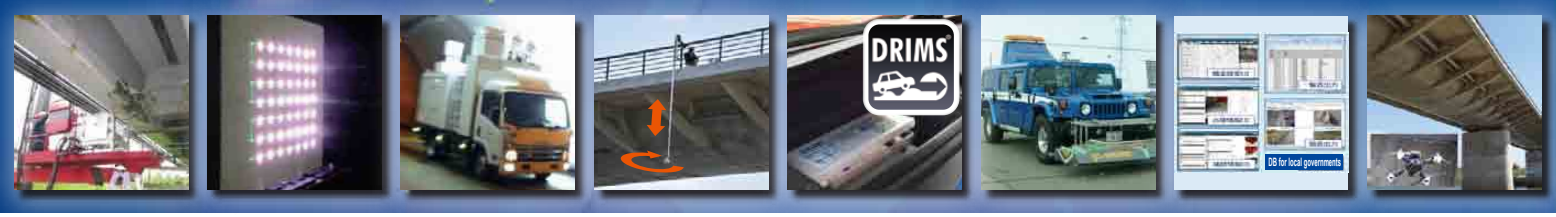
Infrastructure Maintenance, Renovation and Management

Advanced Technology Solutions



Toward Safer and more Secure Civil Infrastructures driven by Developing Technologies

SIP Cross-ministerial Strategic Innovation Promotion Program

Introduction; The R&D Project of Infrastructure Maintenance, Renovation and Management

Greeting

For Sustainable, Safe, and Secure Infrastructure Systems

The Cross-Ministerial Strategic Innovation Promotion Program (SIP) managed by the Council for Science, Technology and Innovation (CSTI) has been established to realize scientific and technological innovations. As a cross-ministerial and cross-field program, SIP is running forward with a focus ranging from basic research to commercialization/industrialization. One of its tasks is "Technology for infrastructure maintenance, renovation, and management" (hereafter referred to as "SIP Infrastructure").

Infrastructure such as roads, railways, harbors, airports, and various disaster prevention facilities support our everyday life and social and economic activities. Many of them, however, were built during the high economic growth period. As they get older, the increase in maintenance and repair expenditure along with the possibility of a serious accident occurring during service have become serious social issues. This program aims at preventing accidents and reducing the burden of maintenance by constructing systematic infrastructure management that utilizes the world's most advanced information and robotics technologies.

Unlike mass-produced products, such as vehicles and laptop computers, infrastructure consists of single products that are designed, constructed, and manufactured individually. The initial conditions of infrastructure vary depending on the time and condition they were built. As a result, in addition to the difference in deterioration actions under service, the rate of infrastructure deterioration also varies. Infrastructure that has been used for several tens of years may pose a higher risk of accidents due to material and structural degradation. To enable effective and efficient preventive maintenance management of infrastructure and to establish a safe and secure infrastructure system, it is therefore crucial to have technologies that can precisely diagnose and take appropriate measures, by closely examining a large number of items of infrastructure individually on-site. It is also important to minimize the hazards and risks associated with manual work on site.

For infrastructure managed by local governments, reduction of life cycle cost is also a particularly important viewpoint. Currently, infrastructure is being constructed across Asia; however, maintenance has already become a big issue there. In this program an asset management system is being developed and introduced to manage maintenance of many types of infrastructure on-site, in order to solve these problems. This asset management system integrates many types of technology such as technology for predicting the remaining life of infrastructure, technology capable of analyzing the state of degradation of infrastructure in a multi-faceted matter, systems that apply GIS to support the collection and analysis of infrastructure inspection data, robots that support or replace all or part of the inspection and monitoring work, support for diagnosis of infrastructure using AI technology, ultra high durability concrete, etc. The technologies developed in this project have superb performance, and we can recommend them with confidence.

The value of Japan's infrastructure stock is estimated to be over 800 trillion yen. Infrastructure should function for several decades. Passing on to the next generation infrastructure that can be used with confidence is our contribution to the future. We believe that the widespread use of the results of "SIP Infrastructure" should contribute to the establishment of a sustainable, safe, and secure society.

PD (Program Director)
Yozo Fujino
Distinguished Professor, Institute of Advanced Sciences, Yokohama National University

Biography

Yozo Fujino graduated from Department of Civil Engineering, at the University of Tokyo in 1972. After completing his Master's degree (Civil Engineering) at the University of Tokyo, he received the Doctor of Philosophy from the University of Waterloo in 1976. He joined the Earthquake Research Institute at the University of Tokyo; the Institute of Structural Engineering at the University of Tsukuba; and Department of Civil Engineering at the University of Tokyo. In 1990, he was appointed as a professor of Department of Civil Engineering at the University of Tokyo. In 2014, he joined the Yokohama National University, and has served in his current position from October 2014. He is a Professor Emeritus of the University of Tokyo. His expertise includes structures, vibration control and monitoring of civil infrastructures with emphasis on bridges. He was awarded the Medal with Purple Ribbon of Honor from the Emperor of Japan in 2007, and the 2015 Hattori Hoko Award (The Hattori Hokokai Foundation), among others.

Outline

In Japan where degradation is progressing as the infrastructure ages, there is concern over the risk of a major accident such as that which occurred at the Sasago Tunnel in 2012, and the increasing cost of maintenance. With the continuation of the stringent financial situation and the reduction in experienced engineers, it is essential to establish and infrastructure management system utilizing new technology in order to prevent accidents and minimize lifecycle costs through preventative maintenance. In addition, the latest information technologies such as IoT, AI, and analysis of big data, create a new business opportunity in infrastructure maintenance, with the potential for the business to be expanded to various foreign countries, in particular the various countries in Asia. By accurately exploring the infrastructure maintenance needs on-site and the seeds of research and development, technologies that can be continuously used on site have been developed, and the appropriateness and effectiveness of the maintenance cycle has been increased. Also the accuracy of preventative maintenance has been significantly increased based on technologies to predict the remaining lifetime, and applied technologies such as AI technology for the data in connection with infrastructure. In addition, a team has been assembled based on local universities that links the problems in infrastructure maintenance with local characteristics, to construct an asset management system taking into consideration these local characteristics. In addition, initiatives are being implemented to verify new technologies, prepare guidelines, provide support for construction of infrastructure and databases (spread to all Japan based on local characteristics), provide training to introduce new technologies to the whole country, to disseminate these technologies overseas in cooperation with the Japan International Cooperation Agency (JICA), and support is being provided to establish these technologies in local areas. The final task before this program terminates in March 2019 will be to connect these various new movements in infrastructure maintenance produced in "SIP Infrastructure" to the next generation, so that investment will continue into the future.

Cabinet Office PD (Yozo Fujino)

Sub-PD

- Hajime Asama (University of Tokyo, Professor)
- Yusaku Okada (Keio University, Professor)
- Masaki Seki (Futaba Railways Industry, President and CEO)
- Tadayuki Tazaki (Japan Construction Machinery and Construction Association, President)
- Kenichi Tanaka (Mitsubishi Electric Corporation, Senior Engineer)
- Kazuhiro Nishikawa (Public Works Research Institute, President)
- Toshihiro Wakahara (Shimizu Corporation, Chief Research Engineer)

SIP Infrastructure Promoting Committee

[Overall Coordination]
Chair: PD
Secretariat: Cabinet Office
Members:
Sub-PDs,
Ministry of Internal Affairs and Communications,
Ministry of Education,Culture, Sports, Science and Technology,
Ministry of Agriculture,Forestry and Fisheries,
Ministry of Economy, Trade and Industry,
Ministry of Land, Infrastructure, Transport and Tourism,
JST, NEDO

Project Promoting Council [Research and Development Promotion]

Chair: PD
Members: Sub-PDs, advisory committee, Cabinet Office, Ministry of Internal Affairs and Communications, Ministry of Education, Culture, Sports, Science and Technology, Ministry of Agriculture, Forestry and Fisheries, Ministry of Economy, Trade and Industry, Ministry of Land, Infrastructure, Transport and Tourism
Secretariat: JST, NEDO
Research units: Universities, National Research and Development Agencies, private enterprises, etc.

01 High Output X-Ray and Compact Neutron Source Visualization Technology

Like medical radiography

Soundness of concrete bridges can be diagnosed by visualization of the inside of them. It enables decisions on repair and strengthening methods.

-Diagnosis of Soundness of Concrete Bridges by Fusion of Advanced X-ray and Neutron Visualization Technology with Civil Engineering-

■Visualization using high output portable X-ray sources

- **Enable visualization of the internal structure of PC beams**
  Insufficient grout filling and rupture of steel wires inside PC beams can be visualized.
- **Transmission images of thick concrete structure can be obtained.**
  High X-ray energy sources while maintaining their portability were realized by linear electron accelerators.
  The high X-ray energies enabled on-site X-ray imaging of thick concrete structure which was not achieved with conventional X-ray tubes.

950-keV source : Maximum thickness of approximately 40 cm

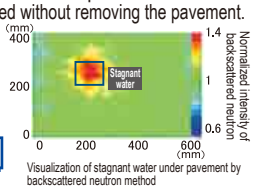
3.95-MeV source : Maximum thickness of approximately 80 cm

X-ray sources can be installed on the bridge inspection vehicles or aerial work platform vehicles.

■Visualization using Neutron Beams

A World's First

- **The world' s first reflective (backscattered) neutron imaging**
  - Two-dimensional visualization of degradation and stagnant water inside slab samples
  - The inside can be checked without removing the pavement.



Visualization of stagnant water under pavement by backscattered neutron method

- **Towards on-site diagnosis of real bridges**
  Working towards development of a transportable neutron source for diagnosis of bridges on site.

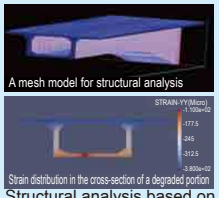
■Results of Use

Demonstration of on-site X-ray inspection of real bridges using high output X-ray sources

First in Japan

Installation of X-ray source

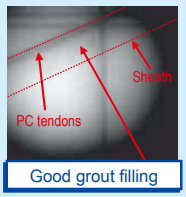
X-ray image



Structural analysis based on visualization results

FY 2015 PC Box Girder Bridge (National road)

Installation of X-ray source



X-ray image

FY2018 PCT Girder Bridge (Managed by Local Government)

Media coverage

- NHK Science ZERO
  30th July 2017
- Nikkan Kogyo Shimbun
  26th February 2018 (6 sides)
- Nikkei Construction
  12th March 2018

Inquiries
Center for Advanced Engineering Structural Assessment and Research, Public Works Research Institute
(Masahiro Ishida, Yoshinobu Oshima) TEL: 029-879-6773 Email: caesar@pwri.go.jp
HP: http://www.tokai.t.u-tokyo.ac.jp/kiki/ HP: http://rans.riken.jp/

02 Hammering Test of Tunnel Concrete using High Power Lasers

Hammering Speed Increased by Factor of 20!

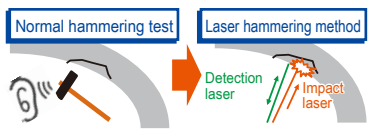
Hammering Test Assist by Remote Sensing and Degitalization

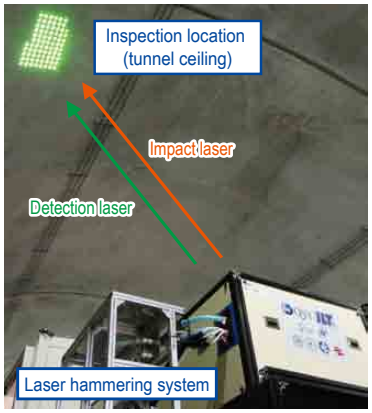
Feature 1 Does not require scaffolding and aerial vehicle!
Enables laser remote seingig to be carried out from a distance of up to about 10 m

Feature 2 About 20 times faster than manually!
Measurement can be carried out hammering up to a maximum of 50 Hz About 20 times → faster than a person (about 3 Hz)!

Feature 3 Tireless!
Hammering test can be carried out repeatedly with a constant laser energy

■Results of Use



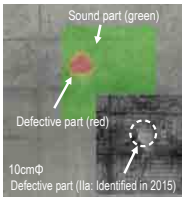


Specification developed by SIP	
Object of inspection	Internal concrete defects (depth 50 mm or less/distance 10 m or less # under evaluation)
System size	Mounted on 4 ton truck (excluding diesel generator)
Inspection speed	Operation at 50Hz (Stop & Go measurement)
Electrical power source	Diesel generator

■Results of Verification Tests

June 2017 Japan Construction Method and Machinery Research Institute Mock Tunnel
May 2018 Narasaka Tunnel, Nara City
June 2018 Tenno Tunnel on National Route 173, Osaka Prefecture Open verification test (see below)

Open verification test at Tenno Tunnel on National Route 173, Nose Town, Osaka Prefecture (length 311 m) (23rd June 2018)



Easy to understand display of results on a optical image

- Hammering test that normally take in the range of 5 to 15 minutes per test were completed in 2 minutes!
- Verification that the combination of image measurement and laser hammering measurement of linings is an efficient inspection method.
- Confirmation of a defect from laser hammering is carried out by a specialist that checks for consistency with close visual check.

↑ Here is a video

Osaka prefecture: It is expected that this technology can be commercialized and utilized.

Nara City: It is expected that the system will become the standard in Japan.

Media coverage

- Nikkei Shimbun (July 1, 2017)
- Science ZERO (July 30, 2017)
- Asahi Shimbun (June 23, 2018)

■ Overall responsibility : RIKEN (Kiwamu Kase) TEL: 048-467-9846 E-mail: kiwamu@riken.jp HP: http://www.riken.jp/research/labs/rap/photon_ctrl/
■ Contact for technical inquiries : National Institutes for Quantum and Radiological Science and Technology (Masaharu Nishikino) TEL: 0774-71-3343 E-mail: nishikino.masaharu@qst.go.jp HP: http://www.kansai.qst.go.jp/
: Institute for Laser Technology (Yoshinori Shimada) TEL: 06-6879-8737 E-mail: shimada@ilt.or.jp HP http://www.ilt.or.jp/study/intro-sonic.html
■ Inquiries regarding implementation : Photon Labo Co., Ltd. (Shigeru Kogure) TEL: 03-6214-2529 E-mail: info@photon-labo.jp HP: http://photon-labo.jp/law.html

03 Tunnel Inspection and Synthetic Soundness Diagnostic System using High-Speed Scanning Non-contact Radar

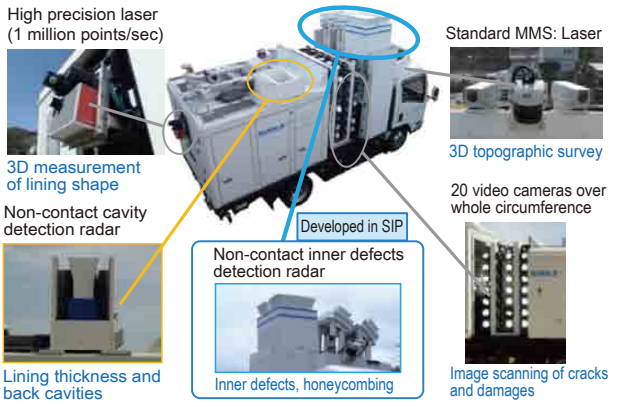
High Speed Inspection of Cavities and Inner Defects at Speeds of 50 km/h and Higher

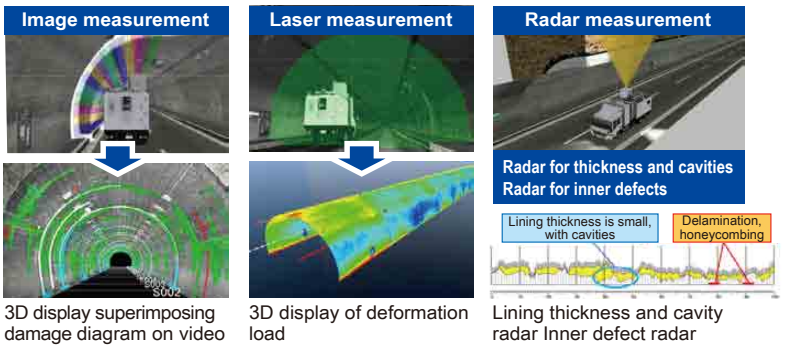
Feature 1 Traffic restrictions unnecessary! (No impact on traffic flow due to high-speed scanning)

Feature 2 Simultaneous measurement of cracks in lining, damage, delamination, back cavities, etc., in one scan

Feature 3 Applicable to almost tunnels! (As the distance from radar antenna to wall is about 3 m)

■Overview, Specification





■Results of Use (Inner defect detection)

- Measurements in a tunnel within Gifu Prefecture (Gifu University SIP*1): Verification was carried out compared with contact type radar, and the same good results were obtained. The synthetic diagnostic system using a combination of laser and radar was able to effectively support soundness diagnosis. *1 See 08
- Mock internal cavity appropriately detected in new bridge at Nagoya University *2
- Experience has been gained on more than 1,000 km of traveling measurement.

*2 An actual bridge model reconstructed from members of the bridge that was dismantled.

■Users' voices

It is effective for obtaining information on cavities, etc., prior to carrying out conventional inspection.

↑ Here is a video

Inquiries
Pacific Consultants Co., Ltd. Infrastructure Management Dept. Tunnel Section (Hideki Yamamoto)
TEL: 03-6777-4763 Email: tn-mimm@ss.pacific.co.jp HP: https://www.pacific.co.jp/service/infrastructure/tunnel/close-up/mimm-r/

04 Bridge Inspection Robotic Camera

NETIS Registration: KT-160016-A

Capable of measuring crack widths in

locations where a person cannot easily go!

(Capable of visually identifying cracks with 0.2 mm width from a distance of 20 m)

Feature 1 **Safety operation**...The inspection survey can be carried out from the top of the bridge or a distant location

Feature 2 **Excellent camera performance** . . . Optical zoom 30, contrast correction. shake correction

Feature 3 **Easy operation** . . . Remote operation of pan, tilt, zoom, and taking photo / movie with a tablet PC

Feature 4 **Portability** . . . Weight (13 kg), installation time of the device is about 5 minutes

Feature 5 **Wide range of applications** . . . Can be applied not only to bridges, but also to road lighting columns, signage columns, tunnels, tanks, jetties, and buildings

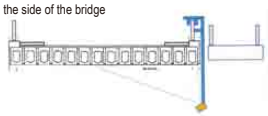
Operate by finger only

■Applied Use Case

I Within box girder with large depth

II Pedestrian bridge at the side of a bridge

Bridge with narrow gap to pedestrian bridge on the side of the bridge



III PC stress ribbon bridge

No space for bridge inspection vehicle

■Remarkable performance

Ⓐ Tool for measurement of crack width and object dimensions

The crack scale, measurement scale, and L-type scale are displayed on the operation terminal screen

Ⓐ L-type scale

Ⓐ Crack scale

Ⓑ Automatic image taking function of low magnification

(When taking zoomed in images, zoomed out images can be automatically taken at the same time)

Ⓒ Continuous automatic image taking

(The whole area to be imaged is automatically imaged in sequence to obtain the required resolution (mm/pixel)

■Results of Use

●Field test by the SIP Local Implementation Support Team

1 Through type steel truss bridge 2 PC Finback bridge

●Used in inspection of damaged bridge after Kumamoto earthquake

●Participated in on-site verification and trial introduction by "Next Generation Social Infrastructure Robot Development and Introduction Study Group*"

3 PC hinged long span bridge 4 Steel plate girder bridge

*Ministry of Land, Infrastructure, Transport and Tourism and Ministry of Economy, Trade and Industry (2014- 2017)

■Users' voices

Inquiries
Sumitomo Mitsui Construction Co., Ltd. (Yasuhisa Fujiwara)
TEL: 03-4582-3060 Email: information@smcon.co.jp HP: https://www.smcon.co.jp/topics/2014/09309778/
Hitachi Industry & Control Solutions, Ltd. Social Infrastructure Sales Division (Yoshitaka Chiba)
TEL: 03-3251-7245 Email: www@ml.hitachi-ics.co.jp HP: http://info.hitachi-ics.co.jp/product/kyouryou/index.html

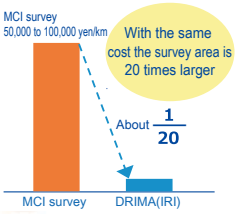
05 Smartphone-based Road Condition Evaluation System

Detect road surface damage simply and inexpensively!

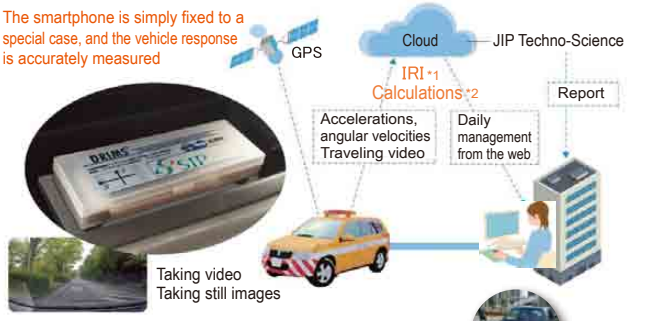
■Overview, Advantages

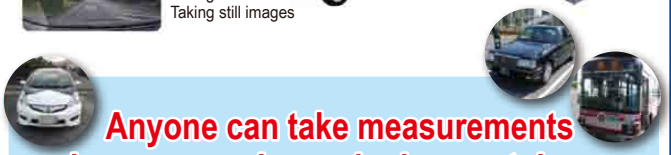
Achieves cost reduction by a factor of 20 and high accuracy compared with the conventional method!
Enables wider ranging and more frequent surveys.

Just put it on the dashboard!



The smartphone is simply fixed to a special case, and the vehicle response is accurately measured

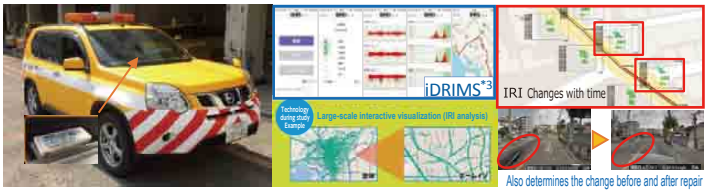




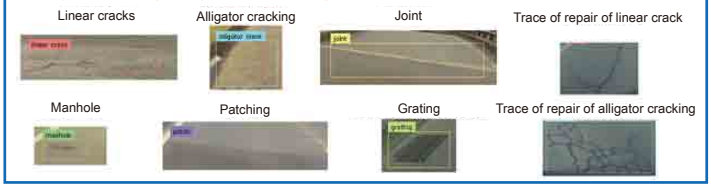
Anyone can take measurements in any car using a single smartphone

■Results of Use

- Within Japan verification tests are being carried out in Ibaraki Prefecture (Ibaraki Prefectural Public Corporation of Constructional Technology), as well as in Chiba City, Katori City, Asahi City, Toyonaka City, Beppu City, and in the Kinki and Shikoku Regional Development Bureaus of the Ministry of Land, Infrastructure, Transport and Tourism.
- Overseas, operation is scheduled to start in Kenya in FY 2018



Locations that require repair can be determined by IRI/flatness + diagnostic analysis of images by deep learning



■Users' voices

Just carry your smartphone, handling is simple.

The results are also consistent with the evaluation opinions of patrol staff. *4

*1. IRI: International Roughness Index
*2. iDRIMS applies IRI "Class 2"
*3. iDRIMS "Measurement": An iOS app that measures the vehicle vibrations using acceleration/angular velocity sensor, etc. mounted on iPhone/iPodtouch
*4. There are also successful test results confirming the performance of the road surface properties automatic measurement device on a vehicle on which iDRIMS is mounted

Inquiries
JIP Techno Science Corporation. (Yasuaki Hirose, Muneaki Takahashi)
TEL: 03-5614-3206 Email: drims_project@jip-ts.co.jp HP: https://www.jip-ts.co.jp/highlights/sip.html

06 High-speed Automatic Radar Diagnosis Technology for Bridges

Traffic restrictions not required!

Ultra high speed measurement at 80 km/h!
Sees abnormalities inside bridge decks!

■Overview, Advantages (Features), and Specification

- Automatic analysis of very small changes in complex radar data by Digital Signal Processing and AI
- Detects cracks in the order of 0.1 mm containing water and Segregation damage inside bridge decks
- Is capable of large-scale analysis of about 100 km in one day
- Supports efficient inspection by road managers using the integrated management system (ROAD-S System) that maps the diagnosis results on maps on the web

■Results of Use

This is already being introduced on a trial basis by three local governments, and at present measurement and analysis is scheduled to be carried out by a further 2 local governments

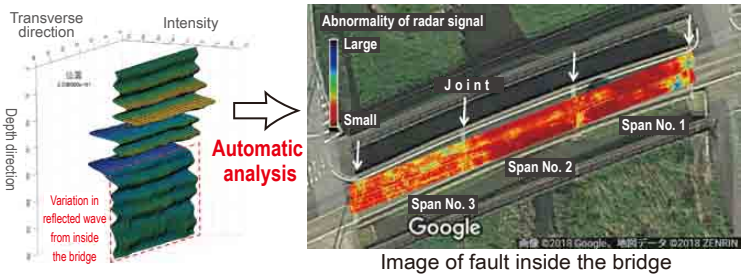


Image of fault inside the bridge

Interface of the integrated data management system

■Users' voices

It is not possible to observe degradation of the interior of the deck from above the pavement. This system that enables diagnosis of the internal condition on-destructively is useful.

At present surveys of whole roads have not been conducted because of financial limitation. Regarding price aspects, the effect of introduction of the system is large.

Media coverage

- NHK "Science ZERO" (broadcast 30th July 2017)
- Nikkei Construction (12th March 2018)

Inquiries
Institute of Industrial Science, the University of Tokyo (Tsukasa Mizutani) TEL: 03-5452-6098 e-mail: mizu-t@iis.u-tokyo.ac.jp
C.E.Management Integrated Laboratory Co.,Ltd. TEL: 03-5846-8385 HP: https://www.dksiken.co.jp/blog/news/date/2018/5214/

Local Implementation

07 Integrated Database System for Bridge Maintenance

Integrated data management of bridge inspection for time-saving and economic advantage!

Realization of advanced inspection and diagnosis, efficiency, and proper repair plan and budget control

■Overview

●Database (DB) system construction, introduction, and support for local governments, based on the DB system for the East Nippon Expressway Company Limited (NEXCO EAST) developed from SIP research project.

■Issues at Local Governments: ex. YAMAGATA

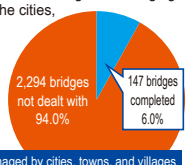
Very large stock of infrastructure to be managed

●Inspection data has already been obtained for 10,000 cases in prefectures, cities, towns, and villages
●This will increase by 1,600 cases annually

Searching for and preparing the necessary information or documents is difficult!

Delay in implementation of measures by local governments, especially cities, towns, and villages

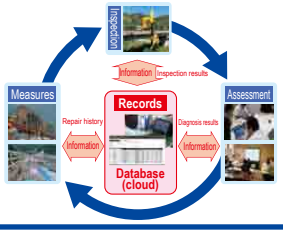
●The key to measures against the aging bridges is the cities, towns, and villages



Bridges managed by cities, towns, and villages (2,411 bridges requiring measures to be taken)

Budget, staff, and technical capability are issues for cities, towns, and villages

Prepare database of the information for the bridge maintenance cycle (inspection, assessment, measures, records)



■Results of Use · Schedule etc.

●Service commenced in Yamagata Prefecture in 2016
●In 2017 all 35 cities, towns, and villages within Yamagata Prefecture introduced the "Yamagata Prefecture Road Bridge Maintenance Integrated Database System (DBMY)"

FY 2017
Extended to 34 cities, towns, and villages in Miyagi Prefecture

Joint operation of DBMY

Center for Infrastructure Management Research (IMC), Tohoku University
Yamagata Prefecture (Main building)
Yamagata-Ken Construction Technical Center
Yamagata Prefecture (General Branch Office)
All 35 cities, towns, and villages within the prefecture
Charge
Provision of service

DBMY provides technical support to cities, towns, and villages as a common platform

Infrastructure DB for local governments
Cooperation in development
Provide results
Center for Infrastructure Management Research (IMC), Tohoku University
Miyagi-Ken Construction Center
Customization of forms for cities, towns, and villages in Miyagi Prefecture

FY 2018
Scheduled to be introduced in Miyagi Prefecture and Sendai City Fukui Prefecture (Scheduled to be introduced in 2018)

In addition, the number of local governments considering introduction is increasing!

■Merits of Introduction

Time required for preparation of bridge diagnosis document for 1 bridge

Manual operation
*Inputting while searching documents
About 3 hours

Integrated database system
About 3 minutes

The Infrastructure DB for Local Governments has been customized for use in Yamagata Prefecture. In this way it was possible to develop in a short period of time and economically a database system that was high-performance and easy to use, and that did not require major modification of the forms, etc., already in use in the prefecture.

Yamagata Prefecture Prefectural land development section

Local Implementation Refer to "Overview of Local Implementation Support Team" in this pamphlet

Inquiries
Center for Infrastructure Management Research, Tohoku University (Makoto Hisada, Ko Kamata, Kiriko Nakano)
6-6-11 Aoba, Aramaki, Aoba-ku, Sendai
TEL: 022-721-5503 Email: inquiry-imc@tohoku-imc.ac.jp HP: http://imc-tohoku.org/

SIP

Local Implementation

08 Robotic Technology to Support Periodic Inspection of Bridges in Local Governments

Achievement of Advanced and Efficient Bridge Periodic Inspection, with Greatly Shortened Traffic Restrictions!

↑ Here is a video

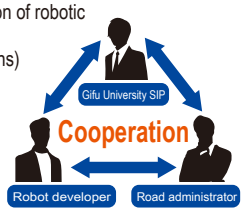
■Overview of initiatives and results

Utilization of robotic inspection technology for inspection of bridges

●Implementation of inspection on bridges where inspection is difficult (large bridges having large cross-sections, etc.)
●Major shortening of traffic restrictions on the bridge (efficiency due to the combination of robotic technology and large-size inspection vehicle) Example: 10 days → 4 days
●Acquisition of detailed inspection information (information useful for future inspections)

Initiative of Gifu University SIP Team

●Development of Guidelines for application of robotic inspection technology to local government bridges
●Performance requirements for robotic inspection technology and performance evaluation
●Examples of optimum combination of robotic inspection technologies



■Future development

●Application to Kakamigahara Bridge periodic inspection
- First inspection in 2018 -
●Proposals for improvement of inspection robot
- From the viewpoint of the user -
●Collection of damage AI teaching data
- Cooperation between the robot developer and the road administrator, with the aim of improving the accuracy of detection of damage by the robot -

Preliminary Surveys with Optimum Combination of Robotic Technologies


Two-wheeled Multicopter


Flying robot with hammering function


Drone with controllable pitch propellers


Bridge inspection camera system


Robotic camera for inspection

See 04

Confirmation by close visual inspection


Ultra large bridge inspection vehicle

Local Implementation Refer to "Overview of Local Implementation Support Team" in this pamphlet

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SIP

Overview of Local Implementation Support

In the SIP "Infrastructure maintenance, renovation, and management technologies", an initiative to support implementation of these new technologies in local governments is being promoted through locally-based universities, etc. (Local Implementation Support Team).

■Support Activities

●Verification test for introduction of new technology for solving the problems of local governments, initiatives to provide technical advice, etc.

Gifu University (Professor Rokugo) Verification of the use of robotic technology on site (Gifu University, Kakamigahara City)

Verification of the performance on site of a bridge inspection robotic camera (Nagasaki Prefecture, Saikai City)

Verification of application of advanced magnetic non-destructive testing device for evaluation of degradation of the bottom of columns for signage (Osaka city, Osaka Prefecture)

●Initiatives to spread information regarding the introduction of new technologies, for training of engineers

Nagasaki University (Professor Matsuda) Providing information to members of the media regarding verification activities at Nakato Bridge (Saikai City, Nagasaki Prefecture)

Public symposium by Hokkaido University and officials from local governments (Sapporo City, Hokkaido)

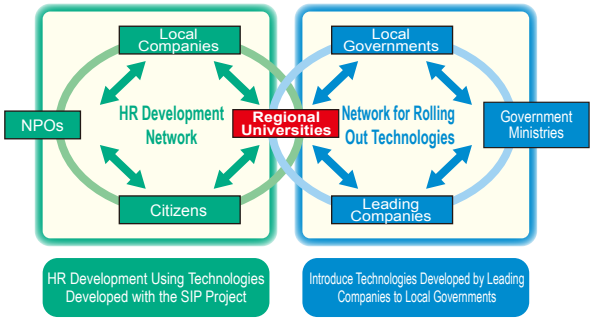
Technology explanatory meeting for members of staff of local governments, those engaged in construction, and high school students (Kurayoshi City, Tottori Prefecture)

●Initiatives to introduce database systems for managing inspection data, etc.

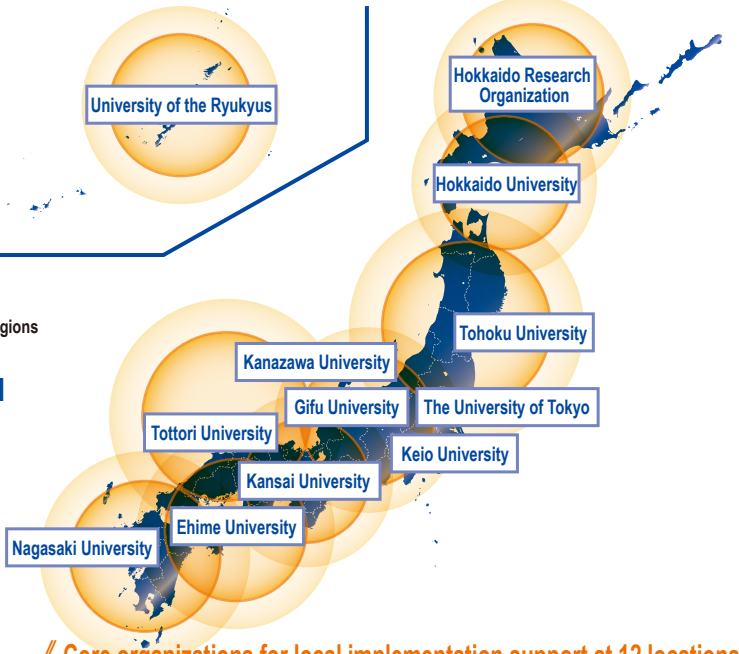
Explanation of database systems by Tohoku University for managers in the 35 cities, towns, and villages of Yamagata Prefecture (Yamagata City, Yamagata Prefecture)

Verification of development of locally managed asset information for waterworks applying GIS technology (Furano City, Hokkaido)

■Support Network



Schematic Concept of Infrastructure Maintenance and Renovation Management in the Regions



《 Core organizations for local implementation support at 12 locations 》

■Users' voices (local governments) regarding local implementation initiatives

There are many bridges managed by the city where the width is narrow and there is no detour, so the utilization of robotic cameras, etc. for bridge inspection is useful. (Nagasaki City, Nagasaki Prefecture)

I expect that the use of the "DB for local governments" will be a powerful measure for solving the maintenance problems of prefectures, cities, towns, and villages. (Yamagata Prefecture)

The reduction in traffic restrictions by the use of bridge inspection robotic technology and the accumulation and utilization of this detailed data is attractive. (Kakamigahara City, Gifu Prefecture)

Cultivation of human resources is important as the population reduces. I would like to see more courses for those that have left school, such as this one. (Sapporo City, Hokkaido)

Effective technology has been implemented to ensure the performance of aged infrastructure as a platform of industry, government, and academia cooperation. (Tottori Prefecture)

Plate thicknesses could be measured rapidly without cleaning and even in water, and this greatly contributed to formulating the maintenance policy. (Shimanto City, Kochi Prefecture)

To date there has been no locally managed small scale waterworks pipeline information. This is a very important source for management, so definitely I want to see it extended. (Furano City, Hokkaido)

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SIP "Infrastructure Maintenance, Renovation and Management" Website (JST)
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2018.12