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Special Edition
(Translation of Feature Article of JSCE Magazine, Vol. 102, No. 10)

Development of Infrastructure Maintenance Cross-Cutting Technology and its Implementation

—— Cross-Ministerial Strategic Innovation Promotion Program (SIP) ——

Civil engineering structures constructed around the rapid economic growth days of Japan are beginning to deteriorate. Many will have been in service for over 50 years and the number of such structures is expected surge in the coming years. Under such circumstances, discussions on how to maintain the infrastructure have been going on for a long time. The Infrastructure Maintenance Engineering Joint-sub-committee, a joint working group of various committees belonging to the Japan Society of Civil Engineers (JSCE), has published, in 2004, a book titled *Social Infrastructure Maintenance Engineering,* in which maintenance engineering is systematically organized. Since then, cross-sectional research and technological development for maintenance have been underway, though less technology for innovation have presently been introduced yet in the field. Thus, for the moment, maintenance of infrastructures is carried out following judgements made based on the experience of skilled engineers and results of on-site surveys.

But in other engineering fields, technological innovation applying information and communication technology (ICT) has progressed remarkably just in these past 20 years. We are enjoying the conveniences provided by the Internet that were unimaginable in the past. At the Japan Society of Civil Engineers, Tamiharu Tashiro, former president of the JSCE, has put up the development of next-generation construction technology, using ICT, robots, and other technologies, as one of major themes for his special task force to tackle. In the future, we expect that cooperation not just between the various fields of civil engineering but with other engineering fields will lead to major technological advancements in maintenance technology.

Development of Infrastructure Maintenance, Renovation, and Management technology, is a project (hereinafter, SIP Infrastructure Project) in the Strategic Innovation Promotion Program (SIP), led by the Cabinet of Japan, that focuses on cooperation between various fields of study.

Research and development in the SIP Infrastructure Project is carried out with a focus on joining hands with a broad range of cutting-edge technologies -- combining civil engineering with ICT, robotics, and other innovative technologies – and not be confined by the boundaries of existing technologies. This Special Edition of Newsletter to translate Feature Article of JSCE magazine (Vol. 102, No. 10) on the SIP Infrastructure Project was planned in the hopes of offering our readers knowledge not only on cutting-edge technologies but that which crosses over various fields.

A major portion of infrastructures are managed by local public organizations. So maintaining infrastructures appropriately within a limited budget is a major issue. In 2014, visual inspection from a close distance once every 5 years became compulsory for tunnels and for road bridges which are 2 meters or more long. But evaluation of bridges in visual inspections depends on the skill of the inspector and skillful inspectors are indispensable. Nevertheless, in regional areas, especially, there are not enough such inspectors and funds are limited; Japan, that is a serious issue that needs to be resolved. In the future, it will be effective to evaluate civil engineering structures efficiently and objectively through observations using ultrasound and radio waves with UAV (Unmanned Aerial Vehicle), robots, and other devices, and not rely on visual inspections from a close distance by inspectors.

To apply new technologies in maintenance, we need to understand innovative technologies correctly and clarify the issues facing their introduction in maintenance activities. Another chief objective of this Special Edition is to organize and introduce this information, and promote understanding of readers by translating the Feature Article of JSCE magazine.

Fig. 1. Schematic drawing of SIP Infrastructure Project
（http://www.jst.go.jp/sip/k07_en.html）

In the SIP Infrastructure Project there are 60 research and development themes under five development topics (Fig. 1.) that were adopted in fiscal 2014. In fiscal 2016, 11 research and development themes were added for the purpose of implementing the developed technologies. The list of 60 research and development themes are introduced in the article on the conversation between Dr. Kazuo Kyuma, the chair of the SIP governing board, and Dr. Yozo Fujino, SIP Infrastructure Program Director (PD).

In this Special Edition No.52, Dr. Kazuo Kyuma and Dr. Yozo Fujino discuss the outline of SIP, the process of how the SIP Infrastructure Project was selected as a national project, and on how the project is progressing and its prospects.

Then, Mr. Yoshioka introduces what the Japanese Ministry of Land, Infrastructure, Transport, and Tourism is doing to promote technological development through the SIP Infrastructure Project, to speed up the evaluation of newly developed technologies to implement them in the field, and the direction of future maintenance technology development the ministry is considering.

The SIP Infrastructure Project has a wide range of research and development themes, so JSCE asked each SIP Infrastructure project members to give an outline of each development topic, shown in Fig. 1, including the special features of the technologies. They also discussed how the SIP Infrastructure Project's asset management technologies are employed in other Asian countries, the international standardization of technologies, and about training engineers in road and bridge maintenance technology, in cooperation with Japan International Cooperation Agency (JICA). These articles will be available in the No.53 Special Edition to be released this April 2018.

New technologies developed through the SIP Infrastructure Project are expected to bring major innovations in infrastructure maintenance. But there are many issues that need to be overcome for the technologies to be implemented. For that reason, as seen in this special edition, JSCE have asked Mr. Tazaki, the SIP Infrastructure Sub-Program Director, to give a summary of the measures to expand the range of applications in civil engineering for the new technologies. JSCE also held a round-table meeting of the research and development members of the regional implementation support team and asked them to discuss problems facing each area in the implementation and application of SIP infrastructure technologies, and what they are doing to tackle those problems.

The SIP is a national program created to materialize scientific and technological innovations. It is indispensable for society and deals with vital issues to overcome to strengthen Japan's economy and industrial competitiveness. It is honored in civil engineering

circles that infrastructure maintenance, an area of civil engineering, is taken up in one of the SIP projects, but it is not so widely known except for researchers in the field. As described in the article on the conversation between Dr. Kyuma and Dr. Fujino, innovative technologies for construction and infrastructure maintenance and disaster prevention and mitigation, which are also civil engineering field, are indicated in the Public/Private R&D Investment Strategic Expansion Program (PRISM), the new SIP, as one of target areas for development. It is our hope that this Special Edition to translate Feature Article of JSCE magazine to introduce SIP infrastructure project will be of assistance to civil engineers who tackle to resolve the issues facing the nation.

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