Chapter 10 Utilizing ICT and Promoting Technology Research and Development

Section 1 Promoting Innovation in the Fields of Land, Infrastructure, Transport, and Tourism Through the Use of ICT

Information technology initiatives in the fields of land, infrastructure, transport and tourism within the Declaration to be the World's Most Advanced IT Nation—Basic Plan for the Advancement of Public and Private Sector Data Utilization (endorsed on May 30, 2017) are being promoted in coordination with the IT Strategic Headquarters (Strategic Headquarters for the Promotion of an Advanced Information and Telecommunications Network Society) as headed by the Prime Minister.

1 Promoting ITS

Intelligent Transport Systems (ITS), a system created through the integration of people, roads, and vehicles using the latest Information and Communications Technology (ICT), enables advanced road use, the safety of drivers and pedestrians, the dramatic improvement of transport efficiency and comfort, solves various social problems such as traffic accidents and congestion, environmental and energy problems, and is leading to the creation of new markets in the related fields of the automotive industry, information technology industry, and others.

We are also proactively promoting initiatives pertaining to the collection and distribution of road traffic information which will work effectively for safety enhancement, congestion mitigation, and disaster preparedness in accordance with our aim to realize the world's safest, environmentally friendly, economical road traffic society based on our Declaration to be the World's Most Advanced IT Nation—Basic Plan for the Advancement of Public and Private Sector Data Utilization, which was endorsed by the Cabinet in May 2017, and on our Public-Private Partnership-Based ITS Concept and Roadmap, which was endorsed by IT Strategic Headquarters in June 2014 and revised in June 2015, May 2016, and May 2017.

(i) The spread of ITS in society and its effect

a. Promotion of ETC and its effects

Electronic Toll Collection (ETC) is now available on all national expressways, as well as most of the toll roads in Japan. The total number of new setup onboard units is roughly 58.76 million as of March 2018 and its usage rate on all national expressways is roughly 91.3% as of January 2018. Congestion at tollgates, which used to account for roughly 30% of the cause for expressway congestion, has been mostly alleviated and has contributed to reductions in CO_2 emissions and environmental burdens. Additionally, measures utilizing ETC are being implemented, such as the introduction of Smart IC dedicated to ETC interchange and discounts for ETC vehicles. In addition to such toll road uses, it is also possible to use ETC for parking payments and boarding procedures for ferries, showing the spread and diversification of services utilizing ETC.

b. Improvement of providing road traffic information and its effects

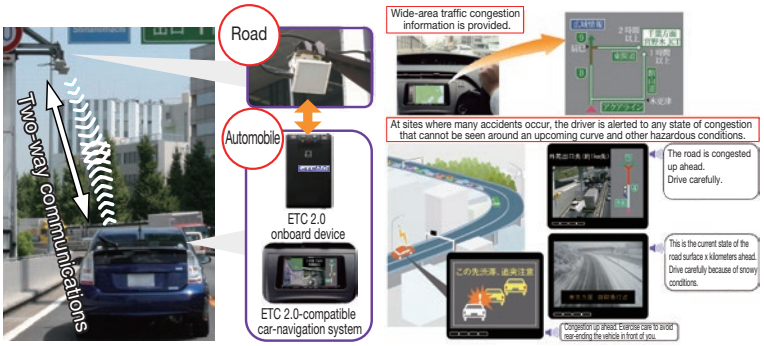
Vehicle Information and Communication System (VICS)-compatible onboard units aim to advance travel route guidance and, as of the end of December 2017, roughly 57.70 million units have been shipped. By providing road traffic information such as travel time, congestion conditions, and traffic restrictions in real-time through VICS, drivers' convenience is improved. This ultimately contributes to better mileage and reduces environmental burdens, including the reduction of CO_2 emissions.

(ii) Technological development and the popularization of new ITS services

a. Popularization and utilizing ETC 2.0

ETC 2.0 onboard units came onto the market in full force in August 2015, and as of March 2018, roughly 2.61 million units had been set up. Using ETC 2.0, we are making efforts to enhance the provision of information on support for traffic congestion prevention and for safe driving, and are advancing efforts aimed at smooth and safe traffic, utilizing about roadside ETC 2.0 units at 1,700 locations on highways across Japan. We are also promoting efforts for smart road use through pinpoint countermeasures for traffic congestion, countermeasures for traffic accidents, productive and smart logistics management, etc., by utilizing a wide variety of extremely detailed big data, including data on speed, routes used, and sudden braking.

Figure II-10-1-1 Wide-area Traffic Congestion Information is Provided by ETC 2.0.



Source) MLIT

b. Promotion of the Advanced Safety Vehicle (ASV) Project

Based on the Advanced Safety Vehicles (ASV) promotion plan, efforts are underway for the development, commercialization, and widespread adoption of Advanced Safety Vehicles (ASV) that assist drivers to drive safely using advanced technology. In FY2017, discussions were held regarding the development of practical ASV technology and other technologies, namely advanced systems that pull vehicles over to the shoulder and take other emergency measures when the driver is driving abnormally.

Figure II-10-1-2 Illustration of a Telecom Use-Type Safe Driving Support System (Advanced Safety Vehicle (ASV))

Source) MLIT

2 Realizing Autonomous Driving

The Autonomous Driving Strategic Headquarters, led by the Minister of Land, Infrastructure Transport and Tourism, discussed the ministry's policies concerning the important matters concerning autonomous driving, and released its interim report in June 2017, from the three perspectives : the development of an environment toward the realization of autonomous driving, the promotion of the development and dissemination of autonomous driving technology, and the demonstration experiments and social implementation aimed at the realization of autonomous driving.

Regarding the development of an environment toward the realization of autonomous driving, Japan has been appointed to jointly chair the Intelligent Transport System and Automatic Driving Informal Working Group (established in November 2014) and the Automatically Commanded Steering Function Informal Working Group (established in February 2015), which were established under the UN World Forum for Harmonization of Vehicle Regulations (WP.29), and is spearheading studies of international safety regulations applicable to automatic driving. Domestically as well, we began discussions about safety criteria that motor vehicles with advanced autonomous driving systems should fulfill and measures to ensure safety. In addition, we released a report (March 2018) by the Research Group On Liability For Accident Compensation

Concerning Autonomous Driving regarding the form that liability for accident compensation related to autonomous driving should take from the viewpoint of the Act on Automobile Liability Compensation (Act 97 of 1955).

Regarding the development and dissemination of autonomous driving technology, we are making efforts for dissemination and awareness raising carried out by public and private sectors in the form of the Safety Support Car (Safety Support Car S), which is equipped with functions to support safe driving, including brakes to reduce damage from impact and devices to restrict acceleration when the acceleration pedal is pushed accidentally, and efforts for the international standardization of leading-edge safety technology. We are also working toward support for autonomous driving through information provision at merge lanes of expressways and toward the enhancement of snow-removal vehicles, for which autonomous driving is being considered.

With respect to demonstration experiments and social implementation aimed at the realization of autonomous driving, in addition to starting demonstrations on public roads of transport services using autonomous driving for the "last mile," we have implemented demonstration experiments of autonomous driving services based at *Michi-no-ekis* (roadside stations) in mountainous regions in 13 locations across Japan. In addition, we have implemented demonstrations of manned convoy driving toward realizing self-driving truck convoys on the Shin-Tomei and Kita-Kanto Expressways.

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Demonstration Experiments of Autonomous-Driving Services based at Michi-no-ekis in Mountainous Areas

With the aging population in mountainous areas, it is becoming an urgent issue to provide a means of transportation for people and goods in everyday life. Meanwhile, most of the 1,134 Michi-no-ekis across Japan are in mountainous areas, and are integrating services necessary for life, including retail, clinics, and administrative counters.

To use these Michi-no-ekis as a hub to provide transportation means for people and goods, the MLIT has been implementing demonstration experiments of autonomous-driving services based at Michi-no-ekis and other places in 13 locations since FY2017. In addition, feasibility testing (theoretical consideration) is being carried out at five locations across the country, with a view toward further substantiation of business models.

The demonstration experiments included technical verification of the smooth driving of autonomous-driving vehicles when sharing roads with regular motor vehicles and of the safety of autonomous driving on snow-covered roads. In addition, the experiments tested delivery of agricultural products and processed goods from villages to Michi-no-eki with autonomous-driving vehicles which were shared by passengers and cargo, and transportation of agricultural products collected using autonomous-driving vehicles to urban areas via highway busses, which should provide an opportunity of considering a business model that is unique to the local area.

In FY2018, we are planing to focus on a long-term experiments in order to create business models, aiming at full-fledged implementation by 2020.

Road and Traffic Inspections

Smooth passage of autonomous and other vehicles

Autonomous driving during snowfall

Verification of public acceptance

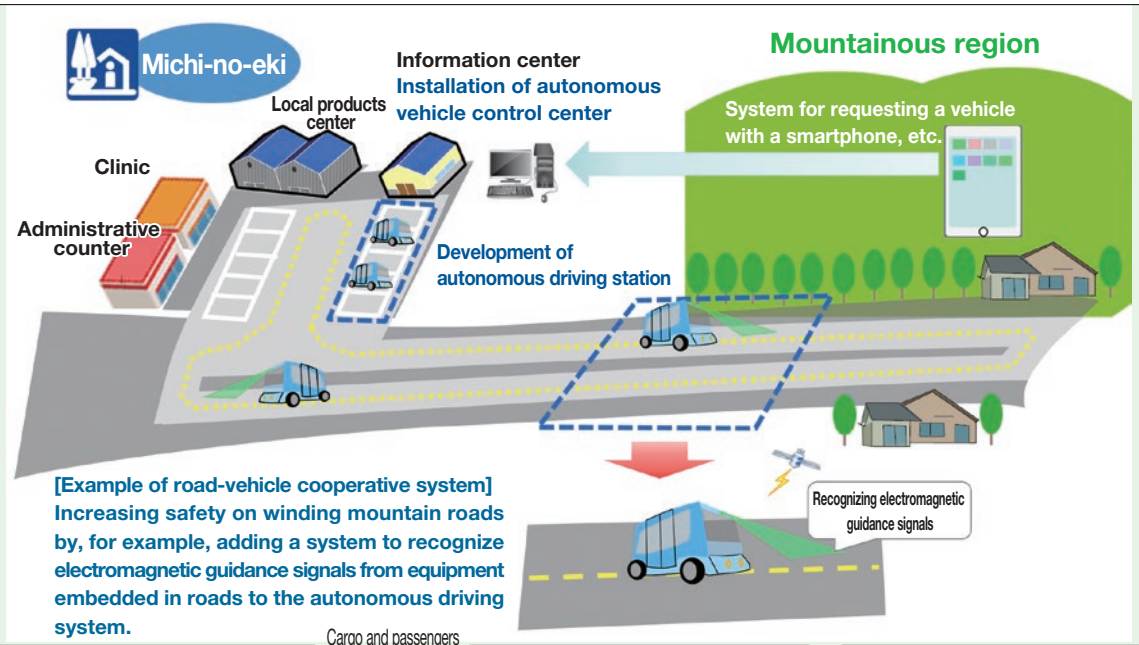
(Credibility of autonomous driving, traveling comfort, etc.)

Riding and alighting in wheelchairs

Verification of effect on regions

Delivering fresh produce from a village to a Michi-no-eki

● Social verification and implementation of autonomous driving services based at such places as Michi-no-ekis through a road-vehicle cooperative system, in mountainous areas where the population is aging in order to secure the movement of people and logistics.



Securing logistics (Home delivery, agricultural produce delivery, etc.) ⟷ Cargo and passengers riding together ⟷ Securing mobility (Shopping, hospitals, public services, etc.) | Revitalizing the region (Tourism, creation of workplaces, etc.)

Sequential trials in 13 places across the country (from September 2017)

Source) MLIT

3 Realizing a Society that Utilizes Geospatial Information in an Advanced Manner

We are promoting efforts toward advancing the use and application of geospatial information[Note1] using ICT and other technologies based on the Basic Plan for the Advancement of the Utilizing of Geospatial Information, which was adopted by a Cabinet decision in March 2017, in pursuit of the realization of a G-Spatial Society (an Advanced Geospatial Information Utilization Society) where anyone can utilize the geospatial information they need anywhere and anytime.

(1) Developing and Updating Geospatial Information as the Foundation of Society

We are coordinating with relevant administrative organizations to promote the rapid development and updating of Fundamental Geospatial Data[Note 2], which can serve as the common basis for positioning on digital maps, and the Digital Japan Basic Map[Note 3], which is a basic map of Japan that includes information required for national land management and other efforts. Various types of information regarding national land are being developed, such as aerial photographs, geographical name information, National Land Numerical Information, continuous monitoring of crustal movements with GNSS-based control stations, and preparation of guidelines for using data obtained from city planning basic surveys to Geographic Information System (GIS). In addition, a system is being constructed that enables prompt assessment and provision of information on national infrastructure, such as development of information on the topographical classification used as the basic material for developing hazard maps prepared for future disasters, and taking aerial photographs urgently during disasters.

(2) Initiatives to Promote the Utilization of Geospatial Information

We are driving forward with efforts to further promote the sharing and mutual use of geospatial information throughout society; our efforts include the promotion of distribution of geospatial information centered on G-Spatial Information Center, which collects and provides various geospatial information developed by each entity, and the improvement of GSI Maps[Note 4] that enables users to overlay various geospatial information on the web. In addition, we are promoting the development of a verification project working toward further diffusion to the general public, human resource development, and the realization of a G-Spatial Society, and we collaborated with industry, academia and government to host the Geospatial EXPO 2017 in October 2017.

Column Japan's Standard for Gravity Values Updated for the First Time in 40 years

Are you familiar with the phrase, "Water seeks its own level"? When explaining that human nature is fundamentally good, Mencius used this phrase to mean that, just as the flow of water from high to low is natural providence, so is the fact that human nature is good.

The fact that water flows from high to low is an obvious natural phenomenon, but would a drop of water that has fallen onto completely flat ground stay still? In almost all cases, the drop of water would move. This is because, even on completely flat ground, water moves due to the increase in gravity caused by the pulling force (attractive force) of heavy substances underground. (Fig. 1)

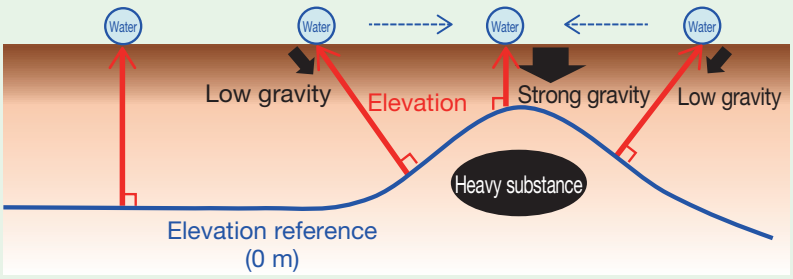
Note 1 Information that represents the position of a specific point or area in geospace (including temporal information pertaining to said information) as well as any information associated with this information. Also called G-spatial information (Geospatial Information).

Note 2 Serves as the basis for the position determined for geospatial information on the digital map such as positional information for the geodetic control points, coastlines, boundaries of public facilities, and administrative boundaries. Criteria and standards are defined by ministerial ordinances of MLIT. The Geospatial Information Authority of Japan completed the preliminary development in FY2011, and it is currently being updated along with the Digital Japan Basic Map.

Note 3 Electronically compiled maps that serve as Japan's basic maps instead of the traditional paper maps, including the 1:25,000 scale topographic maps. In addition to depicting Japan's territory appropriately, it serves as the most fundamental information of the nation's land conditions with geospatial information developed by the Geospatial Information Authority of Japan.

Note 4 Web maps operated by the Geospatial Information Authority of Japan (https://maps.gsi.go.jp/). More than 2,000 layers of geospatial information have been distributed.

Figure 1 Gravity and Water Flow



What kind of force is gravity? On the surface of the Earth, where we live, centrifugal force due to the motion of the Earth works alongside the Earth's attractive force. Gravity is the combination of the Earth's attractive force and centrifugal force. In addition, the strength of gravity depends on the time and place. (Fig. 2)

The value of gravity as measured by the Geospatial Information Authority of Japan is used in many useful ways for our lives on the Earth's surface, including (1) in deciding the elevation reference in order to understand the flow of water, (2) calibrating measurements of mass, (3) surveying active faults and prospecting for resources. (Photo)

Why is the value of gravity used in calibrating measurements of mass? The weight of an object depends on the strength of gravity. Earth's centrifugal force is lower at high latitudes, so gravity is a little stronger in Hokkaido than in Okinawa, with their different latitudes, and as a consequence an object will be heavier in Hokkaido. For example, if you were to buy 1 kg of gold in Okinawa and then measure it in Hokkaido, the scales would say it is about 1 g heavier. Therefore, to prevent confusion in the community and to ensure that any item can be measured at the same weight at any place in the world, the value of gravity in different places is used to calibrate measurements of weight. (Fig. 3)

Figure 2 Relationship Among Attractive Force, Centrifugal Force, and Gravity

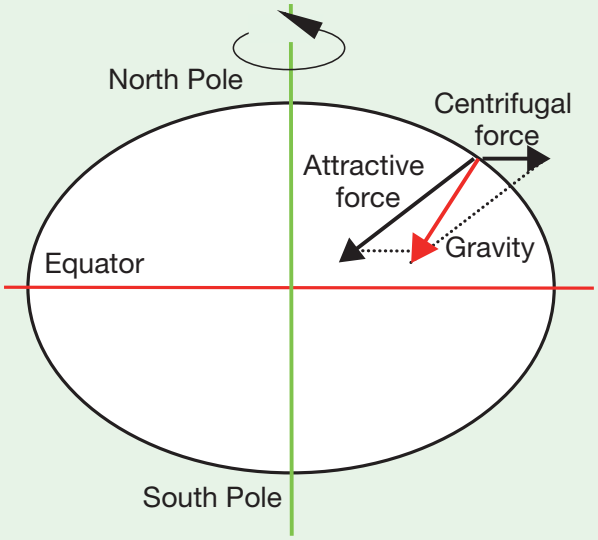


Photo Measuring Gravity

Furthermore, in places with very dense substances in the ground, like around mineral deposits, the value of gravity measured on the surface increases due to the attractive force of the substances. In places where there are breaks in the geological strata, for example around active faults, the density of each side differs, causing fluctuations in the value of gravity. As the state of subsurface structure can be understood through investigation of the distribution of the value of gravity, gravitational values are utilized in the fields of disaster prevention/reduction and in prospecting for subsurface resources, including measurements of the distribution, shape, and scale of active faults underground. (Fig. 4)

Figure 3 Strength of Gravity in Different Places

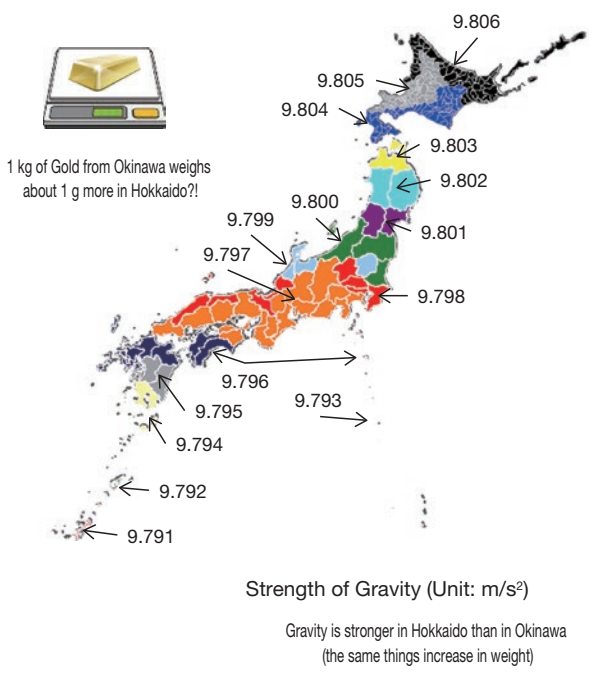
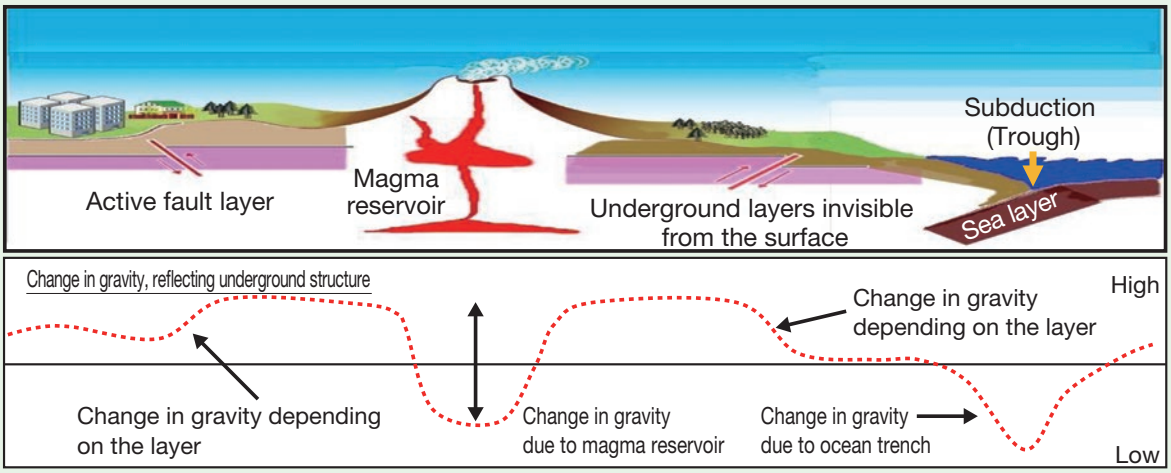


Figure 4 Relationship between Underground Structure and Strength of Gravity



The Geospatial Information Authority of Japan updated, for the first time in 40 years, the national standards for gravity values, which are used in deciding the elevation reference for understanding the flow of water, calibrating measurements of mass, surveying active faults, prospecting for resources, etc., and released Japan Gravity Standardization Net 2016 (JGSN2016). The Authority will continue its highly efficient gravity measurements using aircraft and plans to develop uniform and high-quality gravity values encompassing the whole of Japan.

Column

Toward the Creation of New Services and Industries Utilizing Geospatial Information

Although "geospatial information" may be a slightly difficult term, it comes from positional information and information associated with that. It is used all round us, for example, in car navigation information, information on the position of people or facilities, tourism information, and statistical information.

Until now, this kind of geospatial information was collected and utilized individually by the national government, local governments, companies, other entities, etc., under insufficient coordination.

Under those circumstances, the G-Spatial Information Center launched a service to gather geospatial information held by industry, academia, and government, and provide those information in a form easy for anyone to utilize in November 2016.

As the service promotes the industry-academia-government coordination of geospatial information, the creation of new industries and services utilizing geospatial information is expected.

For example, during the July 2017 torrential rains in northern Kyushu, landslides occurred and blocked roads.

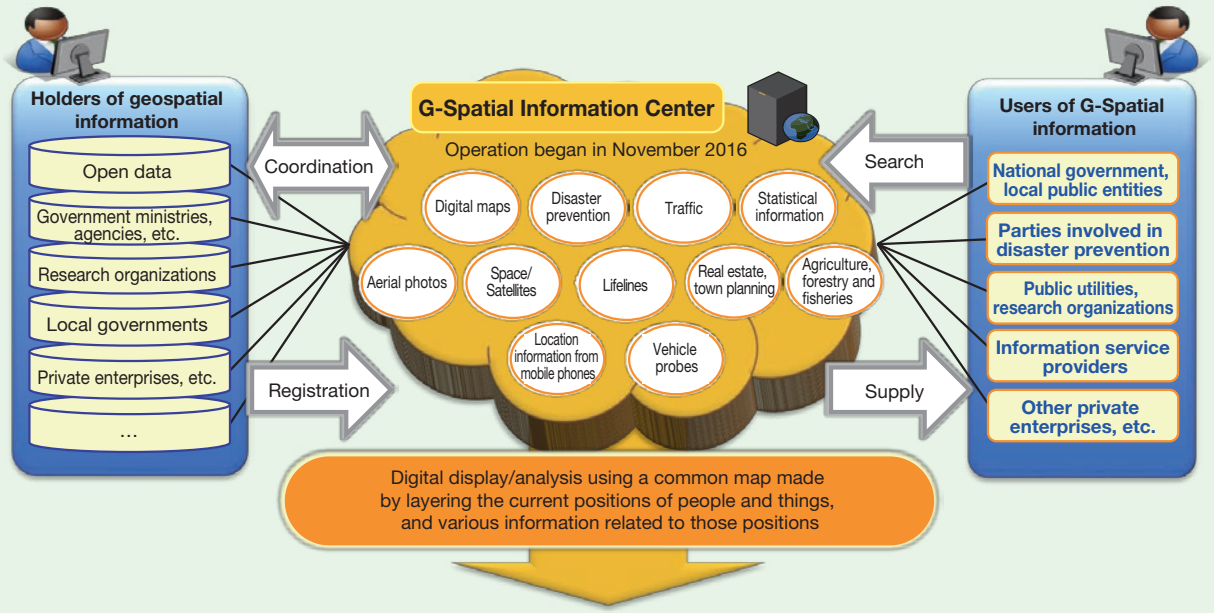
Under this situation, the G-Spatial Information Center contributed swiftly to disaster restoration by ascertaining the disaster status with aerial photos and facilitating the ascertaining of traffic routes by providing records of motor vehicle traffic.

Geospatial information is also expected to be utilized in various other ways throughout everyday life, including in town planning and tourism. A showcase of case examples is described on the G-Spatial Information Center website.*

The provision of geospatial information useful for our lives and for the creation of industries and services will continue to advance through the G-Spatial Information Center.

* https://www.geospatial.jp/gp_front/

Outline of G-Spatial Information Center



Source) National Spatial Planning and Regional Policy Bureau, MLIT

4 Realizing an Electronic Government

We are making efforts toward realizing an electronic government, based on our Declaration to be the World's Most Advanced IT Nation—Basic Plan for the Advancement of Public and Private Sector Data Utilization. As part of those efforts, with regard to digitization across the whole government—both national and regional—and other policies that have a major effect on increasing convenience for citizens and businesses, we are actively promoting efforts that the government as a whole should take, based on the Implementation Plan for Digital Government (endorsed at an e-Government ministerial meeting on January 16, 2018).

Regarding automobile ownership procedures, a "One-Stop Service (OSS)" that allows for the execution of various procedures, such as inspection, registration, automobile parking space certification, and payment of various vehicle taxes online and at the same time, is being promoted through the cooperation of various ministries. Before this year, the OSS had only been introduced for the new car registration process in 11 prefectures, but in April 2017, we dramatically expanded the target processes and regions. Specifically, nearly all processes required for continuous inspections (vehicle inspections known as "shaken"), registration of moves and other changes, and registration of used cars purchased by a new owner are now eligible for OSS, and we are committed to progressively implementing OSS to reduce the burden on prefectural governments by continuing development to integrate national and prefectural systems. In light of government policies such as the Japan Revitalization Strategy and the Declaration to be the World's Most Advanced IT Nation, we intend to continue discussions regarding matters such as measures to further improve convenience using My Number cards.

5 Development and Opening of Optical Fiber for the Management of Public Facilities and Its Housing Space

The development and opening of optical fiber for the public facilities management and its housing space is being promoted in rivers, roads, ports, and sewage, as a response to the "e-Japan Priority Policy Program." As of April 2016, the total extent of the optical fiber controlled by the government for river and road management was about 38,000 km, and of this a portion of core cable roughly 19,000 km that does not interfere with the facilities management was opened to private sector business, and applications for additional use have been received.

6 Sophisticated Water Management and Water Disaster Prevention Utilizing ICT

In light of the new developments in information technology of recent years, new technology is being applied in the field to further the sophistication of water management and water disaster prevention.

Regarding the monitoring of rivers and their basins, XRAIN (eXtended RAdar Information Network), a high-resolution, high-frequency system used to accurately and fully understand concentrated heavy rainfall and localized heavy rainfall, is being harnessed for rainfall observations. For the observation of flow amounts and water levels, the introduction and practical application of new technology, such as ADCP (Acoustic Doppler Current Profiler) and image analysis based on the utilization of CCTVs and other types of images, are being promoted. In ascertaining the extent of flooding during a disaster, we are also promoting efforts for emergency observations using a satellite-based SAR system (DAICHI-2), based on the Agreement to Cooperate in Provision of Disaster Information Using Satellites, concluded between the Ministry of Land, Infrastructure and Transport and JAXA in May 2017.

In addition, in pursuit of advancing river management and disaster response, we are promoting efforts to acquire drones equipped with green lasers that can take measurements below water surfaces and to install small, passive water gauges that do not require long-term maintenance.

Also, for sediment-related disasters caused by heavy rains and other factors, unusual conditions are always monitored through such means as a radar rain gauge that can observe the rainfall situation over a large area with a high degree of accuracy, volcano monitoring cameras, and landslide monitoring systems. Additionally, in preparation for the occurrence of a deep-seated catastrophic landslide, the measures that detect the location and scale of such an occurrence at an early stage are being promoted for rapid emergency restoration measures as well as the prevention and mitigation of damage through appropriate warnings and evacuations.

As for the sewage sector, in an effort to reduce flood damage from localized heavy rainfall and the like, we are driving

forward with the verification of technology to support the promotion of self-help and mutual aid among regional residents, and efficient operation through the optimal use of the capacity of existing facilities through the use of water levels inside pipes, rainfall, inundation and other observational data provided by sensors, radars and the like.

7 Promoting Open Data

Efforts to address open data are being actively promoted within the national government and local public entities, as part of developing environment aimed at utilizing public and private sector data as stated in the Declaration to be the World's Most Advanced IT Nation—Basic Plan for the Advancement of Public and Private Sector Data Utilization. One of those efforts is to have discussions toward making the data held by the Ministry of Land, Infrastructure and Transport open data, while ascertaining in detail the needs of private enterprises, through the Public-Private Round-tables on Open Data (an opportunity for direct discussion between enterprises in the private sector wishing to utilize data and administrative institutions that hold data), hosted by the Cabinet Secretariat from January 2018.

Under these circumstances, regarding data held by public transportation business operators, we set up the Review Meeting for Promoting Open Data in the Field of Public Transportation in March 2017, with the aim of creating opportunities to promote open data in that field. Interested parties from the public and private sectors participated and discussed relevant issues, and an interim report was released in May 2017. In light of the finding that the following three efforts should be made first, we are promoting efforts toward open data: 1) demonstration experiments through public-private sector coordination, 2) discussions about transforming operation status information (positioning information, etc.) and information that would help people with limited mobility to travel into open data, and 3) promoting open data in local regions.

8 The Use of Big Data

(1) Support for Formulation of Transportation Plans, etc., Using Big Data

Due to a declining population, a dwindling birthrate, and an aging population, the business conditions of route bus businesses, particularly in local regions, are worsening and giving rise to concerns that public transportation networks will shrink and service levels will suffer further. The stabilization of the management of route bus businesses and the restructuring of sustainable local public transportation networks are pressing issues, and management improvements by operators and plans for the reorganization of public transportation by local governments are being studied in many localities.

In light of the circumstances, in FY2017, continuing from 2016, we are providing the Local Route Bus Innovation Business Model Implementation Manual and Data Collection/Analysis Tools, which we developed as measures to support innovations by analyzing local route bus business utilizing big data and other relevant information and creating plans to restructure bus routes and schedules and improve management that we instituted based on the Survey to Support Innovations Benefiting Local Route Bus Businesses with the Use of Big Data in FY2015. In addition, we enhanced these Data Collection/Analysis Tools after implementing a trial analysis of bus business operations in model regions utilizing new big data (population flow statistics).

In FY2018, we will implement efforts toward disseminating these Data Collection/Analysis Tools.

(2) Utilization of Automobile Related Information

Based on the Vision of Future Utilization of Automobile Related Information, formulated in January 2015, demonstration experiments of methods for collecting and utilizing information when motor vehicles are serviced or when used motor vehicles are sold have been implemented. The basis for the experiments is a framework for the collection, management, and provision of historical information about motor vehicles organized so far, toward the realization of traceability services that collect and use historical information about motor vehicles. In light of the results of demonstration experiments, we will continue to advance the development of an environment for promoting the utilization of automobile-related information, in conjunction with the digitization of vehicle inspection certificates, which is being discussed from the viewpoint of making procedures related to motor vehicle ownership more efficient.

(3) Promotion of Economic Strategies for Local Roads Using IT/Big Data

In an effort to support growth and flexibility and robustly promote progress on issues involving regional economies and societies, we are promoting a new road policy that uses and applies ICT technology and big data to the fullest.

Due to the full-scale introduction of ETC 2.0 in August 2015, and the establishment of systems for collecting big data on road transportation speeds and the like, the amount of other transportation, economic and other big data and other information distributed has increased nine-fold over the past nine years. In light of these circumstances, and to resolve regional transportation issues, in December 2015, academic and government entities collaborated to establish institutes in 10 locations in Japan for researching economic strategies for local roads, and are promoting discussions about the implementation of road policies and pilot programs using a wide array of big data, including ETC 2.0, that account for issues in each region.

For example, in order to prevent traffic accidents involving rental cars driven by foreign tourists, the number of which is rapidly increasing, efforts are being implemented for pinpoint accident countermeasures, including the designation of characteristically dangerous spots for foreign tourists by utilizing data on sudden braking recorded by ETC 2.0 in rental cars departing from areas around airports used often by foreign tourists, and installing multi-language signs calling for attention and providing warnings in multi-language pamphlets.

(4) New Town Development Using Transportation-related Big Data

We are advancing the development of smart planning, which is a planning method for considering facilities distribution, formation of spaces, and transport policies through simulation of the movement of people and estimation of the effects of policy implementation based on activity data at the individual level extracted from transport-related big data.

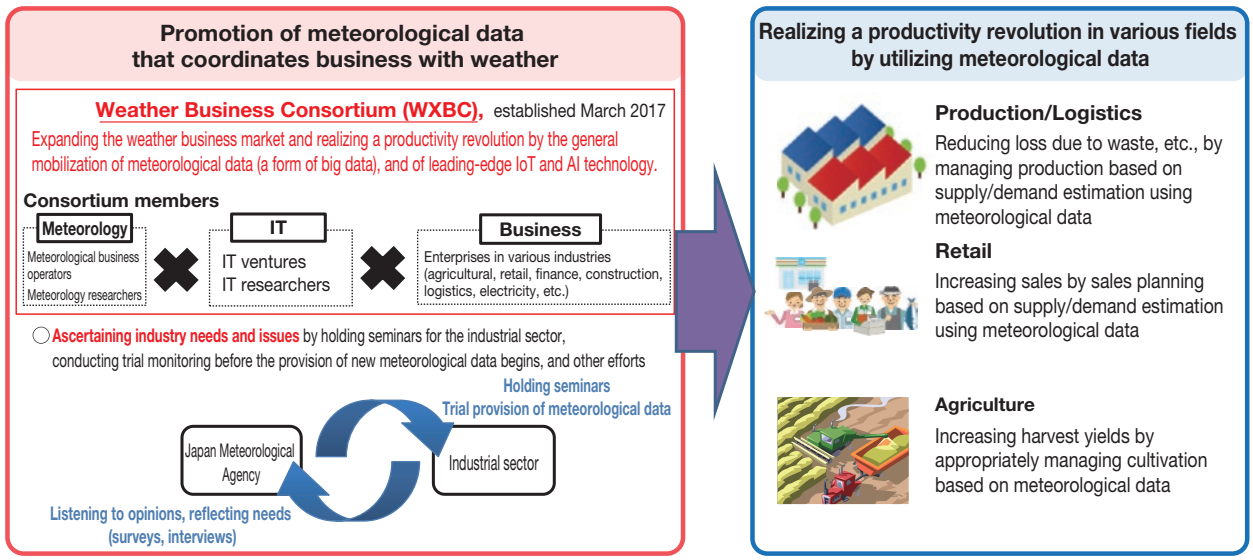
In FY2017, we endeavored to advance improvement in sophisticated systems through verification in multiple cities and enhance measures that can be evaluated and performance indicators. We are also taking efforts to disseminate analysis methods, including working with the Smart Planning Research Subcommittee, setup under the Japan Society for Civil Engineers, to host a seminar on the contents of The Guidebook for Practicing Smart Planning (tentative name), which was formulated in FY2016. The seminar attendees included academic experts, local public entities, consultants, and companies selling big data.

9 Efforts for Increasing Productivity in Business Utilizing Meteorological Data

By combining ICT technologies, in which IoT and AI have rapidly developed, with meteorological data (a form of big data), increases in work efficiency and sales, and improvements in safety are expected in a wide range of industries, including agriculture, retail, transportation, and tourism. Therefore, the Japan Meteorological Agency has been ascertaining the industrial sector's needs and related issues through the Weather Business Consortium (WXBC; established in March 2017)—an industry-academia-government collaboration—and has been promoting the utilization of meteorological data, by providing new meteorological data in response to those needs.

The specific results of these efforts include advances in the utilization of observation data from the Himawari 8 weather satellite and solar radiation estimation data. For example, a demonstration experiment of efficient harvesting of dry, high-quality pasturage made possible by the very detailed water vapor forecast is planned to be held in Hokkaido in summer FY2018.

Figure II-10-1-3 Increasing Productivity in Various Fields by Promoting Meteorological Data Utilization



Source) Japan Meteorological Agency

Section 2 Promoting Technological Research and Development

1 The Position of Technological Research and Development in Technology Policies and Comprehensive Promotion

In light of the policies of the government as a whole, including the Science and Technology Basic Plan (adapted by a Cabinet decision on January 22, 2016), MLIT developed the Fourth MLIT Technology Basic Plan in March 2017. This plan has conveyed the MLIT's policies concerning technological research and development, human resources development, and other matters to national research and development agencies, industry, and academia, etc. As a result, while endeavoring to forester common understanding and to instigate coordination among them, we have encouraged them to work as one for effective and efficient technological research and development, and have also actively adopting the resulting outcomes in public utilities and in the construction and transportation industries.

(1) Initiatives in facilities and Other Organs, Extraordinary Organs, External Bureaus, and National Research and Development Agencies

Key initiatives undertaken by facilities and other organs, extraordinary organs, external bureaus, and national research and development agencies under the jurisdiction of MLIT are as outlined in the figure. National research and development agencies selectively and efficiently conduct research according to social and administrative needs for the purpose of securing maximum results from research and development for the sound growth of our national economy through improvements in the level of science and technology in Japan and other benefits.

Figure II-10-2-1 Major Initiatives for FY2017 by Facility Organizations, Special Organizations, and External Bureaus

Organizations, etc.	Summary
Geospatial Information Authority of Japan	Operating under the auspices of the Geography and Crustal Dynamics Research Center, the Geospatial Information Authority of Japan engages in research and development activities in order to realize a society that utilizes geospatial information in an advanced manner and to contribute to disaster-prevention and environmental objectives by development of technique to monitor crustal movements in real time using real-time kinematic precise point positioning (PPP-RTK), research on aerial detection of temporal development of national land ground deformation through InSAR time series analyses, research on the realization of a vertical reference frame based on a precise gravimetric geoid, research on the analysis of crustal movements considering topology and subsurface structure, research on the development of a rapid and highly accurate GNSS routine analysis system, and research on real-time interpretation of flooding.
Policy Research Institute for Land, Infrastructure, Transport and Tourism	The Policy Research Institute for Land, Infrastructure, Transport and Tourism carries out surveys and research activities: simplified methods of surveying the present state of vacant houses; analysis on detached housing and condominiums with missing or unidentified owners; analysis of macroeconomic effects of public investment using DSGE models; methods for verifying measures for maintaining public transport in regions; sustainable tourism policies; and organizational safety management tools of transport companies.
National Institute for Land and Infrastructure Management (NILIM)	For the purpose of pursuing responses to society's needs and solutions to local issues, the National Institute for Land and Infrastructure Management (NILIM) has been promoting research for an attractive society that is safer, more secure, and more vigorous by research contributing to the following: 1) Disaster prevention and disaster mitigation, and crisis management "such as flood risk visualization project, and establish of prompt inspection and restoration methods for airport pavement when earthquake occurs; 2) " Infrastructure maintenance "such as verification in actual field of survey technology to detect abnormalities in sanitary sewer conduits for improvement of maintenance and management efficiency of sanitary sewer conduits; and 3) " Productivity revolution "such as creating draft standards for in-vehicle devices and communication necessary for the cooperative vehicle-highway ITS system through public-private sector coordination, and efforts toward application of mixed structures that combines timber structures using CLY with reinforced concrete structures.
Meteorological Research Institute	Conducted research on understanding the phenomena of weather, climate, earthquake volcanoes, and the ocean as well as predictions to contribute to "strengthening measures for typhoons and torrential rains," "strengthening measures for earthquake, volcano, and tsunami disasters," and "strengthening of measures related to climate change and global environment."
Japan Coast Guard	Conducted testing and research for equipment and materials used for Coast Guard duties, testing and research for forensic science at sea, and advancing observation technology for seafloor crustal movements.

Figure II-10-2-2 Key initiatives undertaken by national research and development agencies under the jurisdiction of MLIT in FY2017

National research and development agency	Summary
Public Works Research Institute*	Conducted research and development to contribute to the realization of a safe, secure society; the strategic maintenance and improvement of social infrastructure; and the realization of a sustainable, active society for the purpose of helping to the efficient creation of quality social infrastructure and the development of Hokkaido.
Building Research Institute*	Conducted research and development on technologies related to housing, buildings and urban planning including developing technology to ensure the structural safety of buildings to contribute to the prevention of damage and destruction due to giant earthquakes and other natural disasters; developing technology to realize the efficient use of resources and energy in harmony with the natural environment in housing, buildings and urban areas to contribute to the reduction of greenhouse gas emissions; and conducted training related to earthquake engineering.
National Traffic Safety and Environment Laboratory	Conducted test research related to the safety assurance of land transport and environment preservation, technical standards conformity assessment of automobiles, and technical evaluations related to recalls, including "Promoting the development and commercialization of next generation heavy vehicles" and "Survey on the requirement for communication between a pedestrian and a vehicle."
National Institute of Maritime, Port and Aviation Technology*	Cross-Sectoral Research Conducted cross-sectoral research and development on the issues of promoting the use of seas and strengthening global competitiveness, including research and development regarding sea floor observation and exploration, underwater construction, transportation and communications between offshore platforms and the sea floor, transportation and navigation assistance from land to offshore platforms and other next-generation technologies for surveying marine resources, and research and development regarding the improvement of the safety and maintenance efficiency of runway and other airport infrastructure in terms of enhancing the functions of metropolitan-area airports. National Maritime Research Institute Conducted research and development regarding the fundamental research and development to support assurance of safety in maritime transportation, conservation of the marine environment, marine development and maritime transportation, including research and development regarding the systematization of pioneering methods of evaluating vessel safety and more efficient safety regulations; research and development regarding innovative technology to contribute to the realization of green innovation for ships, and methods of evaluating operation performance in actual ocean zones; research and development regarding the establishment of fundamental technology and safety evaluation methods for marine renewable energy production systems; and research and development regarding technology to contribute to technical innovations in human resource development that underpin the development of maritime industries. Port and Airport Research Institute Conducted research and development regarding the reduction of and recovery from disasters in coastal areas, the formulation of stock to support industry and national life, the preservation of maritime rights and interests and the use and application of the seas, and the formulation and use of aquatic environments, including research and development regarding the reduction of and recovery from earthquake damage; research and development regarding the enhancement of port, harbor and airport functions for ensuring global competitiveness; research and development regarding the development and use of the seas through such efforts as developing ports and harbors on remote islands and securing effective marine energy; and research and development regarding the conservation and use of coastal ecosystems. Electronic Navigation Research Institute Conducted research and development that strives to improve safety in air traffic while contributing to the expansion of air-traffic capacity, the improvement of the convenience of air transportation, the improvement of the efficiency of aircraft navigation, and the reduction of the environmental impact of aircraft, including research and development on the advancement of air traffic management through trajectory-based operation; the advancement of airport operations: the optimization of air traffic through the use of onboard information; and the advancement of information sharing and communications between relevant personnel.

*National research and development agency

(2) Initiatives of Regional Development Bureaus

Technical and Engineering Offices as well as Port and Airport Technology Investigation Offices coordinate with relevant offices in their jurisdiction for tests and research of civil works material and water quality, hydraulic tests and design for the effective and efficient development of facilities, development of environmental monitoring systems, and other matters for technology development, as well as the utilization and promotion of new technology tailored to the region.

(3) Promoting Research and Development Technologies of Construction, Traffic and Transportation Fields

Of the important research issues concerning construction technology, issues that are especially urgent and involve a wide range of fields are taken up with the governmental departments taking the lead with the coordination of industry, academia and government to comprehensively and organizationally implement research for the "comprehensive technology development projects," where in FY2017, research and development was conducted for a total of five issues, including Research on Increasing Construction Productivity through Comprehensive Utilization of the ICT.

Also, for the traffic and transportation fields, technological research and development that contributes to ensuring safety, improving convenience, and protecting the environment are being promoted efficiently and effectively with the coordination of industry, academia and government. In FY2017, we engaged in the development of technology that could be used for upgrading public transportation systems utilizing high-precision positioning technology.

(4) Supporting Private Sector Technological Research and Development

To promote private sector investments in research and development, support is given through preferential tax measures for experimental and research expenses.

(5) Promoting Open-Type Research and Development

In order to promote technological innovation in the construction sector, an open call for the development of technologies to solve policy issues (targeted commercialization in two to three years) was made through the Construction Technology Research and Development Subsidy Program, which invites proposals concerning technological research and development to help upgrade and enhance the international competitiveness of construction technology under the purview of MLIT and further promote research and development carried out by MLIT. In FY2017, seventeen new issues and six ongoing issues were adopted.

In addition, in FY2017, four new projects and five ongoing projects were adopted under the Transportation Technology Development Promotion Competitive Funding Program, in which researches and developments were conducted toward the realization of a safe, secure, and comfortable transportation society, the reduction of environmental burdens, and the resolution of other policy issues in the traffic and transportation sectors. And "Traffic and Transportation Technology Forum" was held on December 13, 2017, to introduce the current state of researches and developments and present outcomes under the program, and to elicit a wide range of opinions.

2 Promoting the Utilization and Adoption of New Technology for Public Works

(1) New Technology Utilization System for Public Works

In order to actively utilize promising new technology developed by private sector businesses, a "new technology utilization system for public works" that utilizes the New Technology Information System (NETIS) is under operation. Up to now, there were 28 recommended technologies and 66 runner-up recommended technologies (in total as of the end of FY2017) chosen as innovative new technologies that will further raise the level of technology concerning public works. Also, to promote efficiency of maintenance and management in the field, for the adoption of new technology in the field and the promotion of further technological development, NETIS is leveraged to set technical themes to use and evaluate the submitted technologies in the field.

(2) Supporting the Utilization of New Technology

In order to promote the utilization of new technology in public works and other areas, utilization is evaluated at every design stage, and technology that provides great utilization benefits are designated by the ordering party when construction is contracted. In addition, we prepare technology comparison charts for every type of construction and theme to serve as references for both orderers and builders in the process of selecting new technologies.

Section 3 Improving Construction Management Technology

1 Improving Costing Technology for Public Works

For the purpose of promoting ensured quality in public works, and in order to accurately establish price estimates from the viewpoint of appropriately reflecting the mid- to long-term fostering and securing of workers and market conditions, efforts have been made to consider quantity survey standards and implement revisions when necessary.

Regarding public civil works, efforts have been made to make all construction processes fully appropriate. Such efforts include the revision of the Quantity Surveying Criteria for Civil Works Utilizing ICT, based on policies stated in the Expansion of Comprehensive ICT Utilization in i-Construction, for the purpose of promoting i-Construction, which is aimed at attractive construction sites, as well as the active implementation of works comprehensively utilizing ICT, including works for SMEs.

In addition, the overall quantity survey standards have been revised, in light of the latest status of enforcement and regional characteristics, by revising laws and design criteria and accurately reflecting labor, resource, and transaction costs in social economic trends and markets.

2 CIM and BIM Initiatives

Construction Information Modeling/Management (CIM) endeavors to seamlessly connect processes at all stages by linking and developing three-dimensional models from the survey, planning, and design stages to the construction and maintenance management stages and promoting the sharing of information among concerned parties involved in the entire project. With trial operations having begun in FY2012, along with progress made in discussions toward the introduction and promotion of CIM from the perspectives of both system and technology through industry-academia-government coordination, the Guideline to CIM Introduction (tentative name) was formulated in FY2016. The guideline contains guidelines for making CIM models, utilization methods, etc., and also addresses the role played by CIM businesses that place orders with related parties coordinating widely with public utilities, and fundamental work methods and points for consideration.

Since FY2010, the adoption of Building Information Modeling (BIM) to help visualize design content and integrate and consolidate building information has been subject to trial operations to verify the effect of the adoption of BIM and any issues that might consequently arise. In addition, Guidelines for the BIM models to Create and Use in Government Building Projects, which outline the basic principles and considerations to be taken into account when using BIM for government building projects, were compiled in March 2014. Since FY2014, a track record of cases involving BIM introduction to which the guidelines were applied has been maintained.

Section 4 Technology Development for Construction Machinery and Mechanical Equipment

(1) Development and Supply of Construction Machinery

In order to carry out the appropriate maintenance and management of rivers and roads managed by the national government and respond quickly to disaster recovery, initiatives are being carried out across the nation to implement machinery for maintenance and management, as well as machinery for disaster measures. In FY2017, an extra thirty-nine machines were added and 209 aging machines were updated.

Furthermore, in order to improve efficiency, conservation of labor, and safety of construction associated flood control projects and road development projects, studies as well as research and development for construction machinery and construction processes are being undertaken.

(2) Streamlining and Improving the Reliability of the Maintenance and Management of Machinery

For the protection of citizens' lives and properties from disasters, the construction of floodgate facilities, storage and drainage pump facilities, and road drainage facilities were furthered, starting around late 1965, and many of the facilities are becoming decrepit. As such mechanical equipment is required to function reliably during floods, we are proactively promoting the application of condition-based preventive maintenance in an effort to realize efficient, effective maintenance while ensuring the reliability of facilities.

(3) Utilizing the Accomplishments of Construction Technology Development

In order to safely and swiftly carry out restoration activity at disaster sites where the danger of secondary disasters such as large-scale floods, sediment-related disasters, and slope collapses are high, a hydraulic shovel that can be remotely controlled, dismantled, and airlifted was developed and 11 units were deployed in FY2014.

One of these was deployed to areas affected by deep-seated landslides due to Typhoon Lan in the Kuri Daira District, Totsukawa Village, and Nara Prefecture, where some erosion control units were devastated, and has been utilized in other disaster restoration activities.

Column

Enhancing On-Site Safety through the Development of Unmanned Construction Technology (i-Construction in the field of erosion prevention)

In locations hit by a landslide, there are many sites that are dangerous for people to enter. Under such circumstances, unmanned construction technology that can be controlled remotely has been developed in order to prevent subsequent disasters from occurring on urgent construction sites immediately after a landslide. As the technology particularly contributes to the enhancement of safety, which is one of the goals of i-Construction, it is being promoted for use in erosion protection. One result of this effort is the countermeasure to the large-scale slope slip that occurred in the Aso Ohashi Bridge area during the 2016 Kumamoto earthquake. By using advanced unmanned construction technology to prevent a subsequent disaster due to the slipping of the large amount of unstable earth remaining in the upper slope, the safety at the construction site was increased dramatically. "Advanced" as used here means that a remote-control room 1 km away can be used to control up to 14 items of heavy equipment at the same site at the same time without signal interference. The unmanned construction technology used this time was evaluated highly, even winning the Outstanding Civil Engineering Achievement Award granted by Japan Society of Civil Engineers.

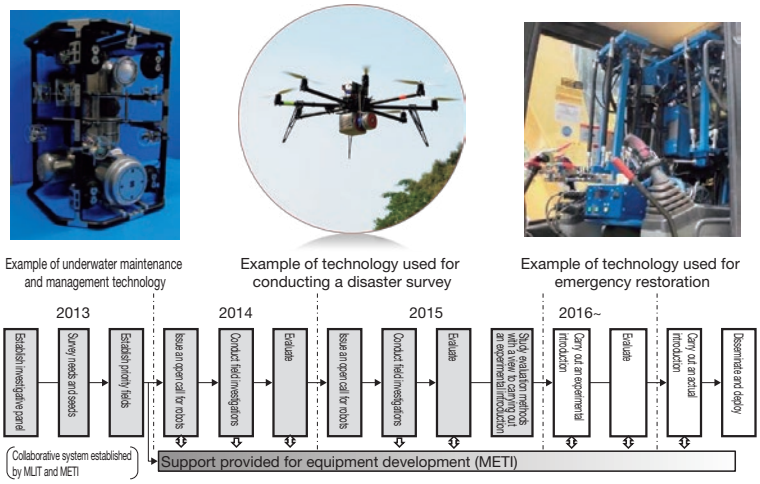
Remote control room

Unmanned operation

(4) Promotion of Development and Introduction of Next Generation Robots for Social Infrastructure

The social infrastructure of Japan is facing problems such as progression of aging, risks of earthquake, storm and flood damage. Therefore, for the "5 important fields" (Maintenance and management: Bridge, Tunnel, and Water; Disaster Response: Investigation and Emergency Restoration) that require the development and introduction of robots, initiatives are underway for the maintenance and management of the social infrastructure and improvement of effect and efficiency during disaster, by planning for the development and introduction of highly practical robots. In FY2014 and FY2015, we made a public appeal to private companies, universities and others for robots capable of addressing our five priority fields, and conducted testing and evaluations at actual sites. Over two years of on-site verifications, we confirmed which technologies have a specified level of capabilities in the maintenance and management, and since FY2016, have been verifying their practical utility by testing them in environments identical to those in which they will actually be used for inspection. In addition, since FY2017, the establishment of requirements (required performance) based on the verification of their practical utility has been facilitated.

Figure II-10-4-1 Promotion of Robot Development and Introduction for Next Generation Social Infrastructure



Source) MLIT