	University of the Ryukyus	Overseas deployment of corrosion prevention technology for steel bridge bolted joints that was developed in Okinawa, where there is a highly saline environment	The Philippines	Steel bridges (Quezon Bridge and Mac Arthur Bridge)
2	Kiyoyuki Kaito	Osaka University	Deployment of infrastructure management technology based on statistical deterioration prediction using on-site inspection data	Myanmar and Vietnam	Roads (paving) and bridges
3	Takashi Kiyota	The University of Tokyo	Restoration and countermeasures for infrastructure damaged by long-distance ground flows resulting from liquidation	Indonesia	Irrigation channels and surrounding trunk roads (City of Paul in Sulawesi Island)
4	Su Di	The University of Tokyo	Deployment of bridge numerical analysis and railroad track evaluation technology for improved maintenance of India's local railroads	India	Bridge structures and railroad track structures
5	Shingo Asamoto	Saitama University	Technological deployment of alkali-silica reaction (ASR) diagnosis and countermeasures and risk evaluation of steel member corrosion in terms of moisture permeation in Asia's hot climate	Singapore, Thailand, and Vietnam	Concrete road bridges
6	Shin Fujiu	Kanazawa University	Development of strategic next-generation inspection system using super-high resolution cameras and AI for bridge and other concrete structures and assistance in development of maintenance plans	Japan, Taiwan, Nepal, and Croatia	Bridges, dams, etc.
7	Koji Matsumoto	Hokkaido University	Application of various nondestructive inspections and monitoring technology to bridges and proposal of knowledge management-based human development system	Myanmar	Bridges
8	Takafumi Nishikawa	Nagasaki University	Determination of load bearing characteristics and study of inspection method for and verification of applicability of diagnostic imaging technology for infrastructure to Bailey bridge in permanent service	Laos	Managed bridge
9	Koji Kinoshita	Gifu University	Corrosive environment investigation aimed at promoting wide use of weather-resistant steel in bridges and proposal for repair work methods in Central Africa and Zambia	Central Africa and Zambia	Weather-resistant steel bridge (Kafue Bridge), steel road bridges, and steel railroad bridges
10	Seigo Nasu	Kochi University of Technology	Study of application of bridge asset management system to developing country	Indonesia	Road bridges managed by local governments in Indonesia

b. Assistance with JICA's long-term trainee program

JSCE is continuing to assist with JICA's long-term trainee system, originally initiated by JICA and the SIP entity, in which road and bridge maintenance engineers from the countries involved are accepted at Japanese universities, where they have an opportunity to learn about Japanese technology and systems. Once candidate students have been put forward by their own governments, JSCE selects and recommends suitable universities for them. So far, more than ten such trainees who are involved in road and bridge maintenance in Cambodia, Laos, Mongolia, Bangladesh, the Philippines, Egypt, and other countries have come to Japan to study. Short-term off-campus training programs are also offered; in August 2019, trainees participated in lectures, bridge inspection demonstrations, tours of engineering facilities, etc., in Tokyo, Nagoya, and Gifu. The hope is that these overseas students will apply Japanese technology and systems to maintenance work when they return to their own countries. Another result will be the development of an international network of overseas alumni. The program plans to bring around 10 people to Japanese universities every year.

Figure 5. Interview with long-term trainee candidates (Cambodia)

Figure 6. Program for long-term trainees in Japan organized by JICA, August 2019 (Photos from JICA)

c. Participation in JICA projects

JSCE promotes the participation of Japanese universities in overseas projects planned and implemented by JICA. Projects related to the maintenance of infrastructure differ from

projects involving new construction; in particular, the applied technology and systems and the planned maintenance cycle must accord with the available local human resources, budgets, and technological ability. The expertise of universities and academic societies greatly helps with the development of the human resources essential to constant repair and replacement in a planned cycle.

Gifu University has joined a JICA project that aims to transfer to Zambia a program implemented by the university in Japan that develops engineers into Maintenance Experts (MEs). The hope is to give Japan's inspection and diagnosis technology solid roots in Zambia, backed up by a proven system of human resources development. The University of Tokyo and Nagasaki University are also planning to participate in JICA technological cooperation projects in Myanmar and Laos

Faced with dwindling populations, rural areas in Japan have been developing technology and systems for maintaining infrastructure within tight budgets. The result is a high level of technological capability to implement measures against infrastructure deterioration. This technology and experience can be expected to serve many other countries as well.

Figure 7. Joint research and education project of Gifu University (Japan) and Zambia University (Zambia).

3. Summary

The activities reported here are based on a research grant system and operate in cooperation with JICA. This is the first time that JSCE has specifically engaged in overseas expansion with respect to infrastructure maintenance. JSCE's previous activities to promote international

exchange, in which its own International Activities Center promoted seminars and cooperation with academic societies in various countries, did not directly involve the deployment of technology or research leading up to it. Through this expansion overseas, JSCE aims to contribute to solving problems in the countries involved through technology deployment and human resource development, concentrating on activities related to the research interests of Japanese researchers.

[1] https://www.jst.go.jp/sip/k07_en.html