May 2020 No.88
Japanese Infrastructure Newsletter

# IDI QUARTERLY

Infrastructure Development Institute—JAPAN

## CONTENTS



**Infrastructure Development Institute – Japan (IDI)**
Plaza Edogawa-bashi 3F. 1-23-6, Sekiguchi, Bunkyo-ku, Tokyo, 112-0014, JAPAN
Tel: +81-3-5227-4107 Fax: +81-3-5227-4109 E-Mail: idi17@idi.or.jp Website: http://www.idi.or.jp/en/

# Crack Repair Method, SAPIS (Sakae Adjustable Pressure Injection System)

Subtitle: Repair Construction Management System for Life Prolongation, SIMMS

(Sakae Infrastructure Maintenance Management System)

## 1. Introduction

SAKAEGUMI has been engaged in civil engineering, construction, and pavement work since 1955. In 1975, it was the first in the region to produce asphalt, thus contributing to the spread of paved roads. From 2007, it began developing concrete crack repair technology, focusing on concrete crack injection, and has been working to prolong the lifespan of concrete structures through its SAPIS and SIMMS technologies, which synergistically consist of investigation and diagnosis, section repair, combined repair and reinforcement work, and post-work evaluation.

We engage in: construction work; investigation and diagnosis with planning, design, and implementation of repair and reinforcement work for concrete structures; leasing of a patented construction method; water jet construction; repair equipment R&D; development and spread of UAV and USV; import and sale of repair materials; examination of construction materials (aggregate and soil); and sale and maintenance of environmental equipment.

In Brazil and Indonesia, SAKAEGUMI provides repair and reinforcement technology for vital concrete structures. To cut infrastructure life cycle costs, the importance of preventive maintenance is now recognized globally, with efforts shifting from corrective to preventive maintenance by technological means. SAKAEGUMI's SAPIS crack repair technology is highly valued overseas and is attracting public and private sector attention in Brazil and Indonesia.

## 2. Company with a trusted technology

In order to provide a complete solution service for concrete structures and contribute to the extension of life of maintenance and infrastructure, SAKAEGUMI develops and provides a construction system and infrastructure repair construction management system to unify the management of four processes, namely (i)

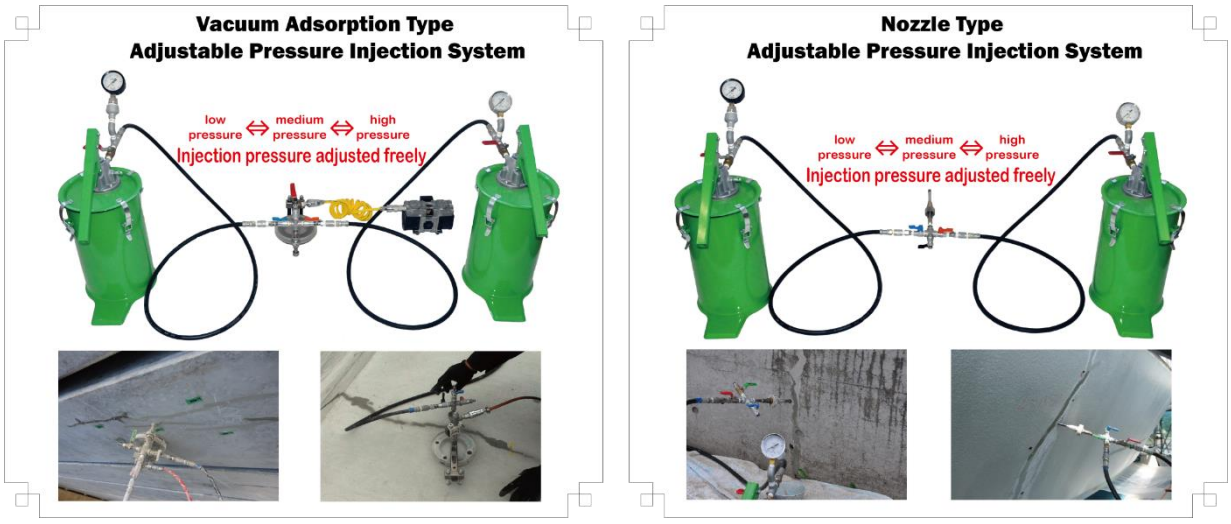



Figure 1 Equipment of SAPIS

Photo1 Crack injection of floodgate

Photo 2 Injection to stop water leakage of water tank

repairing cracks and deteriorated parts of concrete structures using the Adjustable Pressure Injection System; (ii) investigating and evaluating a multi-layered deterioration using various nondestructive inspection machines and other equipment; (iii) cleaning and treating deteriorated parts using ultra-high pressure water (Water Jet) before the repair and reinforcement without damaging healthy parts; and (iv) making property recovery evaluation after the repair and reinforcement.

Concrete crack repair technologies generally used for the purpose of extending the life of concrete structures include methods such as the crack coating method, injection method, and filling method. Currently the mainstream method is the injection method, which pours repair materials to close cracks. However, insufficient injection of repair materials or adhesion failure has frequently caused re-deterioration at an early stage after the repair, which has been an issue within the industry. The Adjustable Pressure Injection System, which has been internally developed by SAKAEGUMI to overcome the problems due to these causes, is divided into Vacuum Adsorption Type Adjustable Pressure Injection System and Nozzle Type Adjustable Pressure Injection System. The difference between these systems are related to how the repair materials are injected, whether from the concrete surface or from inside.

## 3. Features of SAPIS

(1) Technological features

Main features of the Adjustable Pressure Injection Systems (common features of both Vacuum Absorption Type and Nozzle Type):

- The injection pressure can be adjusted freely according to the injection conditions, and the injection performance is higher than existing methods because it can be injected from the deep part of the crack to the surface part.
- Various repair materials ranging from organic to inorganic types can be injected regardless of the target, and high repair effect can be anticipated even if various materials with different repair effects are injected continuously.
- Adjustable Pressure Injection Systems allow for repeated use of infusion devices without any adhesive curing of the infusion devices that are essentially required by the existing methods. Therefore, this new method will reduce infusion materials and environmental burden without generating any wastes.

These three points can be highlighted. Moreover, since waterproof materials can be combined in water-leaking cracks, caulking effects can be

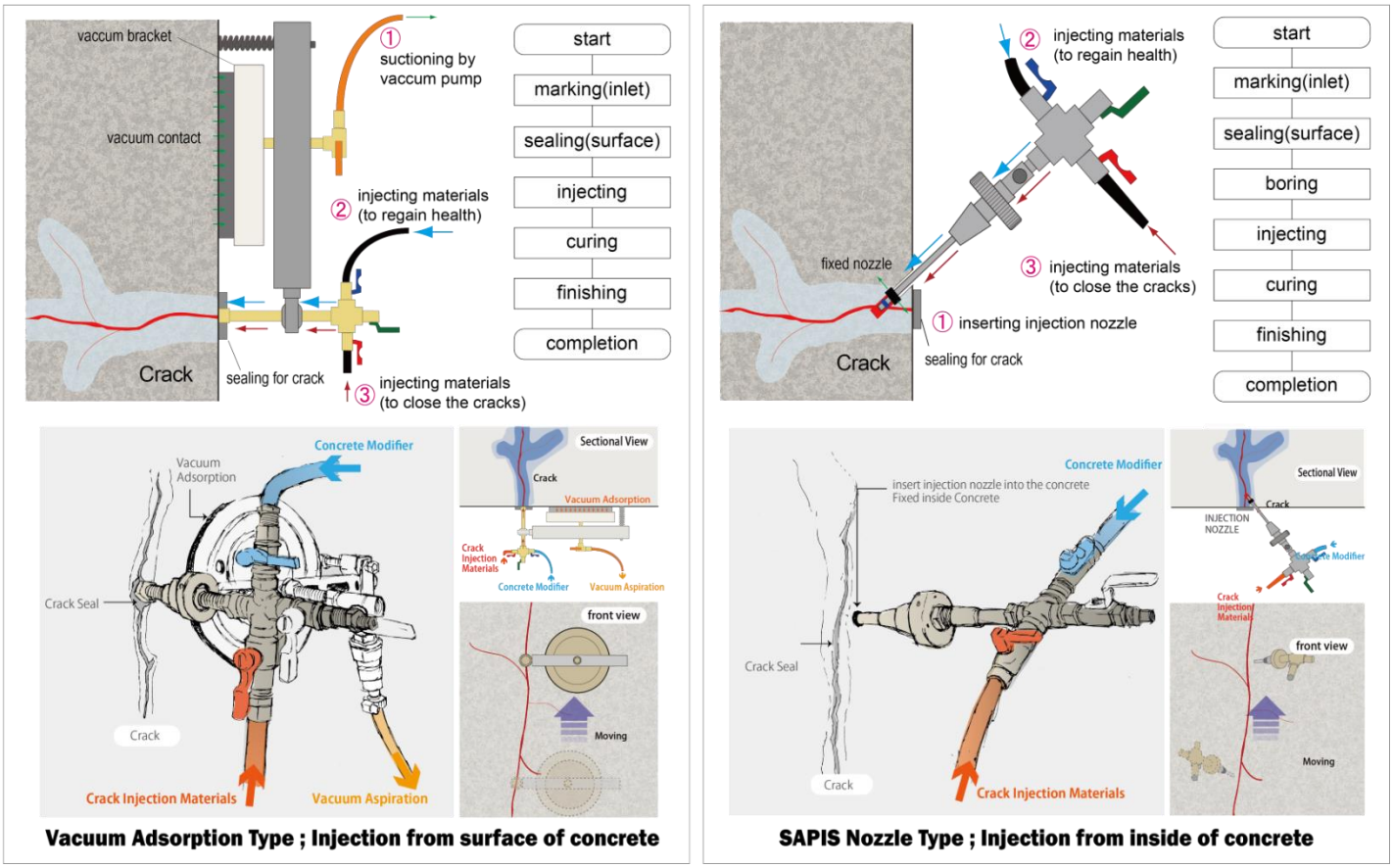



Figure 2 Infusion mechanism of SAPIS

anticipated, which has been difficult technology today. Furthermore, since no adhesive is required and the concrete frame is not soiled, the new methods will allow for repair with a better appearance.

(2) Product and technology specifications and prices

The specifications and prices of Vacuum Adsorption Type Adjustable Pressure Injection System and Nozzle Type Adjustable Pressure Injection System are shown in the following table. Unlike other existing methods, both the Vacuum Adsorption Type Adjustable Pressure Injection System and the Nozzle Type Adjustable Pressure Injection System do not attach any injection devices, making the construction period shorter. The repair construction cost is calculated based on 50m construction, and the total cost of labor, material, equipment and others is approximately 9,000 JPY per meter for the Vacuum Adsorption Type Adjustable Pressure Injection System, and approximately 12,000 JPY per meter for the Nozzle Type Adjustable Pressure Injection System. In addition to their performance that surpasses the existing technologies, the quality of repair work is improved by the management standards that are not generally established in Japan.

| | | Adjustable Pressure Injection System Vacuum adsorption type | Adjustable Pressure Injection System Nozzle type |
|---|---|---|---|
| Outline | | Method of injecting concrete repair material from the crack surface using an injection machine with vacuum adsorption function.Easy to attach and detach to concrete structures. It is possible to adjust the injection pressure from low pressure to high pressure. Any material can be used(inorganic, organic). Multiple repair materials can be injected continuously. | Method of injecting concrete repair material from the inside of the frame by inserting and fixing a nozzle type injection machine into the injection hole provided by drilling the surface of the concrete frame.Easy to attach and detach the injector. The injection pressure can be adjusted. Any material can be used.Used for repairing cracks and peeling, and water leakage prevention. |
| Price(JPY) | | 9,166 JPY per mete<br>（Standard construction quantity50m）<br>Labor costs (unit price in Tokyo), material costs, equipment costs, miscellaneous costs | 12,604 JPY per mete<br>（Standard construction quantity50m）<br>Labor costs (unit price in Tokyo), material costs, equipment costs, miscellaneous costs |
| Repair target | | Cracks developed in small concrete structures and mass concrete structures（It is possible to repair cracks on curved surfaces by selecting the appropriate one from several types of vacuum brackets with different shapes and materials.） | Cracks developed in small concrete structures and mass concrete structures、Water leakage、Peeling of concrete or tile（Select injection nozzle diameter φ10mm, φ8mm, φ6mm and length according to the repair target） |
| Main materials | | Organic materials (epoxy, acrylic, urethane)、Inorganic materials (cement, polymer cement)、Impregnated concrete modifier | Organic materials (epoxy, acrylic, urethane)、Inorganic materials (cement, polymer cement)、Impregnated concrete modifier |
| Quality | Crack width | 5mm～0.02mm | 5mm～0.02mm |
| | Crack depth | 2000mm～0mm | 2300mm～0mm(Maximum depth varies depending on drillable depth) |
| | Injection pressure | 0MPa～2MPa(There is an influence of the vacuum adsorption force that changes depending on the surface condition) | 0MPa～5MPa(5MPa or more is possible depending on the capacity of the infusion pump used.) |
| | Injection method | Injection from the crack surface (The inlet should be at a location where the crack width is 0.2 mm or more) | Perforate concrete frame and inject from inside crack（Standard drilling diameter is φ10.5mm, drilling diameter φ10.5mm to φ6.5mm） |
| | Inlet interval | 30cm～100cm(Judgment based on crack width, depth, body condition, etc.) | 30cm～100cm(Judgment based on crack width, depth, body condition, etc.) |
| | Post-construction evaluation | Use a nondestructive inspection machine to evaluate the crack closure status after injection. | Use a nondestructive inspection machine to evaluate the crack closure status after injection. |
| | Special notes | Continuous injection of multiple materials is possible | Continuous injection of multiple materials is possible |
| Management standards | Quality control | Set the control standard value for Adjustable Pressure Injection System | Set the control standard value for Adjustable Pressure Injection System |
| | Work progress control | Set the control standard value for Adjustable Pressure Injection System | Set the control standard value for Adjustable Pressure Injection System |
| | Photo management | Set the control standard value for Adjustable Pressure Injection System | Set the control standard value for Adjustable Pressure Injection System |
| Construction qualification | | Technician of Adjustable Pressure Injection System（Certification） | Technician of Adjustable Pressure Injection System（Certification） |
| Field conditions | | Not particularly. However, it is necessary to check the temperature at the time of construction (because injection may be restricted at outside air temperature of 5℃ or less) | Not particularly. However, it is necessary to check the temperature at the time of construction (because injection may be restricted at outside air temperature of 5℃ or less) |
| Design condition | | For organic materials： No conditions for crack width.The box is dry.<br>For inorganic materials： Crack width 0.05mm or more. | For organic materials： No conditions for crack width.The box is dry.<br>For inorganic materials： Crack width 0.05mm or more. |
| Environmental impact | | No waste | No waste |
| Safety | | Wearing protective equipment（Gloves, protective glasses etc.） | Wearing protective equipment（Gloves, protective glasses etc.） |

Table 1 Specifications and Prices of SAPIS

## 4. Outline of SIMMS

SIMMS is an infrastructure maintenance management system for repair construction and reinforcement construction. This management system is aimed to unify the management of four processes, namely (1) Investigation of Degradation; (2) Processing of Degraded Parts; (3) Repair Construction and Reinforcement Construction; and (4) Property Recovery Evaluation after the Repair and Reinforcement.

(1) Investigation of Degradation

"Investigating the cause of degradation from different perspectives. - Concrete is just like a human body -"

It is important to precisely specify the cause of the disease to provide proper treatment.

For the degradation of a concrete construct, it is necessary to investigate in detail from different perspectives and diagnose the result in a multi-layered manner.

(2) Processing of Degraded Parts

"Leave the healthy part as it is and only treat the degraded parts"

When mending the degraded part, it is essential not to cause any micro-cracks that can damage the healthy part. Water jet is a technology that can successfully "remove only the problematic parts" and "its treatment is limited to the degraded area" of an infrastructure.

Workable construction types by Water jet are shown below.

Revive the skid resistance :WJ(RSR) / Cleaning : WJ(CL) / Surface - Treatment : WJ(ST) / Cutting : WJ(C) / Coating - Stripping : WJ(CS) / Trimming : WJ(T) / Removal : WJ(R)

(3) Repair Construction and Reinforcement Construction

"Improve cost effectiveness by optimizing repair and reinforcement"

To repair is to recover the performance to the original state and to reinforce is to improve the original performance.

It may not be possible to recover the performance to the original state depending on the situation. The cost effectiveness of repair and reinforcement can only be achieved after proper survey and high-performance degradation treatment is performed.

Our most popular construction types of repair and reinforcement are shown below.

<Repairing Construction>

Crack repair / Cross section repair / Surface coating / Impregnant coating / Exfoliation prevention / Stopping water leaks / Leakage prevention and waterproofing / Water induction

<Reinforcement Construction>

Replacement of concrete material / Increase of concrete cross sections / Addition of reinforcement material

(4) Property Recovery Evaluation

"Convey the information that customers want to know most"

Previously, it was not possible to see how much the performance was improved after the completion of mending. We will utilize different non-destructive testers to investigate the characteristics after the mending and provide post-mending evaluation.

Through the investigation of the properties of concrete structure that has been repaired using different non-destructive testers, the post-repairing evaluation will be provided, and the repairing quality can be improved.

<Comparison of External Appearance before and after Repairing>

Check of sealed cracks / Check of crack depth / Comparison of floating, honeycombs and internal degradation before and after repairing / Evaluation of execution management of repairing and reinforcement based on the management standard / Post-diagnosis of civil engineering structure (Comparison of engineering documents against execution logs, etc.) / Post-diagnosis of construct (Comparison of engineering documents against execution logs, etc.)

As of 2020, SAKAEGUMI has created a “life prolongation construction management system” that is consist of four processes. Firstly,

"Deterioration investigation" has evolved as an "advancement of investigation technology by introducing the latest measurement and measuring equipment", Secondly, "Deterioration treatment" has allowed for "higher quality of deterioration treatment by introducing the latest machinery", Thirdly, "Repair construction and reinforcement construction" has been established as "fusion of repair technology and reinforcement technology". Fourthly, "Property recovery evaluation after the repair and reinforcement" has advanced as a "development of repair and reinforcement charts fusion ICT technology and BIM / CIM"

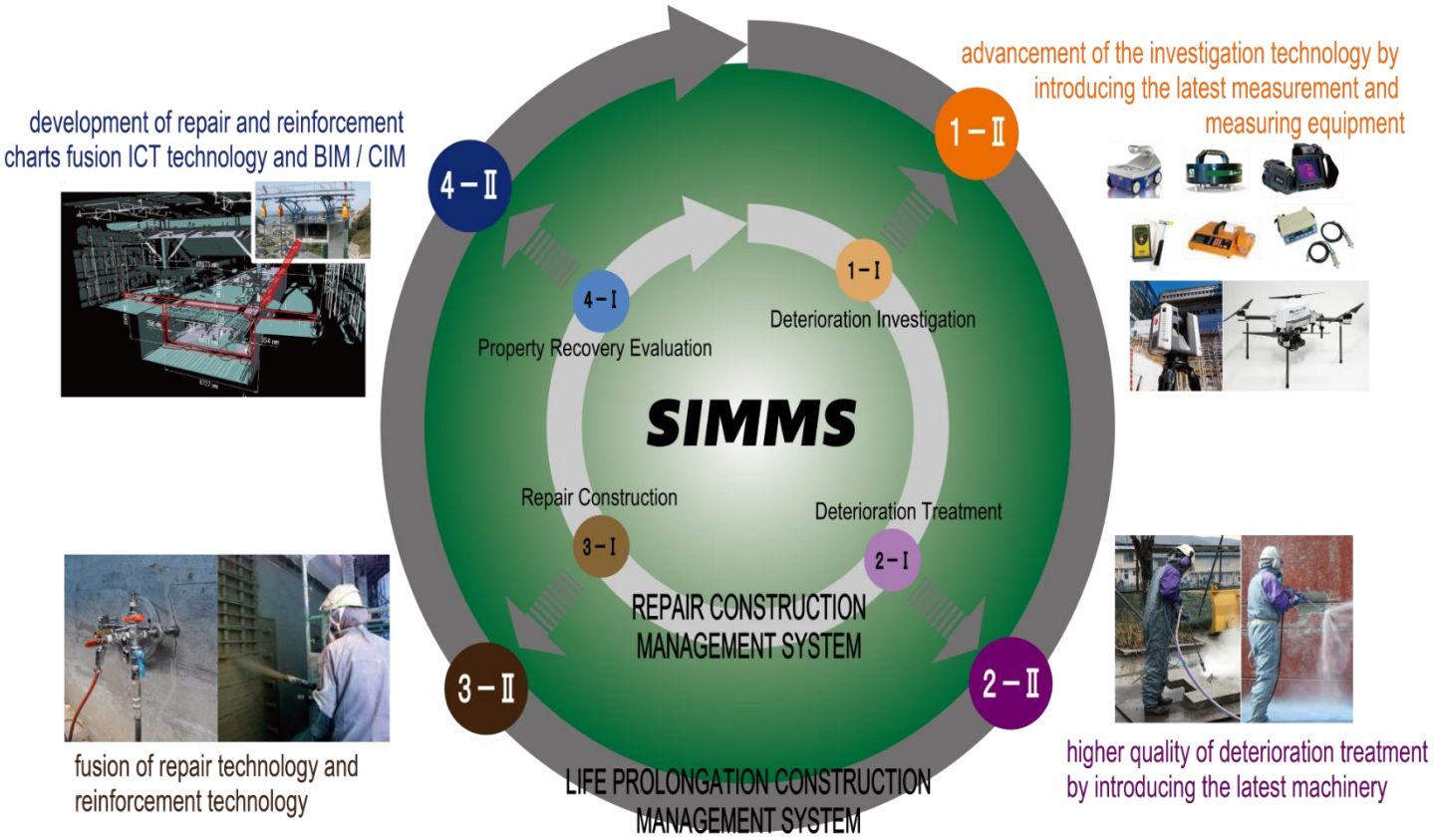



Figure 3 Conceptual diagram of SIMMS

## 5. Expected effect

We encourage potential clients to implement and disseminate the Adjustable Pressure Injection System for crack repair of bridges (on roads and railways) and tunnels. This will contribute to improving workability of crack repair, shortening repair work time, improving cost advantages for repair work, and reducing environmental impacts and public expenditure through repair work.

Moreover, an improvement of engineers' ability in conjunction with an increase in the number of engineers well-versed in the proposed construction methods is expected to improve the repair of cracks and deteriorated parts in bridges and tunnels, also contributing to preventive maintenance and long life of concrete structures. Furthermore, by carrying out the crack repair work systematically, safe and stable bridges and tunnels will be established in the transportation and traffic sectors, and the numbers of structure collapse will be decreased.

## 6. Conclusion

SAKAEGUMI will advance its investigation and diagnosis technology, develop ICT repair technology, and introduce repair materials from all over the world, while pursuing technological innovation in cooperation with domestic and overseas researchers. Furthermore, the company will strengthen its overseas business structure and train non-Japanese personnel in SAPIS. In the long term, the company will encourage international networking among engineers and efforts to prolong the lifespan of concrete structures, thus making international social contributions.

Technology Developer
SAKAEGUMI CORPORATION
https://sakaegumi.jp

Contact
SAKAEGUMI CORPORATION
Yoshihiro SASAKI (Mr)
yoshihiro@sakaegumi.jp
**TEL (+81)198-65-3032**
**FAX (+81)198-65-3324**

Photo 3 Repair work under JICA in BRAZIL

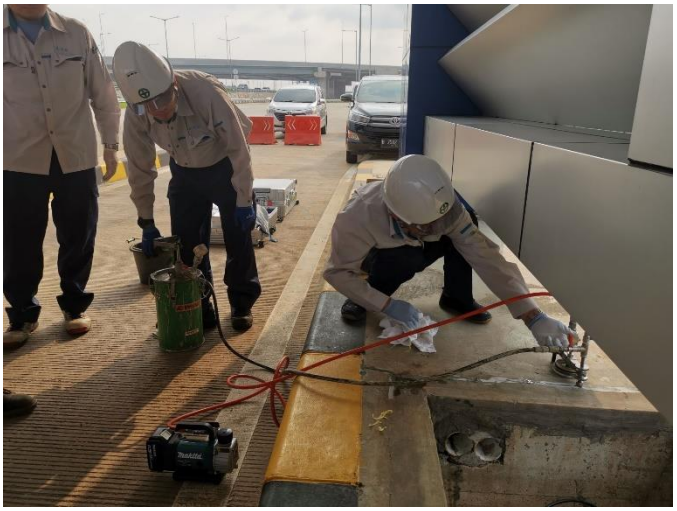


Photo 4 Repair work in INDONESIA

## 1. Deployment Background

With the recent global climate change, every year Japan suffers severe damage from wind and flood damage caused by large typhoons. Especially, it is still fresh in our memory that the damage caused by Typhoon Hagibis last year destroyed the infrastructure that we had expected to be completely safe and caused damage to citizens' property and lives.

On the other hand, there are reports that the impact of disasters such as storms and floods caused by climate change will be even greater in ASEAN countries where infrastructure development and soft measures are not as advanced as in Japan, or where measures are currently being taken. In addition, in light of this situation, I am aware that the Ministry of Land, Infrastructure, Transport and Tourism and other ministries and agencies provide expert support to ASEAN countries, and that many ODA projects for infrastructure development are being planned and implemented by JICA. For example, there are various disaster prevention facilities such as large management facilities such as dams and weirs, drainage facilities from the main river, drainage pump stations and sluice pipes to prevent inland flooding.

disaster prevention information systems using ICT, which has been provided in Japan for many years, to support the related projects and disaster countermeasures implemented by the local government. I would like to introduce the outline and features of the system, activities in each country, and the latest technologies.

## 2. System overview and features

1） System overview

There are five main functions that comprise the system. First, it collects sensor information from each facility along the river to the command center. Second, the function to compute, aggregate and accumulate the collected information. Third, the function of data management and distribution to administrators and other relevant agencies.

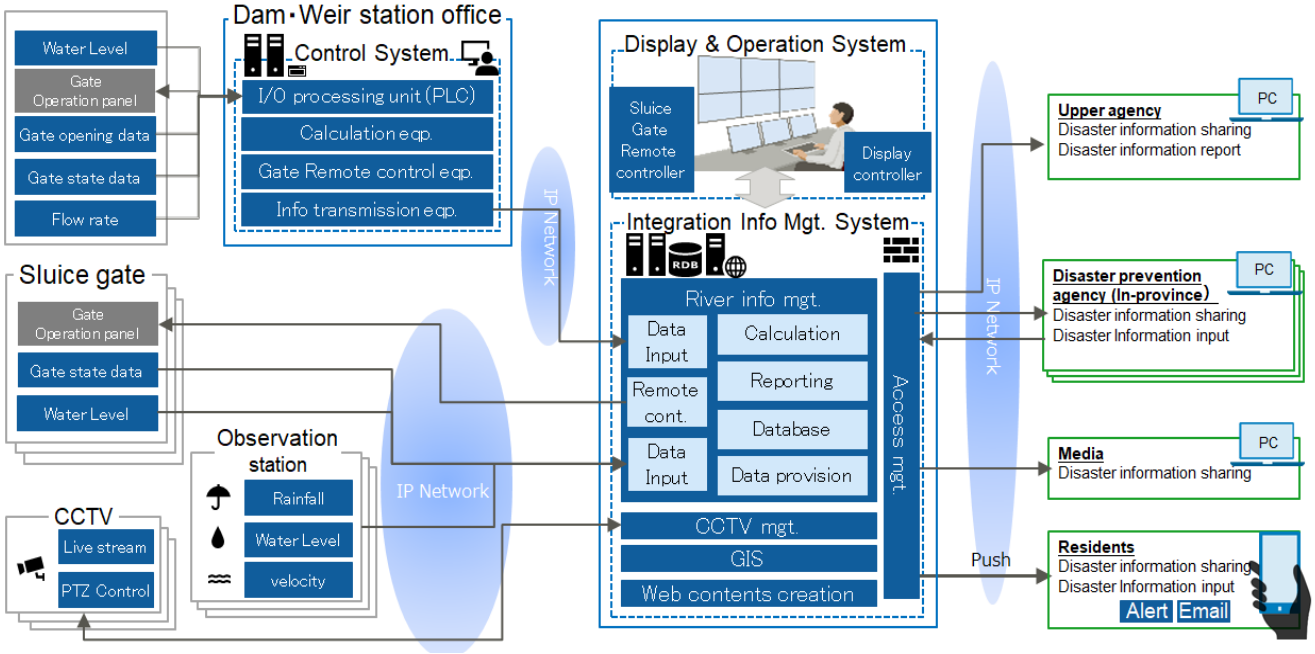



Figure 1 System Overview

Fourth, the function of remote control from the command center to the field facility. Finally, it is the function provided for the general public.

These functions are combined with ICT to create a system. Figure 1 shows the whole picture.

① Collection of sensor information

The status of many management facilities along rivers is collected in real time from various sensors and network equipment. Typical sensors are observation equipment such as water level meters, rain gauges, flow velocity, and flowmeters. If there is a gate facility such as a dam, weir, or water gate, the information from the opening meter and the condition of the gate facility such as heavy failure or light failure are collected.

As for networks, secure IP communications using radio and optical transmission equipment, which are also well established in Japan, will be realized. On the command center side, the servers which have been sold not only Japan but also all over the world (PrimergySeries), and it is important to realize the information collection in accordance with the time from the field sensor side to the server.

② Calculation, aggregation and accumulation

Based on the data collected at the scheduled time, the server is equipped with the calculation processing for the abnormal value judgment based on the preset threshold, the time accumulation, and the real-time monitoring specialized for each facility. For example, in the case of dams and weirs, the discharge quantity is calculated based on the information from the gate opening meter. By calculating the inflow based on the reservoir level and the reservoir capacity of the dam, the system contributes to appropriate discharge according to the discharge plan based on rainfall and other weather conditions and downstream water level conditions. In floodgates, sluice gates and drainage facilities, the difference between the inside water level and the outside water level is calculated to contribute to the appropriate

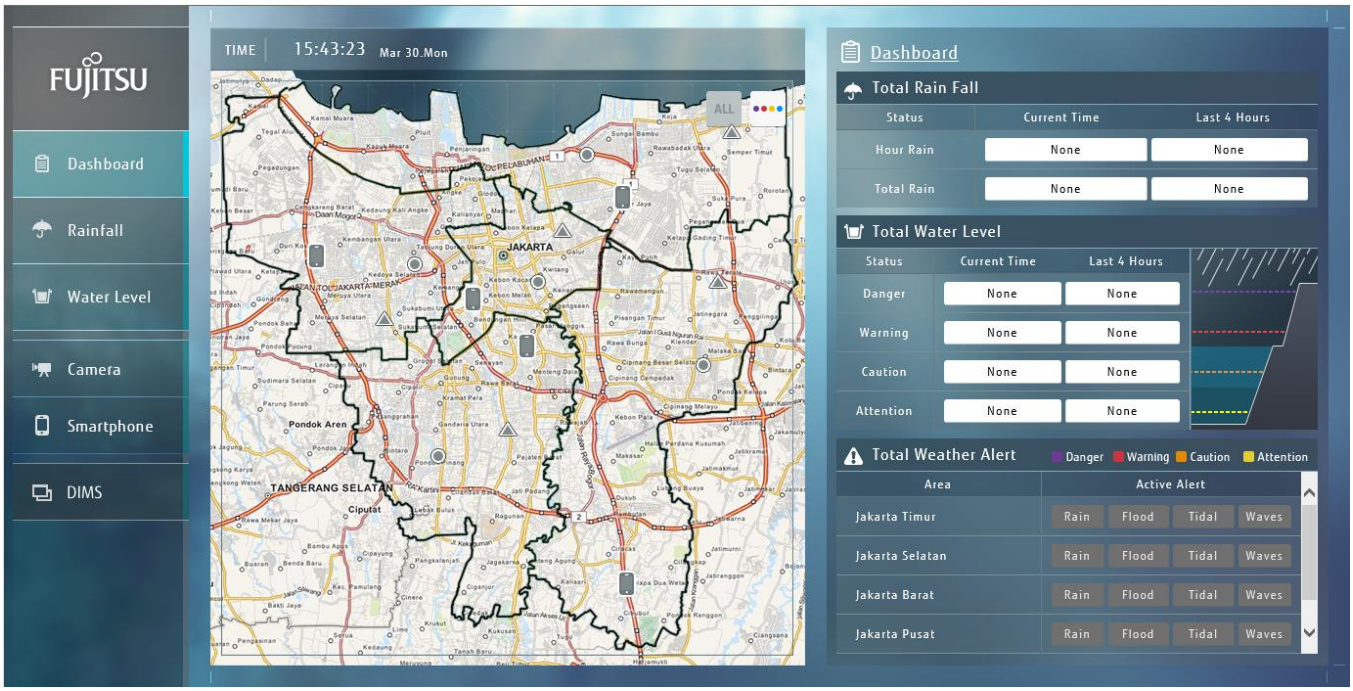



Figure 2 Monitoring Screen

operation of various gates and drainage pumps.

It is also equipped with a facility operation history, daily, monthly, and annual tabulation processes, which contribute to the release planning and future facility maintenance and management plans for reports from upper organizations.

Computed and aggregated information is stored in storage (ETERNUS series) with worldwide sales records, and reliable database middleware (Symfoware Server Postgres) for data analysis.

③ Managed Distribution

The information collected and calculated in real time is distributed to various tools as web contents as a function of administrator monitoring. For example, a monitoring PC or a large monitor. Assuming a large scope of management, integrated monitoring using digital maps such as GIS and schematic diagrams is realized by using location information of each facility as a key. Figure 2 shows the reference screen.

For large monitors, it is possible to control multi-screen display and operate multi-vision using multiple large monitors.

In addition, content for mobile tools such as smart phones will also be distributed for on-site checks and monitoring at home.

The key to delivery is user management. In order to realize the delivery according to requests such as business level and authority, the delivery restriction function is based on the requirements definition design in cooperation with the customer. This restriction also enables the distribution of web content to various disaster-related organizations.

④ Remote control

First of all, large facilities such as dams and weirs can be controlled by opening and closing the gates from the nearest control office. This is achieved by the operation together with the opening information and the gate state information which can be monitored in real time in the collection process.

Remote control of a wide range of river management facilities will be realized from the command center, which will conduct centralized management. For example, the water gate is fully open and fully closed. This includes loudspeaker broadcasting and rotating light operation for the purpose of alerting neighbors during operation.

Both are based on screens that are easy to understand from the operation panel or PC.

Figure 3 shows the reference screen for gate operation.


**Figure 3 Gate Operation Screen**

⑤ Provision

In addition to delivering web content for administrators, it can also provide information to a variety of mobile tools for the general public. In addition to providing online content for smartphones, the service is also combined with an e-mail distribution function. When the water level and rainfall information required by users exceeds a certain threshold, the latest information is sent by e-mail to support alerts from disaster-related organizations.

Security is the key to success. By

deploying firewalls, we can provide a proven response in line with your security policy, from network design such as DMZ, barrier segment, and basic line such as proxy, DNS, and virus protection to detection and protection systems such as IDS/IPS against cyber-attacks.

2） Characteristics

When large-scale natural disasters such as storms and floods occur frequently in recent years, we believe it is necessary to establish a system that makes the situation at the site more easily understood and informs the general public. As a ICT supporting this system, we have introduced an outline of the system based on numerical data from sensors such as river water level and rainfall. However, in view of the current social situation, such as the declining birthrate and aging population, and globalization, live video from the workplace is again important as information that can be more easily understood.

In particular, it is helpful to see videos with high definition and real-time capabilities that make it easier to understand the situation on the ground.

For many years, we, Fujitsu, have been providing the system for distributing high-definition live HD video from CCTV cameras to wide-area networks based on IP encoding/decoding technology to the Ministry of Land, Infrastructure, Transport and Tourism and local disaster prevention organizations.

The features of this system are introduced below.

① Real-time IP video delivery

Many CCTV cameras have been installed in Japan for the purpose of monitoring the status of river management facilities and monitoring important points for river disaster prevention. The live video is IP encoded in H. 264 (Transmission speeds of 4 Mbps to 6 Mbps) so that the status can be grasped anytime and anywhere in the Ministry of Land, Infrastructure, Transport and Tourism, and decoded for display on a PC on the IP network or a large monitor in the disaster prevention office. However, even Giga-based IP networks will fail if a large number of CCTV cameras are accessed by a large, unspecified number of people.

Therefore, multicast delivery technology is essential. This is achieved by controlling the stream sent from the encoder in response to the delivery request from the server and the layer3SW deployed on the intermediate network by the common protocol IGMP. For an overview, refer to flow diagram (Figure 4) below.

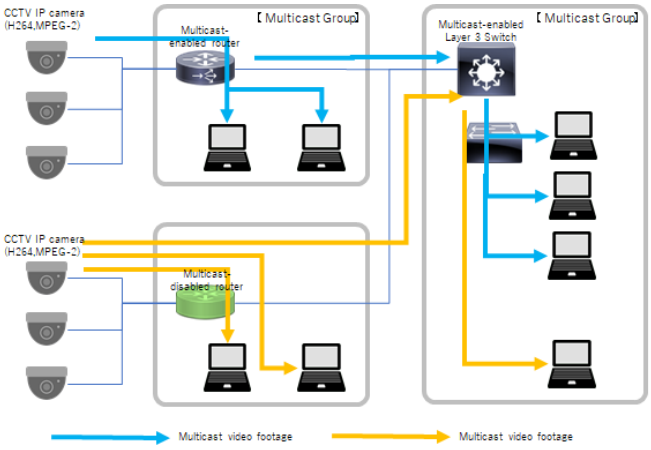



**Figure 4 Video Distribution Flow Diagram**

It also features centralized metadata management for CCTV cameras. For example, key codes such as camera ID are standardized with management information such as camera name, coordinate information and address.

This makes it easier to associate live images with real-time sensor information in the vicinity and makes it easier to understand field information and distribute it as web content.

The reference screen is shown in Figure 5.

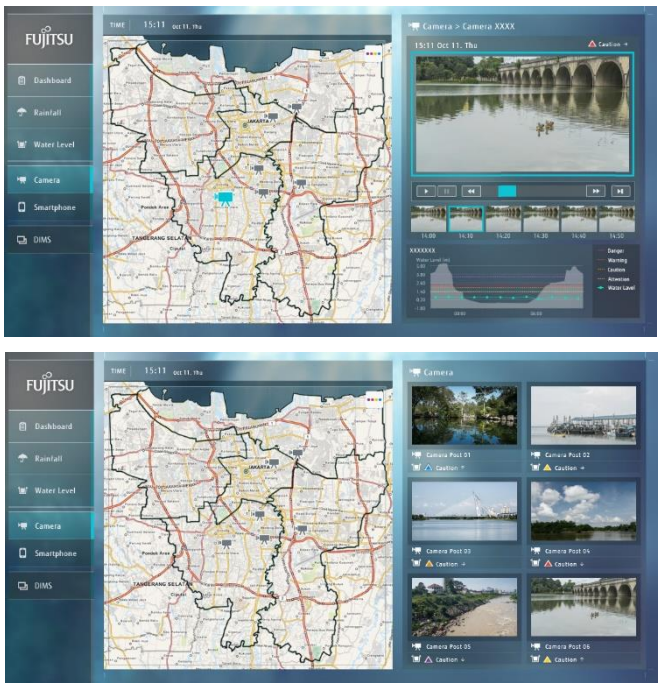



**Figure 5 Live video + Data display screen**

It contributes to the effective countermeasure planning in disaster prevention related organizations such as Ministry of Land, Infrastructure, Transport and Tourism.

② Early Warning in conjunction with media

The features of the intranet are introduced in the previous section. This section describes the features of a wider extranet.

In considering a system that can be communicated quickly and easily to the general public in the event of a disaster, we need to consider what we, the general public, use to get information.

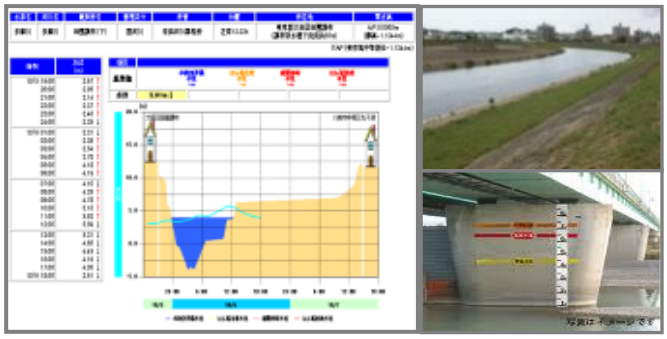
It depends on the age and subject, but I think TV broadcasting is the mainstream to get information first.

In Japan, the specification of L alert has been established as an interface for passing disaster prevention related information such as real-time sensor information and on-site CCTV video (still image) among disaster prevention organizations of the national and local governments and media organizations including broadcasting stations.

Fujitsu has also introduced an interface-based information distribution system Early Warning in the future.

In addition, we provided the effectiveness of live video and developed a product that extends multicast delivery to local broadcasting stations, connecting the Ministry of Land, Infrastructure, Transport and Tourism and media. It is not rare to watch live videos that are managed by the Ministry of Land, Infrastructure, Transport and Tourism as part of digital broadcasting. And not only live video, but also content transmission mashed up with real-time sensor information IPch can be built as a system.

Figure 6 shows the reference screen.



From "Disaster prevention information on river"
(http://www.river.go.jp/)

**Figure 6 IPch display screen**

## 3. Introduction of initiatives unique activities to overseas

Based on the river disaster prevention system in Japan introduced above, we are proposing similar system with the assistance of JICA to disaster prevention organizations in ASEAN countries such as Indonesia, Thailand, Vietnam, the Philippines, and Myanmar.

There are some countries where it is in operation, but the number of river management facilities and river observation stations is small in all countries, and we have

grasped the actual conditions required from the development of facilities for integrated monitoring and the preparation of disaster prevention plans which are common in disaster prevention organizations in Japan. In addition, since many local people and communities have visually confirmed the river water level status in ASEAN countries, we are proposing solutions to support the current work.

The solution name is Human Sensor System. A field survey revealed that smartphones are more widespread in ASEAN countries than expected. We developed an application for measuring water level and rainfall for the smartphone and software that collects data on Fujitsu's cloud for data monitoring and displays it in an integrated dashboard

Before installing real-time sensors for water level and rainfall data, it is helpful that the application is installed on the smartphones of local disaster prevention staff and community members, and the water level is input through the application when they check the water level on their eyes. At the same time, they can take a photo and send measurements and image data of photos to cloud monitoring software via carrier line. The system can show GIS-based dashboards and graphs of time-series lists and transitions. Figure 7 shows the reference screen of the smartphone application.

Below are some of our overseas initiatives.

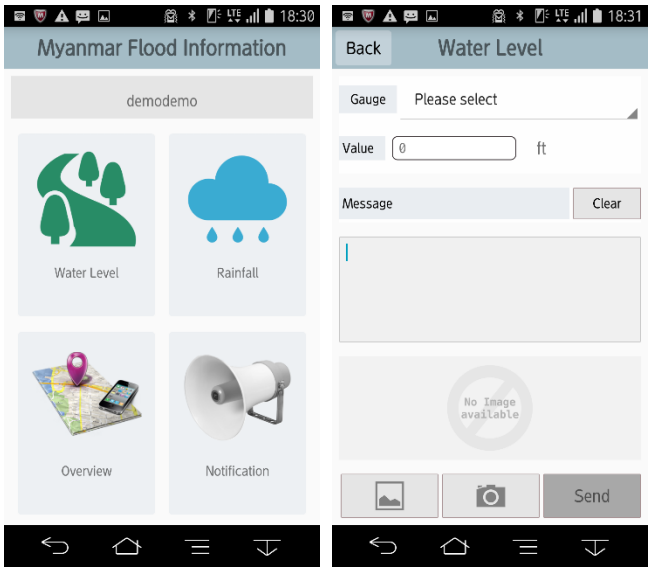



**Figure 7 Smart phone application display screen**

① Indonesia

A survey of river administrators in Manado, North Sulawesi, targeting river administrators, revealed that there were some points where water level sensors were not installed or where water level sensors had already been installed that could not be measured due to the failure of equipment at the site. In order to strengthen flood countermeasures, there was a need to increase the number of site measurement points and share information between the site and the administration. Instead of a water meter, we installed an AR marker on the site that can virtually display the water meter's memory on a smartphone app. A smartphone application and monitoring software were used to support the river water level work that local staff visually measured, arranged, and reported at regular intervals. Figure 8 shows the

working photographs of local staff.

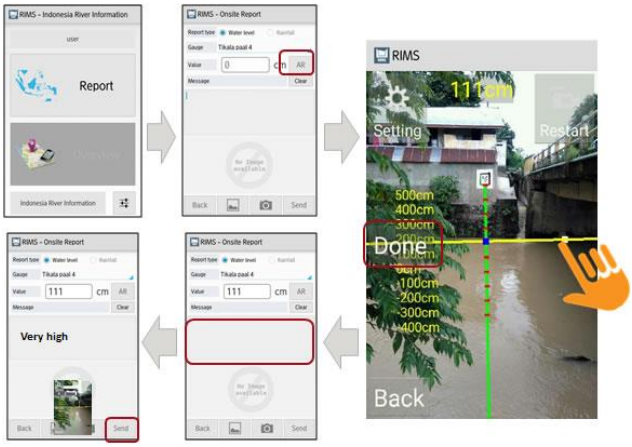



Figure 8 Indonesia Local Photo

② Thailand

In addition to the existing water level measurement points, there was a need to increase the density of measurement points along the Chao Phraya River managed by the Royal Irrigation Bureau to raise the awareness of residents about disaster prevention. As in Indonesia, AR markers are installed instead of water gauges. Prepare a mechanism to download a smartphone application for water level measurement from a server. We provided the system that determines the threshold based on the water level information measured with the participation of local residents and sends an alert to the measurer and the residents who installed the application. Figure 9 shows the ceremony at the beginning of the service at the Royal Irrigation Bureau.

In the example above, in Indonesia, interviews were conducted with river administrators to support local disaster prevention operations, and in Thailand, interviews were conducted to help raise awareness of disaster prevention among the general public.

On the other hand, there were problems in ensuring the safety of measurers in the event of heavy rain and in continuous measurements at night.

Taking the opportunity of the human sensor system, we will consider the development of a system similar to that in Japan or in the field.


Figure 9 Thai ceremony photo

## 4. Potential for furniture overseas expansion

In the previous section, we introduced our initiatives overseas activities. We understand that Japanese case studies and latest technologies are helpful in ASEAN countries. We hope to explore the potential of this technology by incorporating Fujitsu's technologies. However, we also notice the several issues. There are three main points. The first is to reduce the cost of using wireless networks to collect real-time information from the field and to secure networks for transmitting large-volume data such as video. The second point is the integrated data

management of the data managed by each area and each subject to cover a wide management area.

The third is early warning based on consolidated data.

① Securing the Network

Carriers and other wireless networks, which are essential for collecting information from the field, are subject to continuous usage fees, making it difficult to meet local budgets.

For this situation, it is necessary to investigate the available frequency band in each country. However, the latest technology, local 5G and next generation wifi is expected to evolve.

② Standardize for Data Integration Management

It is the standardization of disaster prevention related data which is managed separately by each area and management body. It is expected that efforts toward the formulation of standard specifications that have been implemented in Japan for many years will be reference for ASEAN countries.

③ Early Warning

It is expected that the forecast information will be provided to the general public by utilizing the real-time information, in addition to the pre-alarm announcement based on the threshold judgment of the real-time information. It is expected that flood prediction based on standardized data and water level prediction data by AI will be provided as early warning.

## 5. In conclusion

As described in this article, Fujitsu have been engaged in supporting the operation of social infrastructure through ICT. From now on, we will transform ICT company to Digital Transformation (DX) company for the future. We believe that we will be able to achieve the expansion to provide our system to overseas through listening to the opinions of local customers and start working toward solving various issues.DX will start with activities that work together with such customers. In particular, in the area of disaster risk reduction, we are aware that disaster risk reduction organizations around the world are at the stage of taking concrete measures, bearing in mind the international guidelines on disaster risk reduction called "Disaster risk assessment based on scientific data - Disaster risk identification - Disaster risk reduction planning" which were proposed in the Sendai Framework for Disaster Risk Reduction adopted in 2015. We are also aware of the specific measures, disaster prevention plans, and operation rules of each country, rather than technology leading, and we will work together to develop practical measures suited to the local conditions.

At the end of the article, I would like to express my deepest gratitude for this opportunity.

【CONTACT】
FUJITSU LIMITED
New Social Network Business Promotion Department
Social Network Business Division
Social System Business Unit
Director Toshimasa Morinishi (Mr)
MAIL: morinishi.toshi@fujitsu.com
TEL: +81-3-6252-2534
HP: https://www.fujitsu.com/global/