Infrastructure Maintenance, Renovation, and Management

Developing Technologies to Support Sustainable, Safe and SecureInfrastructure Systems, Driven by Five Research Projects

From roads to harbors, railways to airports, infrastructure is the fundamental element of modern society that supports our life and social activities. A sustainable economy, productivity, and the wellbeing of a nation depend heavily on the reliability and sustainability of its infrastructure. A large portion of today's infrastructure was built during the period of high economic growth. In recent years, numerous cases of infrastructure deterioration have surfaced, leading to major accidents. Many other problems include the cost for social capital repairs and maintenance across twelve different sectors (roads, river embankments / dams, sabo facilities, coastal levees, sewerage, port and harbor facilities, airports, aids to navigation, parks, public housing, government buildings, and observation facilities). Estimates suggest these costs will reach between ¥5.5 and ¥6.0 trillion in fiscal year 2023, and between ¥6.0 and ¥6.6 trillion in fiscal year 2038. In the face of such circumstances, many are looking toward infrastructure maintenance, renovation, and management technologies as a strategy to prevent accidents and reduce the burden of repairs and maintenance.

Program Director

FUJINO Yozo

Yokohama National University
Institute of Advanced Sciences
Distinguished Professor

* The affiliation and title of PD shall be as of the end of the 1st period (the end of FY2018).

Profile

After completing the Master of Engineering program in the Department of Civil Engineering at the University of Tokyo in 1974, FUJINO Yozo studied at the University of Waterloo, Canada and received his Ph.D. in civil engineering in 1976. He then returned to Japan in 1977 and served as a research associate at the Earthquake Research Institute of the University of Tokyo. In 1978, he joined the Department of Structural Engineering at the University of Tsukuba as an assistant professor. FUJINO joined the Department of Civil Engineering at the University of Tokyo in 1982 as an associate professor. In 1990, Dr. FUJINO became a full professor of civil engineering at the University of Tokyo. Professor FUJINO took an appointment from the Yokohama National University in October 2014. Professor Emeritus, the University of Tokyo.Among other honors, Professor FUJINO was awarded the Medal with Purple Ribbon from the Emperor of Japan in 2007, the Hokokai Award (Hattori Hokokai Foundation) in 2015 and Japan Academy Prize in 2019.

Research and Development Topics

1. Research and development on inspection, monitoring, and diagnostic technologies

Develop technologies that provide efficient and effective inspection and monitoring capabilities to assess infrastructure damage.

2. Research and development on structural material, deterioration mechanism, repair, and reinforcement technologies

Develop simulation technologies to assess deterioration mechanism of structural materials; create a structural deterioration forecast system.

3. Research and development on information and communications technologies

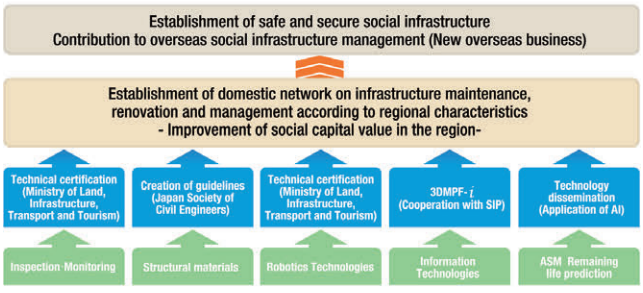
Develop data management technologies utilizing the enormous volume of information generated by infrastructure maintenance, management, renovation, and repair systems.

4. Research and development on robotics technologies

Develop robotics technologies to inspect, diagnose, operate, manage, and repair infrastructure elements efficiently and effectively; develop robots to perform surveys and excavation in dangerous situations such as disaster areas.

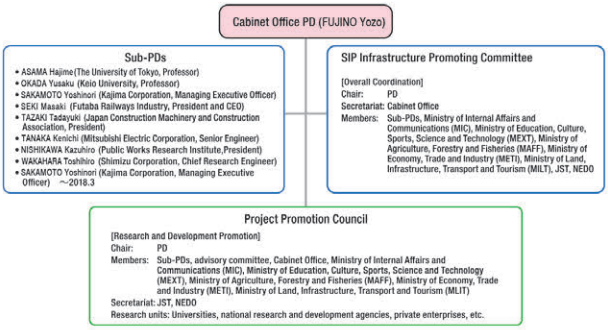
5. Research and development on asset management technologies

Implement infrastructure management for the technologies produced from topics 1. through 4. above. Develop asset management technologies for efficient operations management making the most of limited financial and human resources.



Implementation Structure

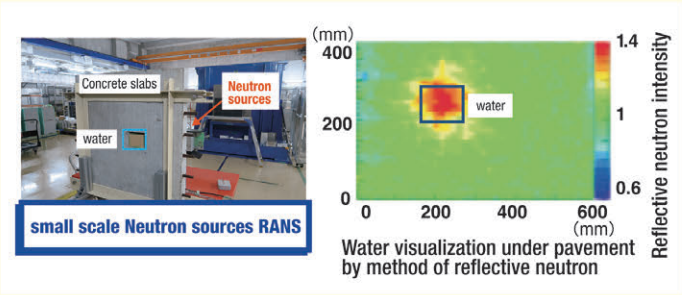
The SIP Infrastructure Promoting Committee is led by the Program Director (PD) and Cabinet Office, with participation by sub-PDs, concerned government ministries and agencies, the Japan Science and Technology Agency (JST) and the New Energy and Industrial Technology Development Organization (NEDO). Project Promotion Council meetings are held in cooperation with universities, national research and development agencies, private enterprises, and others as the main research units. The PD, sub-PDs, advisory committee members, and concerned government ministries and agencies advise research units on research and development. At the same time, they examine intellectual property strategies, including standardization strategies for developing nations and other foreign countries.



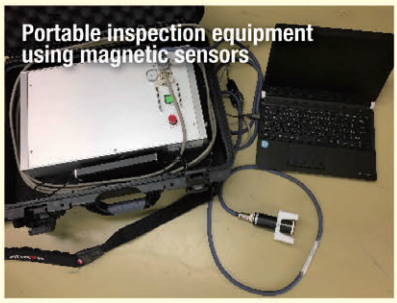
* It shows the structure and organization at the end of the 1st period (the end of FY2018).

Establishment of infrastructure systems utilizing new technologies

The technology developed in this project has excellent performance and can be confidently recommended.
For example, one of them is visualization technology of the state of rebar inside concrete using X-rays. We can use neutron to visualize cavities and water inside the concrete.
There are many subjects to practical use of these results, but there is no doubt that it is the world's most advanced technology.
There are many promising technologies such as the measurement system with compact probe capable of easy measurement of plate thickness and crack by high sensitivity magnetism, the world's first system capable of detecting the internal defect of the deck by electromagnetic wave radar radiating from a car traveling at speed of 80 kilometers per hour, the life expectancy system of concrete floor slab and inspection support systems for tunnels and bridges.

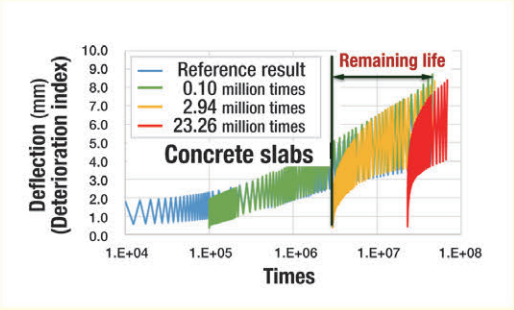


•Water Visualization System Using Small Scale Neutron Sources



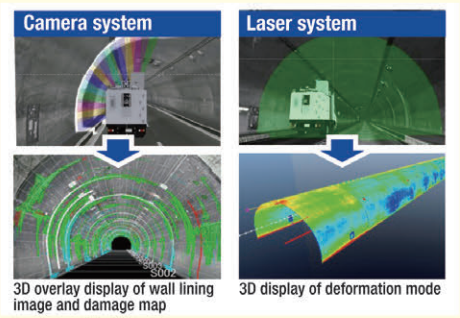
•Ultrasensitive Magnetic Nondestructive Testing

•High Speed Scanning with 3D Radar

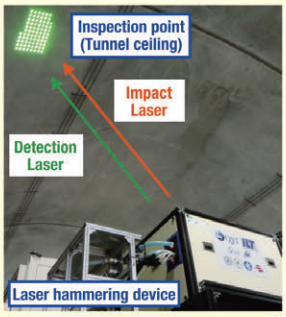


•Remaining Life Prediction of Concrete Slabs

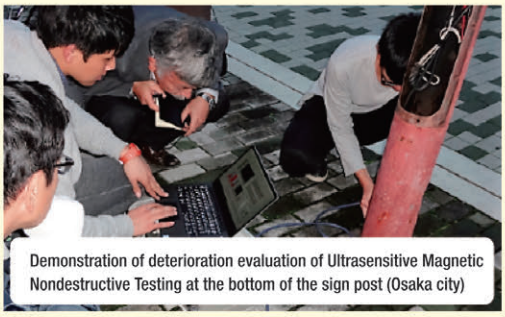
•Bridge Inspection Support Robot System



•Inspection for Tunnel Using a Rapidly Scannable Non-contact Radar



•High Speed Inspection System by Laser Hammering



•Activities of the Regional Implementation Support Team

•For specific information on Infrastructure Maintenance, Renovation, and Management, please see the following URLs:

•For details on developed technologies:

Comprehensive list of infrastructure technologies
https://www.jst.go.jp/sip/dl/k07/sip_k07_souran.pdf

•For other contents:

Website of SIP "Infrastructure Maintenance, Renovation, and Management"
https://www.jst.go.jp/sip/k07.html