



Ministry of Land, Infrastructure, Transport and Tourism
National Institute for Land and Infrastructure Management

NILIM



Damage Survey of National Highway No. 249 Nakaya Tunnel
due to the 2024 Noto Peninsula Earthquake



Damage Survey of the Nanao Port
in the 2024 Noto Peninsula Earthquake



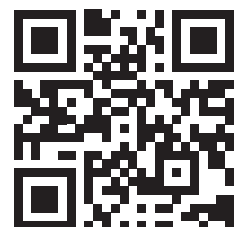
Development of smartphone apps
for the survey of "green visibility ratio"



Exchange of opinions with residents on how to improve explanatory
tools for "River Basin Disaster Resilience and Sustainability by All"

Research Institute that creates the society of the future

FY 2024



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Cover photos

- (Top left) Damage Survey of National Highway No. 249 Nakaya Tunnel due to the 2024 Noto Peninsula Earthquake (Road Structures Department)
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- (Bottom right) Exchange of opinions with residents on how to improve explanatory tools for "River Basin Disaster Resilience and Sustainability by All" (River Department)
→ Reference: P12. Research to improve national resilience and protect the life and livelihood of the people
(2. Development of an experimental site using a digital twin to drastically improve the disaster prevention capacity in a river basin)

Mission of the National Institute for Land and Infrastructure Management (NILIM)

As the only national research organization in the social infrastructure/housing field, our goal is to use technology as the driving force to create an attractive country and society that are safer, more secure, and more vigorous, both now and in the future.

■ NILIM research policy (excerpt)

Basic stance

- Participate in the policy development of the Ministry of Land, Infrastructure, Transport and Tourism as a technical specialist taking into account the administrative perspective among other aspects
- Apply the advanced and comprehensive technical capabilities cultivated through research activities to the actual fields of work.
- Connect to the creation of new policy using insight into the future image of national land/society and through the promotion of technology development.

Activities forming the basis

- Research and development that supports planning, drafting, and spreading the policy for land, infrastructure, transport, and tourism (pp. 11–20)
- Advanced technical support for response to disasters/accidents and improvement of countermeasure techniques (pp. 21–22)
- Competence in new technologies of in-house engineers on the frontline (p. 23)
- Collection, analysis, and management of data forming the technical basis of policy formation and return to society (p. 24)

Click here for the full research policy. →

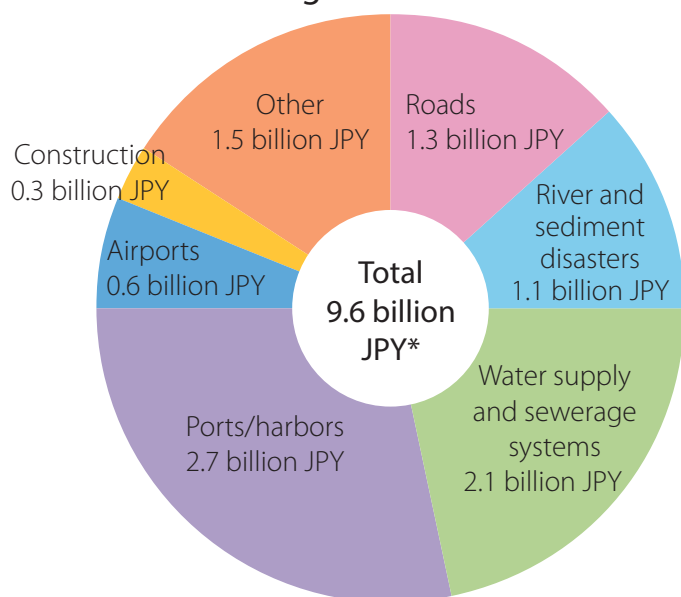


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Research budget and employees

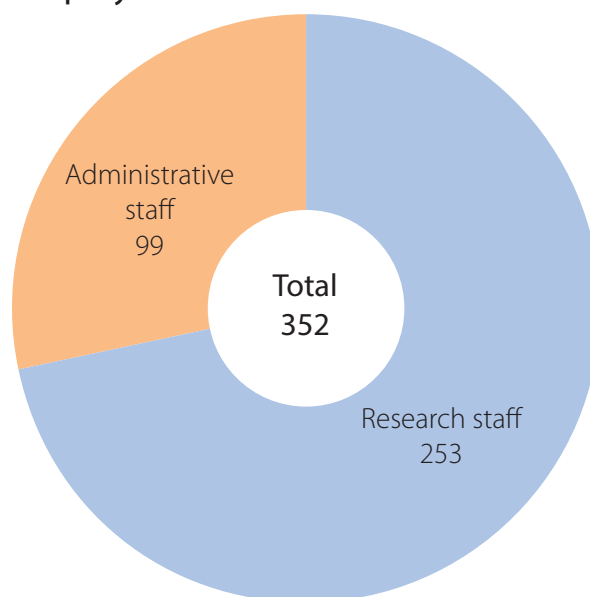
Research budget



Structure of research budget (initial budget for FY 2024)

*The total and the breakdowns do not match because no adjustment is made to the decimal places after rounding.

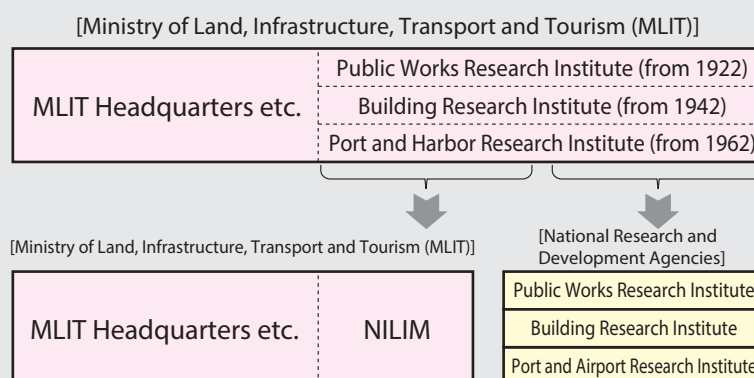
Employees



Structure of employees (as of April 2024)

Establishment of NILIM

- After the reorganization of ministries and agencies in January 2001, as part of the incorporated administrative agency system, sections that had been taking on operations that were inseparable from the Ministry of Land, Infrastructure, Transport and Tourism were merged in April 2001.



Establishment of the Water Supply System Division and the Noto Water Supply and Sewerage Reconstruction Support Division

- For the purpose of efficient implementation of the business in water supply and sewerage systems -

- In April 2024, the administration of water supply system improvement and management was transferred from the Ministry of Health, Labour and Welfare to the Ministry of Land, Infrastructure, Transport and Tourism (MLIT).
- Dealing with all issues including public-private partnerships in water supply and sewerage systems, it is necessary to promote approaches to the research and development of water supply and sewerage systems.
- The functions of disaster prevention in the water supply business also need to be enhanced by utilizing the know-how and on-site capabilities of the MLIT.
- The Water Supply and Sewerage Systems Department implements research and technological management that contribute to the planning and execution of technological policies for water supply and sewerage systems, from the wide and comprehensive viewpoints of the national research institute.
- In order to give technological advice on early reconstruction to local governments, etc. that suffered serious damage due to the Noto Peninsula Earthquake, etc. of water supply and sewerage systems, the Noto Water Supply and Sewerage Reconstruction Support Division was established at a local site (Nanao City, Ishikawa Prefecture).

Water Quality Control Department

Sewerage System Division
Wastewater and
Sludge Management Division



Water Supply and Sewerage Department

Water Supply System Division
Sewerage System Division
Wastewater and Sludge
Management Division

Noto Water Supply and Sewerage
Reconstruction Support Division



Disaster prevention and mitigation, national resilience - For increased strength and flexibility -

- In recent years, weather disasters have become more severe and frequent because of the effects of climate change.
- Infrastructure that was intensively developed during and after the period of rapid economic growth will become obsolete at the same time in the future.



Levee breakage due to heavy rain in July 2018



Damage to the seawall caused by the storm waves of Typhoon Faxai in 2019

○ Three-year emergency measures for disaster prevention, disaster mitigation, and national land reinforcement (FY 2018–2020)

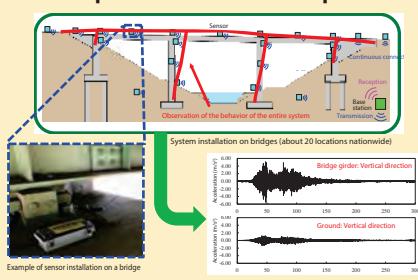
In light of the July 2018 heavy rains, the government of Japan will implement emergency measures over a three-year period, in addition to the existing measures.

[Examples of measures implemented throughout Japan]

■ Examples of measures implemented by NILIM



Construction of a Sabo dam with high capture capacity of sediment and driftwood trapping performance (Suzaka City, Nagano Prefecture)



Development of seismic monitoring systems that can identify the behavior of an entire infrastructure system during an earthquake



Construction of an experimental channel to enable the overflow experiments necessary to study the development of tenacious river levees.

○ Five-year emergency measures for disaster prevention, disaster mitigation, and national resilience (FY 2021–2025)

Further acceleration and deepening of the following areas implemented under the three-year emergency measures with focused and intensive measures

1. Measures to address increasingly severe wind and flood damage and large-scale earthquakes that can happen any time soon
2. Acceleration of measures to address aging infrastructures to shift to preventive maintenance of the infrastructures
3. Promotion of digitization etc. for efficient implementation of measures to increase national resilience

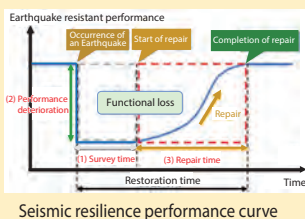


Example: Measures for river basin disaster resilience and sustainability by all

■ Examples of measures implemented by NILIM

To prepare cities to effectively deal with earthquakes

- No effective indicators are available for evaluating the post-earthquake functional use of RC
- No unified method is available for evaluating which technologies and techniques the best for damage controllability.



- To build a framework for securing post-seismic continued usability by assessing damage and reparability evaluation methods based on seismic response.

Efforts for improving the quality and efficiency of inspection

- The urgent issue is to improve the efficiency of inspections and repairs through the use of new technologies and other measures.
- Sharing information with bridge owners about the trial use of inspection support technologies on sites based on a newly developed inspection planning protocols.



Trial use of inspection support technologies on sites

Efforts to prevent and reduce the damage from earthquakes in existing urban areas by improving regional disaster preparedness

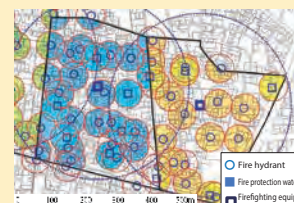
- In order to enhance regional disaster preparedness, it is necessary to elaborate soft measures by precisely gathering and sharing disaster information.

- To verify the effectiveness of new technologies (AI cameras, interconnected fire alarm systems, disaster management tools, etc.) and develop techniques for evaluating their effectiveness.



Detection of fires and other types of disasters using AI cameras

- The safety of densely built urban areas has been evaluated solely by means of hard measures such as improvement of roads and rebuilding.
- They do not consider the effectiveness of soft measures such as initial firefighting efforts by local residents.



The range of effective initial firefighting is visualized to evaluate regional disaster preparedness.

- To develop a method for evaluating disaster management performance that reflects the effectiveness of both soft and hard measures.

Disaster relief dispatches to various parts of Japan

- In the event of a disaster, the NILIM dispatches experts with advanced technical knowledge in various fields to the affected areas upon request.
- Particularly in the event of a serious disaster, TEC-FORCE* and other experts are dispatched to provide strong support to the prevention of secondary disasters and the restoration of disaster-hit areas.

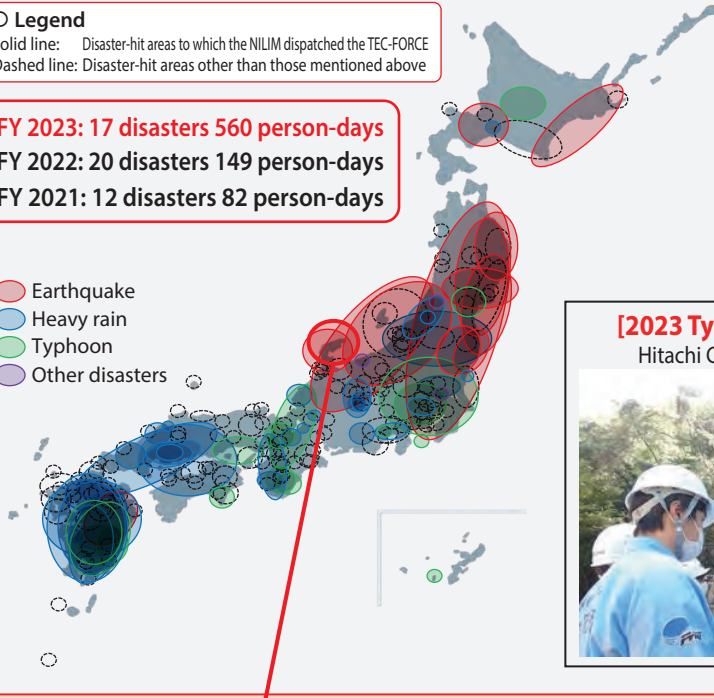
* Technical Emergency Control Force: The system to dispatch expert teams established in FY 2008 by the Ministry of Land, Infrastructure, Transport and Tourism in order to respond to extensive natural disasters by surveying disaster damage and providing local governments and other organizations in the disaster-hit areas with technical assistance.

○ Legend

Solid line: Disaster-hit areas to which the NILIM dispatched the TEC-FORCE
Dashed line: Disaster-hit areas other than those mentioned above

FY 2023: 17 disasters 560 person-days
FY 2022: 20 disasters 149 person-days
FY 2021: 12 disasters 82 person-days

- Earthquake
- Heavy rain
- Typhoon
- Other disasters



[2023 Turkey-Syria Earthquake]

Antakya, Hatay Province, Turkey

* Expert teams were dispatched in this case by the Japan International Cooperation Agency (JICA) as the Government of the Republic of Turkey requested assistance from the Government of Japan.



[2023 Typhoon Yun-yeung]

Hitachi City, Ibaraki Prefecture



[Heavy Rain That Started on June 29, 2023]

Yamato Town, Kumamoto Prefecture



[Response of the NILIM in the 2024 Noto Peninsula Earthquake]

- Upon request, the dispatching of researchers to the affected areas started immediately after the disaster happened.
- All-hands-on-deck technical support was provided by NILIM in collaboration with the Public Works Research Institute, the Building Research Institute, and the Port and Airport Research Institute.

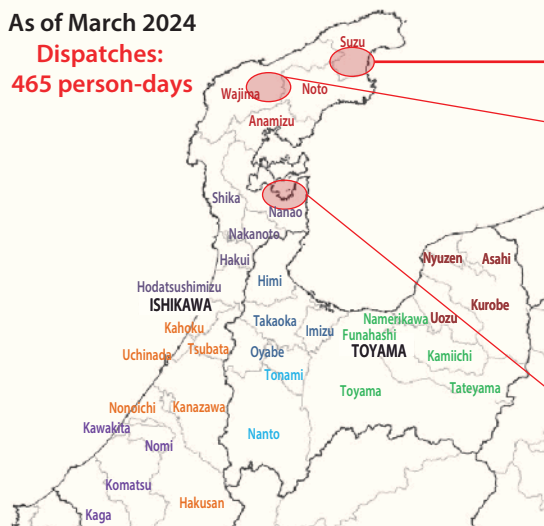
- Technical guidance on early construction of water supply and sewerage systems collaboratively was given to local governments. It was used to confirm the effects of seismic countermeasure for sewerage pipeline facilities, emergency repair methods, and others.
- In order to evaluate the risks of disasters in the lower reaches of the areas where channel blockage occurred, helicopter surveys and ground surveys were conducted, and their results were reported to the prefectural government and local governments. Technical guidance was provided on the monitoring methods, etc.
- The level of damage to the road structures was investigated and technical evaluation of the conditions was carried out. At the same time technical support was provided regarding the methods of restoration after analyzing the features of such damage.
- On-site surveys were conducted on the damage to buildings, and the results were publicized. At the same time they were reported in committee meetings where they carried out analysis of the causes of structural damage to the buildings.
- The amount of damage to ports was checked and the extent to which the ports could be used was presented. Two days after the onset of the disaster, berthing of large vessels in the ports of Nanao and Iida was realized.

Response to the damage to sewerage facilities was discussed in the on-site response headquarters.



As of March 2024

Dispatches:
465 person-days



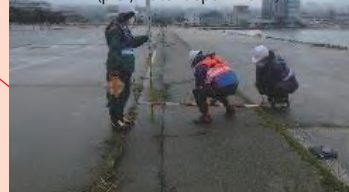
The level of inundation was investigated in an area where channel blockage had occurred (Wajima City)



Safety checks at a dam (Suzu City)



Subsidence due to damage caused by the disaster at the Yada Shin Quay, Nanao Port (pier, water depth -7.5 m)



The extent of damage to buildings (Nanao City)



Introduction to research activities aimed towards the realization of a green society

[MLIT Environmental Action Plan]

- There are concerns about natural disasters becoming more severe and frequent due to the effects of climate change.
- In an effort to realize a sustainable and resilient green society that widely encompasses a decarbonized society, a society that adapts to climate change, a nature-harmonious society, and a recycling society, effective and efficient responses need to be taken by MLIT.
- By prioritizing the "MLIT's Green Challenge" as an important project, measures such as decarbonization, adaptation to climate change, biodiversity conservation, resources recycling, etc. will be deployed. The target date is 2050 and the period until FY 2030 specified as the planning period.

■ NILIM Green Society Realization Research Promotion Group (established in July 2023)

- The "Climate Change Adaptation Research Group" and the "Environmental Research Promotion Group" have been merged and enhanced in order to expedite the realization of a green society. The merger aided the steady execution of the MLIT Environmental Action Plan.
- NILIM will implement various efforts to aid the realization of a green society that encompasses a decarbonized society, a society adapting to climate change, a nature-harmonious society, and a recycling society as put forth in the MLIT Environmental Action Plan.

Classification of measures	Research field	Homes and buildings	Urban development and infrastructure	The flow of people and goods.
Decarbonized society		Promotion of (1) (2) Measures for the sources of absorption and carbon recycling, (3) Decarbonization, (4) Energy saving, and • Renewable energy		Promotion of • Smart transportation and • Green distribution
Society adapting to climate change		Promotion of adaptation measures in the areas of • Natural disaster • Water resources and water environment and • People's life and urban life		
Nature-harmonious society			Promotion of • Green infrastructure, • Sound water circulation, (5) Sea conservation and restoration	
Recycling society		• Promotion of distribution and renovation of existing houses	(2) Promotion of high-quality construction recycling, etc.	

* (1) to (5) in the table correspond to the "Examples of measures implemented by NILIM" described below.

■ Examples of measures implemented by NILIM

(1) Promotion of the use of wood in medium- and large-scale buildings

- To increase demand for wood, which has high carbon storage effects, medium- and large-scale buildings, where the use of wood has been slow to spread, need to be constructed with more wood through the use of CLT and other wooden materials.
- Prototypes feasible for actual applications are created, and various experiments and analyses are conducted from the perspectives of structure, fire safety, durability, and sound insulation.
- Various guidelines including trial designs are formulated.



Example of a trial design of Prototype II (S + CLT wall)

(2) Promotion of the use of concrete-based new materials for construction purposes

- The development of concrete-based new materials* that contribute to the reduction of CO₂ emissions is underway in the private sector. Yet, criteria required for ministerial approval to use this material as the main structural parts of buildings have not yet been established.
- Indicators of quality and performance required to company with the Building Standards Act are examined to promote their uses in building constructions.

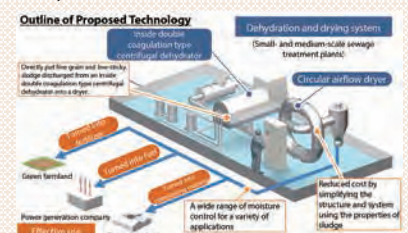
* Materials similar to ordinary concrete, an example being the zero-cement material that is under development to be used as a building material (the name is used within this project).



Example of concrete-based new material

(3) Comprehensive study of sewerage technology aimed at carbon neutrality

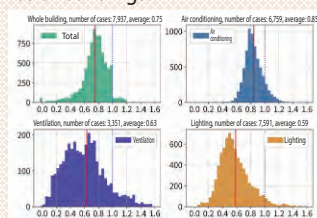
- In the Energy Management Subcommittee of the Research and Development Committee on Sewerage, the trends of research and development related to the effective utilization of energy extracted from sewage and the reduction of greenhouse gas emissions from sewerage, etc. will be organized, and technologies that should be dealt with promptly will be selected.
- In addition, tools that are helpful to the study of decarbonization by local governments and survey manual drafts will be created.



An example of the effective use of sewerage resources (technology of the B-DASH Project)

(4) Support for planning of energy conservation measures

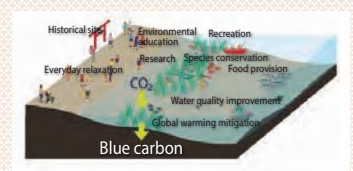
- A mandatory system of compliance with energy conservation standards is in operation under the Act on the Rational Use of Energy, which was revised to further improve the energy-saving performance of buildings.
- A large amount of energy conservation standard application data are analyzed to clarify actual energy conservation performance.
- The relationship between building design specifications and energy conservation performance is analyzed to support the formulation of energy conservation measures.



Distribution of energy conservation performance

(5) Ecosystem services of blue carbon ecosystem

- Blue carbon (BC) is attracting attention as a sink for greenhouse gases in coastal areas.
- BC ecosystems have multiple services, but their values are not properly recognized.
- A method to visualize multiple ecosystem services in coastal areas is developed.



Multiple ecosystem services of coastal areas

Infrastructure DX - Transforming society with digital technology -

[DX in the infrastructure field]

In response to rapidly changing socioeconomic situations, the following goals are to be achieved in the infrastructure sector using data and digital technology:

- to transform social capital and public services based on the needs of the people, and
- to transform the operations themselves, organizations, processes, and the culture, climate, and work style of the construction industry and the Ministry of Land, Infrastructure, Transport, and Tourism, thereby improving public understanding of infrastructure and realizing safe, secure, and prosperous lifestyles.

○ Promotion of DX in the infrastructure field

[Promotion system]

MLIT Headquarters

DX Promotion Headquarters in the infrastructure sector

- Promotion of policy on data utilization
- Establishment of implementation policy for promotion of BIM/CIM and others

Regional Development Bureaus

Human Resources Development Center

- Implementation of BIM/CIM training
- On-site demonstration of new technology and others

Collaboration

Research facilities

DX Data Center, Construction DX Experimental Field

- Centralized management and analysis of directly controlled BIM/CIM data
- Development of new technologies utilizing 3D data, 5G, etc. and others

Structure within NILIM:

DX of Infrastructure Systems Research Committee

- Promotion of research through cross-disciplinary collaborations

Collaboration among research facilities

- Cooperation agreement on DX concluded with the Public Works Research Institute (PWRI) and the Building Research Institute (BRI)



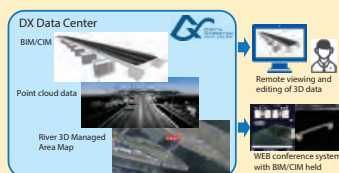
About the promotion of DX in the infrastructure field and the promotion system: created based on the "1st MLIT Infrastructure Sector DX Promotion Headquarters" material

■ Examples of measures implemented by NILIM

Building the DX Data Center

- 3D data such as BIM/CIM and point cloud data are very large, making information sharing difficult.
- Since highly functional terminal devices and expensive software are required, it is difficult for small-scale contractors to make use of the data.

- The "DX Data Center" has been built as a system for storing 3D data and for the smooth sharing of information by the entity placing the order and contractor.



Conceptual image of utilizing the DX Data Center

Achieving a higher quality in the infrastructure and national land foundation by means of DX (BRIDGE measures*)

- Toward the goal of creating "future cities" aimed at in Society 5.0, achieving a higher quality in the infrastructure and national land foundation by means of DX is indispensable.
- The "DX promotion in the infrastructure sector," reform is being promoted in the following 3 fields: "how to make infrastructure," "how to use infrastructure" and "how to utilize infrastructure."

In this policy, i.e. the "promotion of DX in the infrastructure sector," digital technologies and data will be utilized, and the sophistication of MLIT DATA PLATFORM will be implemented.

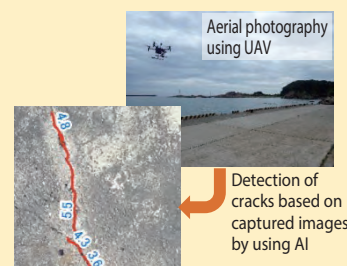


An example of data overlapping on MLIT DATA PLATFORM

Development of efficient ways to inspect port facilities using AI

- In order to respond to aging infrastructure and a shortage of workers, it is necessary to reduce labor and shorten the time required for port facility inspections.

- Development of efficient ways to acquire data for port facility inspections
- Development of a system to detect cracks and/or other deformations from acquired data by using AI



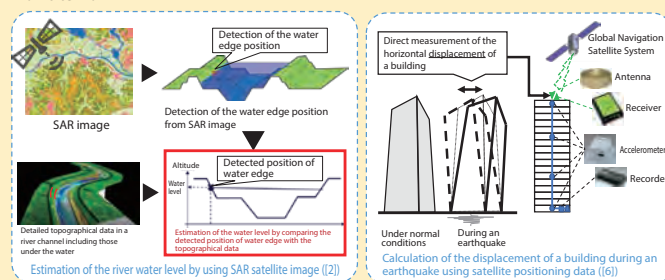
An example of crack detection

Social implementation of remote sensing technologies utilizing satellites, etc. (BRIDGE measures*)

- At the time a disaster occurs, it is necessary to make a quick assessment of the situation and to take swift emergency action to open and restore roads as well as to take emergency measures to restore rivers and seacoast levees, while at the same time preventing the expansion of additional damage.
- Utilization of remote sensing technologies such as satellites

Implementation of research and development to enable the achievement of the following 3 goals

1. Development of techniques for grasping the overall condition of damage caused (to infrastructure, urban areas, and buildings)
2. Development of adaptation technologies to small SAR satellite constellations, etc.
3. "Technical standards" and "Reflection on standard specifications" that are directly linked with on-site work



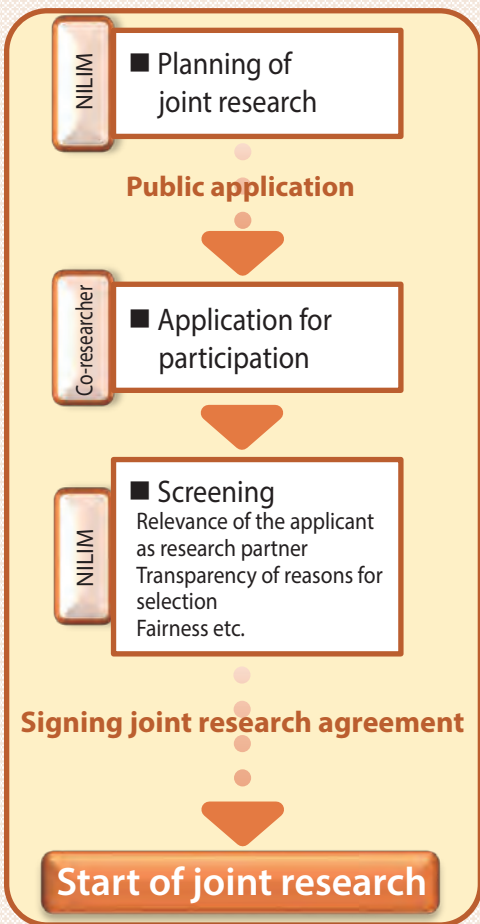
An example of the research results and the current situation achieved.

*BRIDGE measures: Measures being implemented in the "programs for bridging the gap between R&D and Society 5.0" in the Cabinet Office

Utilization of the joint research program - For the industry-academia-government collaboration -

The NILIM is conducting joint research on common issues where collaboration with other organizations is expected to produce better results more efficiently.

■ Flow to the start of joint research



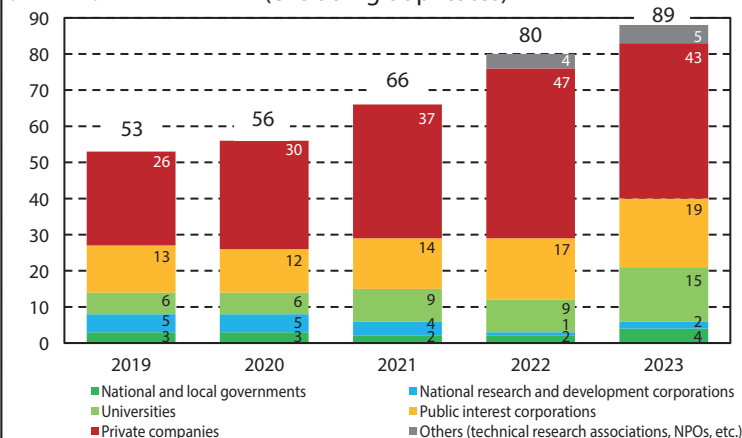
■ Results in recent years

- The NILIM has been conducting joint research in collaboration with various institutions, including the national and local governments, national research and development corporations, universities, and public interest corporations.
- The NILIM is collaborating and conducting joint research with more than 50 institutions every year.

Number of joint research projects conducted in the last five years.

	2019	2020	2021	2022	2023
New	7	3	3	9	6
Continuation	13	17	16	7	9
Total number	20	20	19	16	15

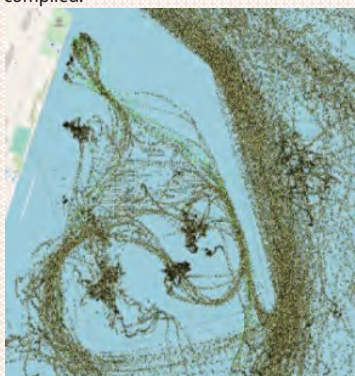
Number of collaborating institutions in the last five years
(excluding duplicates)



■ Examples of research

Joint research on optimizing the operation, including carbon neutrality, of work vessels in offshore civil engineering work

[Collaborating institution] Specialists Center of Port and Airport Engineering
[Research period] April 2023 to March 2026 (**in progress**)
[Outline of the research]
Characteristics of the movement of work vessels that emit large amounts of CO₂ emissions in offshore construction work are analyzed using AIS data to study efficient ways to operate the vessels. Efficient ways to operate work vessels and ways to improve the tracking ability of their movements will be compiled.



Example of work vessel movement (AIS data)

Joint research on performance evaluation of exterior wall ventilation methods for wooden buildings

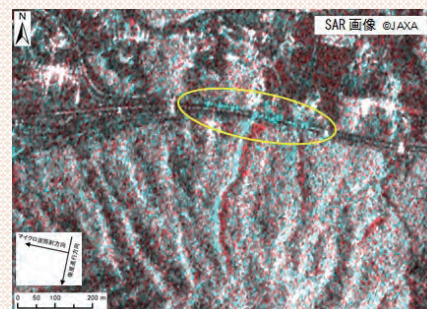
[Collaborating institution] Institute of Technologists and 11 others
[Research period] March 2022 to March 2025 (**in progress**)
[Outline of the research]
Increased use of wooden buildings and ensuring their long-term durability are positioned as important issues in achieving carbon neutrality goals. In this joint research, outdoor exposure tests of actual buildings (experimental house) are conducted to study performance evaluations of exterior wall ventilation methods of wooden buildings in regard to their long-term durability.



Experimental house

Joint research on the development of sediment disaster monitoring method using the Daichi-2 satellite

[Collaborating institution] Japan Aerospace Exploration Agency (JAXA)
[Research period] July 2017 to March 2022
[Outline of the research]
Sediment disaster management requires technologies that can quickly identify the location and extent of a disaster in order to sophisticate initial responses after the onset of a disaster. In this joint research, a method to acquire such information using synthetic aperture radar images acquired by the satellite *Daichi-2* in an emergency.

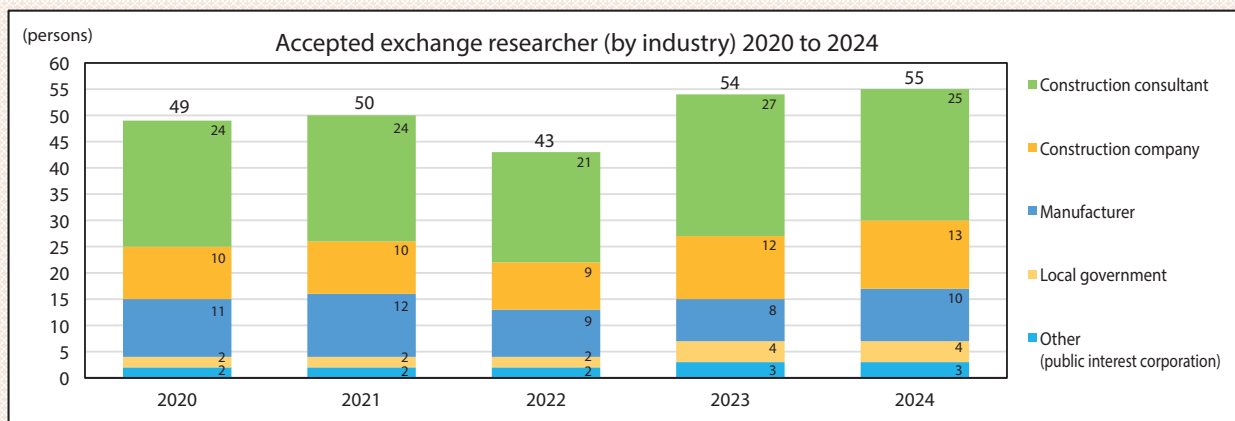


Sediment and driftwood generated by a mountainside collapse accumulate on the road.

Introduction of researcher exchange program

- The NILIM is conducting [the researcher exchange program] to accept experts from outside organizations such as local governments and private companies as NILIM researchers.
- They can gain knowledge and experience in planning and drafting policies and technical standards related to housing and social infrastructure development under the guidance of the head of the research office and senior researchers of the NILIM.

Accepted experts



Comments from the alumni of the researcher exchange program



Takashi Kusunoki
Enrollment period: 2022 - 2023
Home organization: Obayashi Corporation
Assigned section: Research Center for Infrastructure Management (at that time)

I was engaged in research at the Research Center for Infrastructure Management for 2 years from FY 2022 where I conducted investigation and analysis, by focusing on the contractual systems of Japan and other countries such as the United States and Great Britain. I compared the positive points of each system as well as their differences.

At NILIM there are various researchers who gained experience in Industry, Government and Academia. Through a process of repeated discussions in a wide variety of subjects such as collaborations between design and construction, improvement in productivity, and work style reform, we were able to provide better infrastructure. It was a valuable experience to be involved in a wide variety of discussions and help revise the guidelines. In addition, it has become a great asset for my future as I was able to improve my abilities through friendly competition and deepen exchanges with people who had no direct contact with me in research activities. It afforded me the opportunity to learn by taking part in study meetings and experimental facility observation meetings, in fields other than my field of expertise.

In the home organization, I hope I will be able to work actively as an engineer who can engage in many types of problem solving and make use of a wide range of knowledge and viewpoints in which things are observed by having a bird's-eye view that I have acquired at NILIM.



Hironori Togawa
Enrollment period: 2023 -
Home organization: Kyoto City Water Supply and Sewerage Bureau
Assigned section: Water Supply and Sewerage Systems Department

I am conducting research on technologies to achieve carbon neutral in wastewater treatment and sludge treatment. In the sewerage sector, greenhouse gas emissions reduction is required, and at the same time contribution to sustainable recycling-oriented

society is expected. Both are achieved by the effective utilization of wastewater and wastewater sludge such as conversion into renewable energy or into resources. At the Wastewater and Sludge Management Division, research concerning greenhouse gas emissions reduction, research and development of new technologies is being carried out. Also, empirical research on their commercialization, and others are implemented. I am studying planning and evaluation techniques while introducing technologies to achieve carbon neutrality. In one of those projects, I have conducted an investigation into the actual conditions of the occurrence of N2O from the wastewater treatment process. This is one of the global warming gases, and I plan to present the results of that research in a paper. Also, through meetings with experts and the on-site observation of new technologies, I exchanged opinions with people from a wide variety of fields and was able to obtain a variety of viewpoints for addressing social problems beyond the borders of specific industries. This has been a great learning experience for me that I will be able to integrate into the work at my home organization.

Shintaro Mashiko
Enrollment period: 2022 - 2023
Home organization: Dia Nippon Engineering Consultants Co., Ltd.
Assigned section: Urban Planning Department (at that time)

I conducted research on technologies to improve the mobility environment focusing on "improving traffic services" within the greater framework of "developing technologies to revitalize suburban residential areas."

In the suburbs, the aging of the population and the decline in the level of service provided by the existing public transportation system have made it problematic for many residents to get around on a daily basis. I thus conducted a social experiment using Green Slow Mobility, a new type of mobility, to collect and analyze the data from vehicles actually driving on residential roads with passengers on board. Based on the data I collected, I clarified how the new type of mobility should be used according to regional characteristics, organized ideas into a paper, and submitted it to academic societies. This was a very difficult task for me because I had no such opportunity back at my company. However, I was relieved when I received the Excellence Award as a tangible achievement. I also gained the know-how of how to build consensus with relevant organizations and how to work on social implementation processes through the valuable experience from the standpoint of a client.



Kanta Okamoto
Enrollment period: 2021-2022
Home organization: Alpha Hydraulic Engineering Consultants Co., Ltd.
Assigned section: Coastal, Marine and Disaster Prevention Department (at that time)

I was assigned to Coastal Disaster Prevention Division, Coastal, Marine and Disaster Prevention Department of the NILIM (Yokosuka Office) as an exchange researcher in April 2021.

The assignment I was working on at that time was the study of design method of port facilities based on future storm surge and wave forecasts in relation to climate change adaptation measures at ports and harbors. It was a golden opportunity for me to experience the responsibility that my study results might be used to review design standards, which I had been on the user side, and the sense of accomplishment when it was realized. Also, although it was during the COVID-19 pandemic, I was able to interact with many people at the NILIM, Port and Airport Research Institute, and university faculties mainly through my work. When I return to my company, I would like to apply the knowledge and experience I gained at the NILIM to actual operations by using various approaches to address issues that I can find thanks to my experience at the NILIM.





Research and development that supports the planning, drafting, and spreading of the policy for land, infrastructure, transport, and tourism

Main research themes of the NILIM in FY 2024

1. Research to improve national resilience and protect the life and livelihood of the people ... 12 – 14

P.12 Efforts to **provide stable water supply and sewerage services**

P.12 **Development of an experimental site using a digital twin** to drastically improve the disaster prevention capacity in a river basin

P.12 Improvement of the quality of **dam maintenance management through AI analysis** of measured data

P.13 **Protecting lives** against sediment-related disasters by finding places that are even slightly safer

P.13 Efforts to **evaluate the risks of damage to road bridges when flooded**

P.13 Efforts to improve the quality of **road management through the use of new technologies**

P.14 Efforts to broaden participation and **include people who have difficulty evacuating** by improving evacuation safety during a fire

P.14 Efforts toward **the efficient improvement of port facilities against climate change**

P.14 Efforts to **improve efficiency and sophistication of airport pavement inspection operations**

2. Research to increase the productivity and growth potential of society ... 15 – 17

P.15 Production of innovation by developing **MLIT DATA PLATFORM**

P.15 **Improvement of productivity and work style reform at construction sites** through the use of ICT

P.16 Initiatives for the implementation of **automated driving trucks** on expressways

P.16 **Sophistication and improvement of the efficiency of road traffic data acquisition** using AI

P.17 Integrating visible greenery into **urban development to accelerate GX**

P.17 Efforts to **plan and propose port policies** that reflect future changes in the market

P.17 Improvement of productivity in the port sector through **the use of ICT and BIM for infrastructure**

3. Research to support comfortable and secure living ... 18 – 20

P.18 Efforts to **reduce greenhouse gas emissions** from the sewerage system

P.18 Study for **coastal ecosystem restoration**

P.19 Improvement of comfort through **proper maintenance and management of roadside plantings**

P.19 Promotion of **effective measures to deal with vacant houses** by using structural performance evaluation technologies

P.20 Efforts to **ensure the safety and reliability of living**

P.20 Initiatives **to make cities smarter** with digital technology

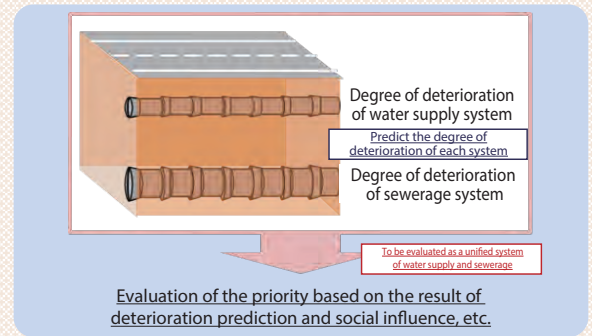
1. Research to improve national resilience and protect the life and livelihood of the people

1 Efforts to **provide stable water supply and sewerage services**

Deterioration-prediction-formula to approximately estimate the degree of deterioration of water supply pipelines will be established, and a proposal will be made for measures to devise a plan for rebuilding inspecting and investigating water supply and sewerage. That will contribute to the realization of efficient rebuilding and methods for inspection and investigation of water supply and sewerage pipelines.

- Regarding water pipes (hard PVC pipes), since it is difficult to implement inspections and the degree of deterioration is not directly related to elapsed year, it is difficult to identify the degree of deterioration.
- Although it is efficient to the rebuilding inspection and investigation of water supply and sewerage systems, techniques to determine the degree of priority of such systems have not been established.

- Deterioration-prediction-formula to approximately estimate the degree of deterioration of water supply pipelines (hard PVC pipes) will be established.
- A proposal will be made for measures to devise a plan for rebuilding as well as inspection and investigation of water supply and sewerage collaboratively.

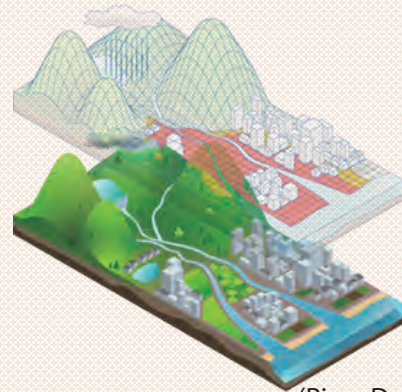


(Water Supply and Sewerage Systems Department)

2 **Development of an experimental site using a digital twin** to drastically improve the disaster prevention capacity in a river basin

Developing Digital Testbed, the experimental platform that reproduces river basins in cyberspace, contributes to the acceleration of technology developments for visualizing the effectiveness of flood control measures and next-generation flood forecasting through the public-private partnership.

- It is necessary to communicate risk among various stakeholders and to establish preparedness for disasters before a disaster occurs in order to promote River Basin Disaster Resilience and Sustainability by All.
- Risk communication requires visualizing the effectiveness of measures, and the establishment of the disaster prevention system in advance requires taking advantage of the forecast information.
- The experimental platform that reproduced a watershed was developed in cyberspace using open data such as 3D data that has been developed in recent years; It will start operation in FY 2025.
- Using the experimental platform, this study aims to develop technology to visualize the effectiveness of flood control measures in the basin and next-generation flood forecasting technology through the public-private partnership.

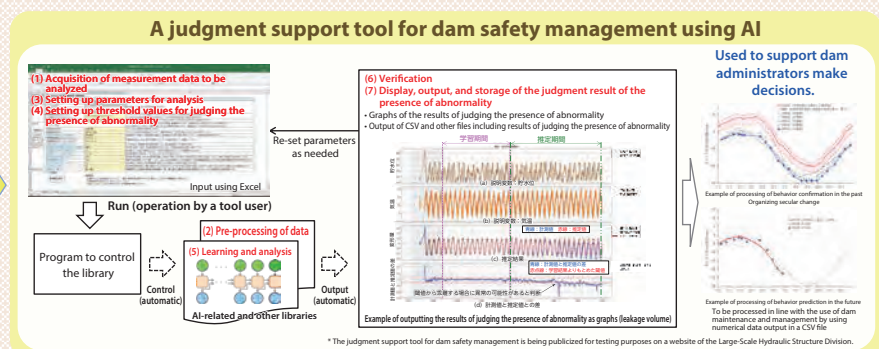
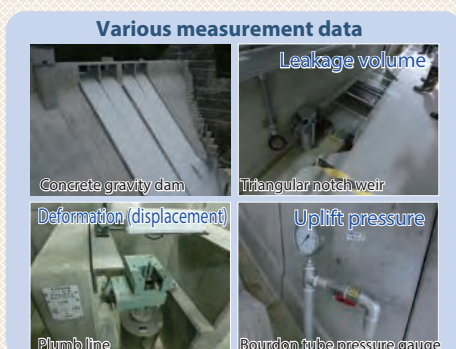


(River Department)

3 Improvement of the quality of **dam maintenance management through AI analysis** of measured data

AI is used to analyze various measurement data acquired for safety management at dams. The system uses the analyses to support inspections conducted by on-site personnel and contributes to improving the quality of dam maintenance and management.

- In the maintenance and management of dams, early identification of abnormalities is required based on various measurement data obtained from inspections. However, such process requires judgment based on experience, and there will be a shortage of skilled personnel in the future.
- A tool was thus developed to use AI to analyze changes in the long-term behavior of dams and effects of earthquakes to detect possible abnormalities



(River Department)

4 Protecting lives against sediment-related disasters by finding places that are even slightly safer.

A proposal for the numerical calculation method will be made that shows both the range and the areas at risk for flooding by using a debris flow. It will include the influence of houses and other structures in its calculation and contribute to an action plan for evacuation in the event of a disaster.

- A technique is required to calculate beforehand the relative degree of danger and the areas at greatest risk of a debris flow in a sediment-related disaster warning area.
- Study of a method for evaluating the influence of houses and other structures on the flood range by a debris flow
- Assumption of sediment production and outflow scenarios using a calculation of water and sediment outflow, and organizing points to be noted in the calculation
- Analysis of risk information obtained from the results of calculation and a study of the method used to provide such information

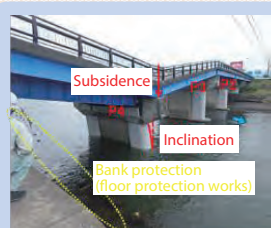


(Sabo Department)

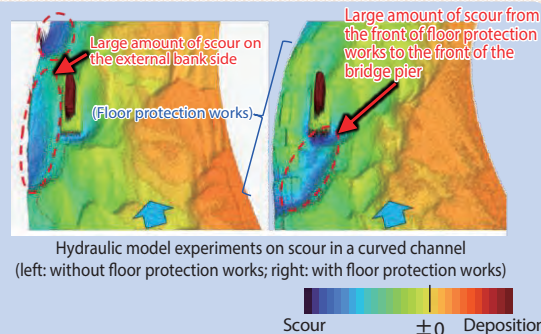
5 Efforts to evaluate the risks of damage to road bridges when flooded.

By presenting evaluation and verification techniques of scour risks and the effects of preventive measures, we will be able to contribute to the promotion of effective measures against scour of existing bridges and the ability to secure road networks during a disaster.

- A situation occurs often in which the foundation of a road bridge is scoured by a rising river, etc., and subsidence or inclination of a bridge abutment or pier occurs, and the road functions are lost for a long period of time.
- An efficient method of recognizing high-risk bridges (bridge abutments and piers) and a reasonable method of setting the range of preventive measures is required, in order to promote the preventive measures against scour early and effectively protect bridges that have a high risk of damage caused by a disaster.



Example of damaged bridge



Hydraulic model experiments on scour in a curved channel (left: without floor protection works; right: with floor protection works)

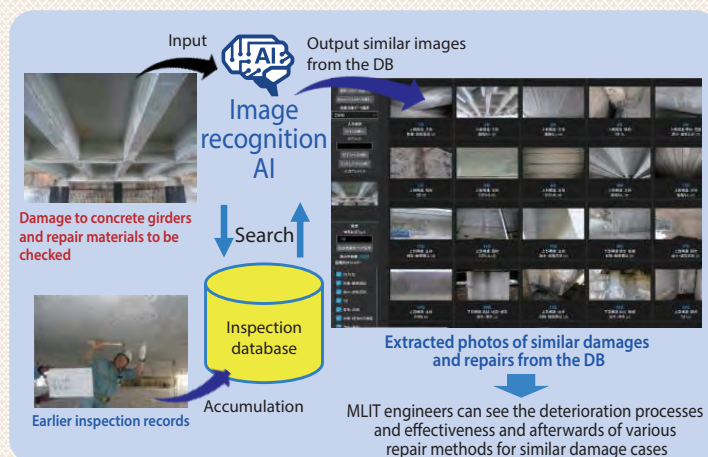
- Hydraulic model experiments and numerical analyses have shown that, depending on the shape of the river and the structural alignment, etc., the type of scour compromises a bridge.
- In the actual operations of road management, a proposal for numerical analysis techniques will be made that enable the range of local scour around the bridge foundation to be estimated, which will be required when determining the range of preventive measures against scour and others.

(Road Structures Department)

6 Efforts to improve the quality of road management through the use of new technologies

The quality of road management will be improved through more effective repairs using new technologies, including AI.

- Processes and causes of bridge deterioration and damage vary depending on their specifications and surrounding environments, and the effectiveness of countermeasures also varies.
- In repair, it is helpful for engineers to know various examples of damages and countermeasures with their afterwards. However, sources are limited to collect and track the information on earlier damage and repair records.
- Joint research with MLIT Regional Development Bureaus revealed image recognition AI technologies can help MLIT engineers search and track similar damages and various repairs and their afterwards and make decisions in repair planning.
- It also found that image recognition AI and other technologies can be used to search cases from a large amount of past inspection data.
- Studies will be continued to explore the use of new technologies and procurement processes for better road management.



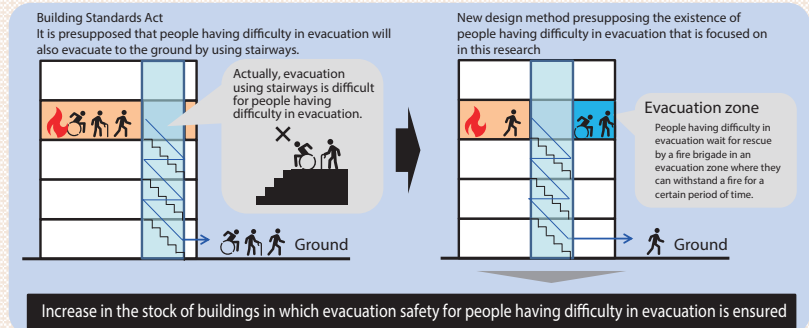
(Road Structures Department)

Efforts to broaden participation and **include people who have difficulty evacuating** by improving evacuation safety during a fire

In order to ensure the safety of the so-called "people having difficulty in evacuation" such as the elderly and wheelchair users during a fire, new evacuation safety designs will be developed for buildings on the premise that there are such people at the scene of a fire.

- In the Building Standards Act, evacuation of non-disabled people by using stairways to the ground is presupposed.
- There are cases where "people having difficulty in evacuation" whose vertical evacuation is difficult are left behind during evacuation at the scene of a fire.
- In recent years, fundamental technologies have been developed that can be utilized for safe evacuation of people having difficulty in evacuation, such as evacuation zones and evacuation using an elevator, but such technologies have not yet been disseminated.

- Building an evacuation action model (action model that represents the movement of an evacuee) of people having difficulty in evacuation that utilizes VR (virtual reality)
- Preparation of evacuation safety design guidelines in which techniques for applying fundamental technologies, etc. are organized

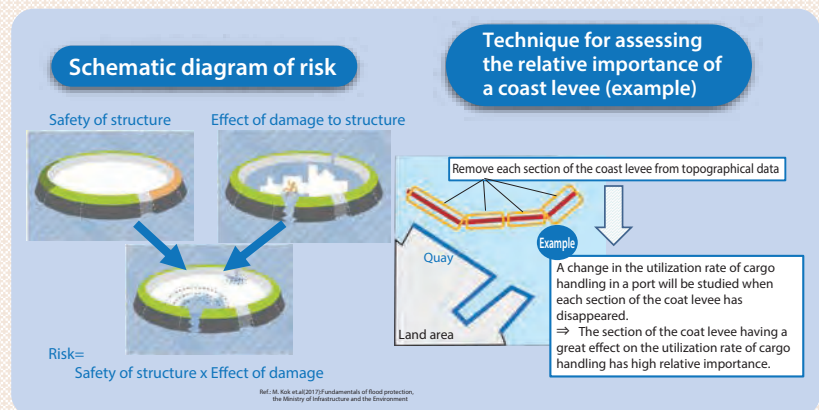


(Building Department)

Efforts toward **the efficient improvement of port facilities against climate change**

In order to take measures against climate change for port structures, a technique for differentiating the safety margin of structures based on risk concepts will be studied, thereby aiming at the reflection of such technique in the technical standards, etc. of ports.

- It is assumed that the design conditions of port facilities (waves, tide level, etc.) will become severer due to climate change.
- Since the safety of structures is set uniformly, there is a concern that many structures will not be up to code in terms of technical standards in future.
- Focusing on the degree of decline in the port functions caused by damage to part of the sections of a coast levee, the relative importance of each section will be assessed.
- A technique for setting the safety margin of a coast levee will be studied, according to the risk of decline in the port functions

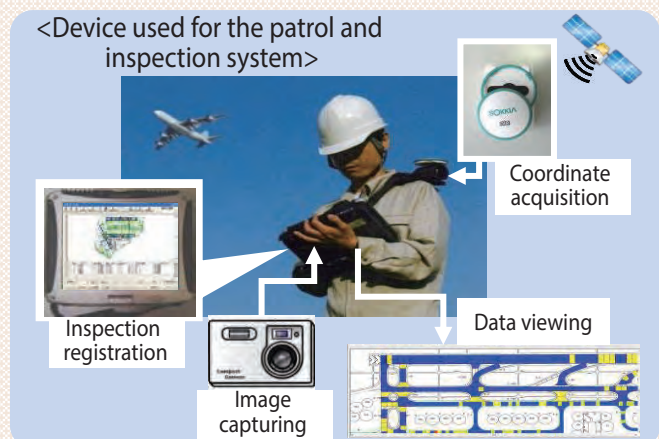


(Port, Coastal, and Marine Department)

Efforts to **improve efficiency and sophistication of airport pavement inspection operations**

The functions of the airport pavement patrol and inspection system, which has been developed and operated to improve the efficiency and sophistication of airport pavement inspection work, are improved. The improved functions will contribute to the improved efficiency of maintenance and management work.

- Preventive maintenance and management are necessary to ensure the safety and punctuality of aircraft operations.
- Prompt reporting of runway failures, accidents, and disasters is required
- The system is newly equipped with a function to view periodic inspection information (PRI information) and a function to register repair information, in addition to the conventional inspection registration function and the function to determine the necessity of repairs for each type of abnormality.
- The system is also newly equipped with a function to report an accident and disaster that enables quick and easy reporting of runway failures etc., as well as sharing and viewing of accident and disaster information.



(Airport Department)

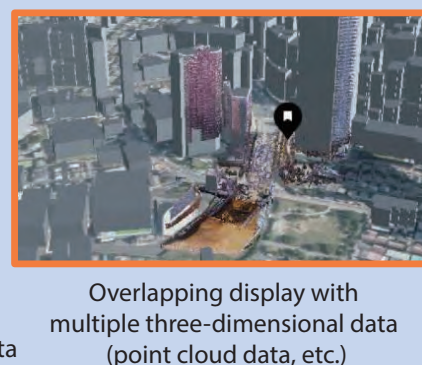
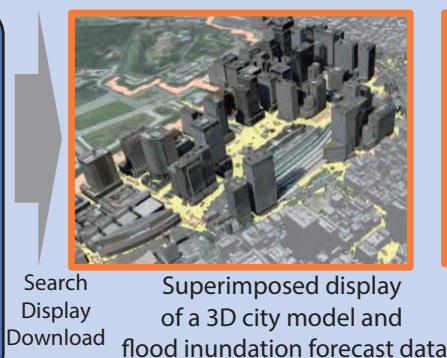
2. Research to increase the productivity and growth potential of society

1 Production of innovation by developing **MLIT DATA PLATFORM**

A platform was built to enable the linkage of the various data held by the government and private sectors. This will contribute to the efficiency of operations, the sophistication of the MLIT policies, and the creation of innovations through industry-academia-government collaboration.

- In order to promote the utilization of data by the government and private sectors, it is necessary to establish a platform to realize a digital twin that reproduces physical (real) events in cyberspace by linking data held by the MLIT with data from the private sector and others.
- There is a need to promote technological development and R&D to link and utilize the various data held by the government and private sectors. This is to use the infrastructure data to improve productivity in the field of construction and non-construction fields such as disaster management and logistics.
- We have built MLIT DATA PLATFORM with functions for searching, displaying, and downloading data across the board by linking APIs with the various databases owned by the government and private sectors.
- In FY 2023, research and development were implemented, such as a study of format, etc. toward the automation and standardization of data integration, development of data provision functions, and others.

MLIT DATA PLATFORM



(Research Center for Infrastructure Management)

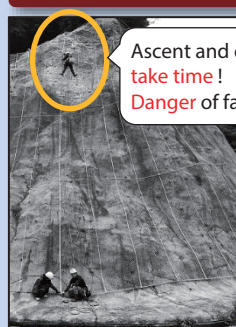
2 Improvement of productivity and work style reform at construction sites through the use of ICT

This study is contributing to the improvement of productivity and work-style reform in the construction industry by establishing rules for the use of ICT-based construction and measurement technologies in the management of as-built shape management* in public works, and others.

*A practice to confirm whether the height, length, width, slope, flatness, etc. of constructed civil engineering structures meet specified values.

- With regard to ICT construction, which is the main initiative of the i-Construction project that started in FY 2016, the applicable construction types and technologies are gradually being expanded based on the progress of technological development in the private sector.
- While taking into account proposed technologies, etc. from private sector organizations, we are continuing to improve the standards so that they can be properly applied to the as-built shape management of public works, and others.
- In FY 2023, we prepared standards, etc. (six work types and 8 technologies) responding to new measurement technologies and work types such as technology for improving productivity and safety by using a terrestrial laser scanner (TLS) for the measurement of as-built shape in an elevated place of slope works.

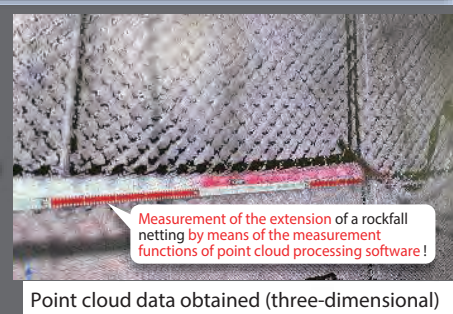
Three-dimensional as-built shape management in rockfall netting works by means of a terrestrial laser scanner (TLS)



Ascent and descent take time!
Danger of fall!



As-built shape management using TLS (after)



(Research Center for Infrastructure Management)

It will contribute to an early implementation of automated driving trucks on expressways to develop a system that provides unseen traffic conditions on a main lane to merging vehicles.

- Large vehicles need to travel longer for accelerating or changing lanes at a merging section compared to general vehicles.
- It supports safe and smooth automated driving to provide information on a road ahead that cannot be detected by on-board sensors of automated driving trucks.
- For Level 4 automated driving trucks, a field operational test will begin in FY 2024 on Shin-Tomei Expressway to verify an effectiveness of a system that provides merging support information and look-ahead information (fallen objects, road works regulations, etc.), and a technical specification for the system will be created.

Image of a field operational test for providing merging support information

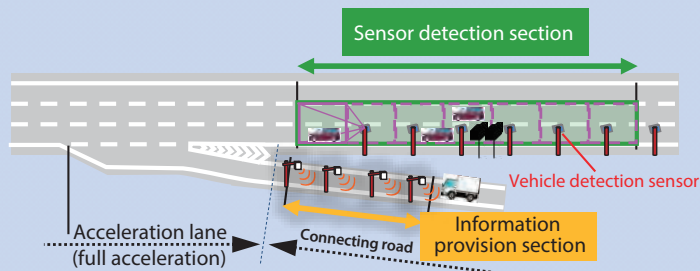
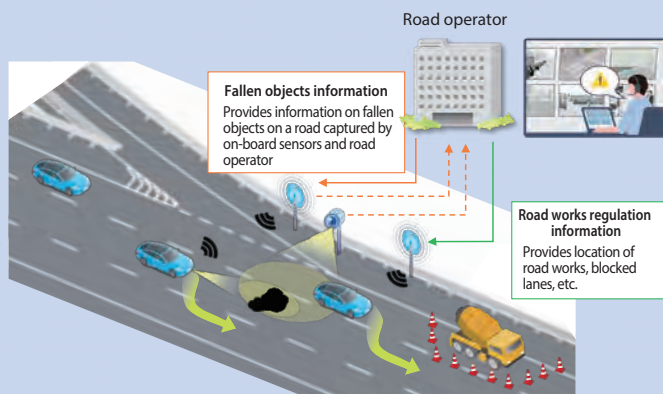


Image of a field operational test for providing look-ahead information



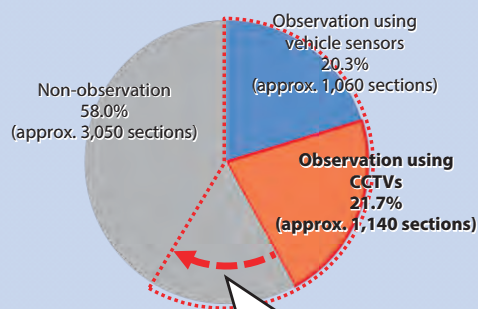
(Road Traffic Department)

The AI-based traffic volume observation method is developed to contribute to the improvement of road traffic services based on objective numerical values, by realizing efficient acquisition of a wide variety of road traffic data

- Although the construction of road networks is constantly progressing, there are various problems in improved roads, such as traffic jams and accidents, punctuality, aspects of disaster preparedness, etc.
- It is necessary to proceed with measures for improving road utilization services, by establishing techniques for efficient acquisition and analysis of road traffic data.
- Conventional traffic volume observation equipment was intended for obtaining data of vehicles only, and the areas of installation were also limited. Other problems that need to be addressed are the sophistication and cost reduction of the observation techniques.
- An efficient traffic volume observation method using AI analysis of the videos of existing CCTVs will be developed, and improvement of accuracy and expansion of survey targets (pedestrians, etc.) will be studied.

<Ratio of sections where traffic is constantly observed in National Highways under jurisdiction of MLIT>

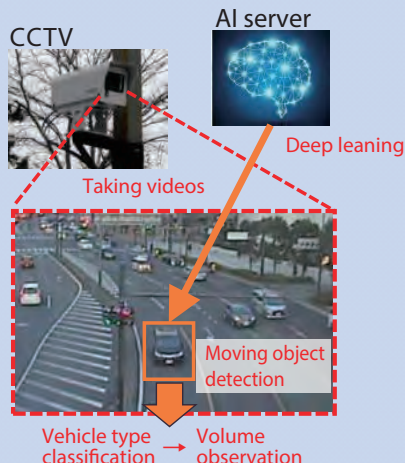
*Approx. 5,260 sections as of January 2023



There is a plan to expand the sections where data can be obtained by improving the accuracy of the observation method.

<Observation method using AI analysis of CCTV images (image diagram)>

*Introduction in all over Japan has been started since 2020.



<Study of the improvement of accuracy of observation method>



Videos taken by multiple cameras having different heights, depression angles and horizontal angles in a test course of NILIM are analyzed by AI. Study of the conditions of the angle of view that improves accuracy of the identification of a car model.

*CCTV: Video cameras installed for road management (abbreviation for Closed Circuit TeleVision)

(Road Traffic Department)

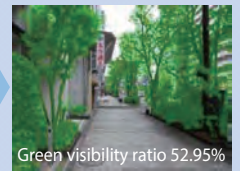
5 Integrating visible greenery into urban development to accelerate GX

AI can efficiently survey the green visibility ratio, a growing indicator of visible greenery, replacing traditional green coverage ratio assessments. This can facilitate the creation of greener landscapes and improve overall well-being.

- As the demand for improved well-being has risen since COVID-19, urban greenery is expected to play a more significant role in Green Transformation for urban development.
- To effectively integrate greenery into urban development, we need technology that can measure and evaluate how greenery contributes to creating pleasant landscapes and improving quality of life.

- Developing an AI-powered survey tool for green visibility ratio to reduce labor and costs.
- Development of an evaluation method to set quantitative targets for visible greenery.
- Empowering local governments to conduct surveys of visible greenery (green visibility ratio), alongside traditional green space area surveys (green coverage ratio), for their Green Master Plans.

Developed an efficient AI-powered survey tool for green visibility ratio



An image recognition AI can instantly measure the green visibility ratio by using a smartphone.

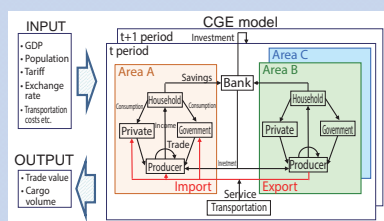
(Urban Planning Department)

6 Efforts to plan and propose port policies that reflect future changes in the market

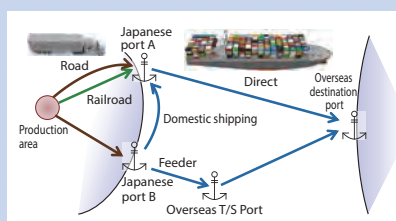
We developed future cargo volume forecasts that accurately reflect changes in the global economic and social conditions and the container transport market. This will support the planning and formulation of national port policies and the revision of port plans by port management bodies.

- Accurate estimation of future port cargo volumes is necessary for planning and formulating port policies and revising port plans.
- It is now difficult to foresee the future because of the impact of the spread of COVID-19, the movement toward a zero-emission society, the progress of the mega-EPA and the rise of protectionism, the supply chain crisis due to tight international container transport capacity, and other factors.
- The forecasting model for Japan's overall foreign trade port cargo volume and the port and route choice model for foreign trade container cargo are continuously improved to calculate future forecasts.
- Quantitative evaluation is conducted on the impact of recent rapid changes that existing models cannot take into account such as changes caused by COVID-19 and the movement toward a zero-emission society. The evaluation is used to develop a method that reflects these changes in future forecasts.

<Forecasting model for foreign trade port cargo volume>



<Port and route choice model for foreign trade container cargo>



(Port, Coastal, and Marine Department)

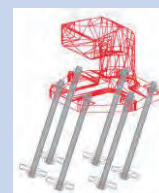
7 Improvement of productivity in the port sector through the use of ICT and BIM for infrastructure

Methods and standards are developed and organized to facilitate the use of ICT and BIM for infrastructure in the development of port facilities. This contributes to increased efficiency and safety in design and construction sites.

- The as-built shapes of foundation works (rubble leveling) and floor digging works are measured by a diver or by multibeam echo sounding, and there is room for improvement in productivity and safety.
- Regarding the measurement of as-built shape by using construction history data of mechanical leveling or grab dredging ship, verification of accuracy is performed by on-site testing, and an as-built shape management technique is studied that would be able to partially omit the measurement work by a diver or by multibeam echo sounding.
- When promoting the use of BIM, the time for creating three-dimensional models for BIM is a burden in the implementation of operations and work
- By bearing in mind members such as a mooring post or fender, a generic object (standard part) having a shape not dependent on a specific manufacturer was created, and it was publicized in October 2022 as "an example of BIM generic object in the port sector" so that the object could be used by anyone who wished to use it.



As-built shape measurement by using construction history data
(left: mechanical leveling (foundation works), right: grab dredging ship (floor digging works))



Examples of BIM generic objects
(left: mooring post, right: fender)

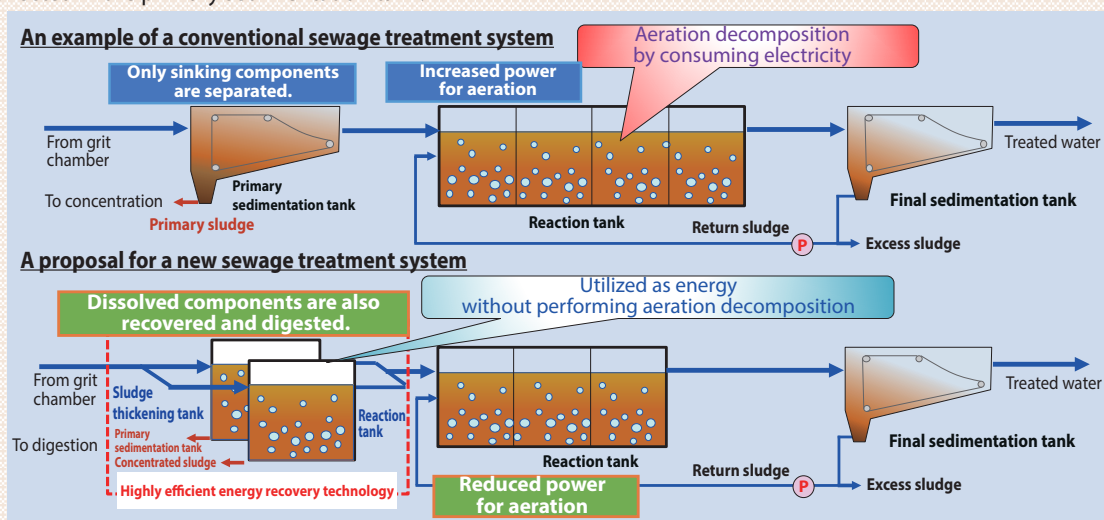
(Support Center for Port and Harbor Advanced Information Technology)

3. Research to support comfortable and secure living

1 Efforts to **reduce greenhouse gas emissions** from the sewerage system

The development of energy recovery technology using the primary sedimentation tank will increase the amount of biogas generated and reduce the amount of electricity consumed by the reaction tank. This thereby contributes to the reduction of greenhouse gas emissions from the sewage system.

- In conventional sewage treatment, solids are collected in the primary sedimentation tank and then aerated in a reaction tank to decompose dissolved components. (Power consumption is an issue.)
- Biogas is generated from solids (sludge) in the digestion process and used as fuel.
- Under the Breakthrough by Dynamic Approach in Sewage High Technology Project (the B-DASH Project), the technology to recover dissolved components in the primary sedimentation tank is developed.
- Electricity used for aeration of the reaction tank can be reduced. Also, biogas generation increases because of an increase in the amount of sludge collected in the primary sedimentation tank.

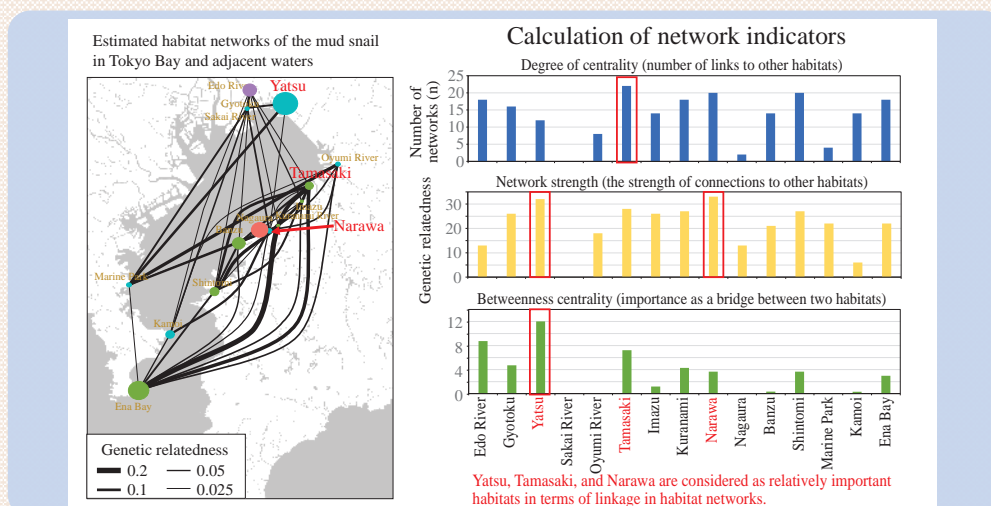


(Water Supply and Sewerage Department)

2 Study for **coastal ecosystem restoration**

This study aims to make new connectivity in habitat networks of coastal organisms by creating habitats in shallow water areas using dredged soil from harbor and port development. The development of technologies that properly understand the network structure will contribute to the natural restoration of the marine environments with rich biodiversity.

- Understanding the network structure is helpful to consider habitat design.
- Development of a DNA analysis method for understanding the spatial scale of habitat networks
- Development of a method for parent-child identification to estimate connectivity between habitats and the strength.



(Port, Coastal, and Marine Department)

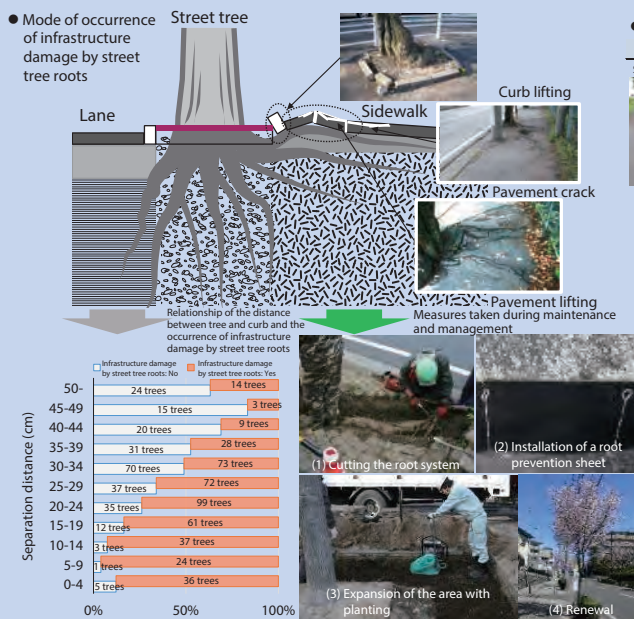
3

Improvement of comfort through proper maintenance and management of roadside plantings

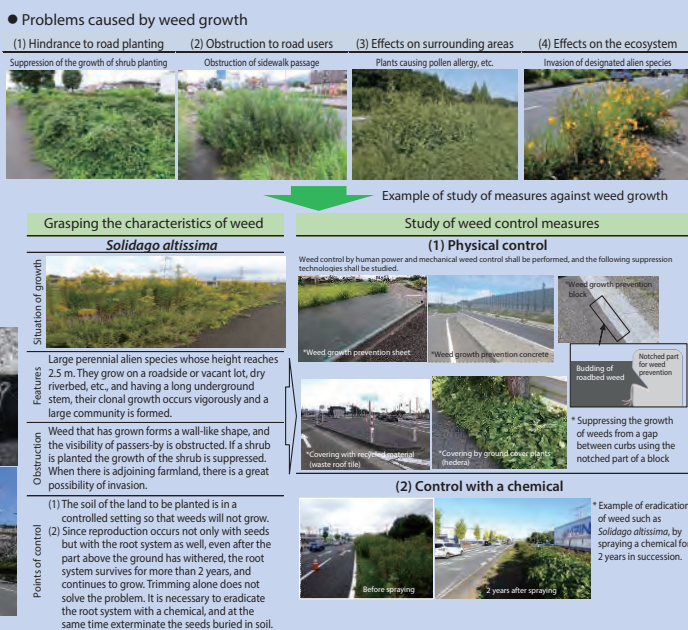
By presenting on-site application methods for preventing infrastructure damage by street tree roots and weed control of street trees, beautiful plantings are maintained without interfering with road traffic and contribute to the improvement of comfort in the road space and roadside environment.

- In areas with planting along roads, traffic obstruction due to infrastructure damage by street tree roots, obstruction of visibility due to the overgrowth of weeds, and deterioration of the landscape occur.
- High-quality greening that can comprehensively demonstrate greening functions while maintaining road traffic functions is necessary.
- The cause of occurrence is elucidated by grasping the current situation. The effectiveness of each measure is verified through test constructions and case studies.
- Methods and points to note for on-site application are organized and reflected in the maintenance and management guidelines for road greening.

[Measures against infrastructure damage by street tree roots]



[Weed control measures]



(Research Center for Infrastructure Management)

4

Promotion of effective measures to deal with vacant houses by using structural performance evaluation technologies

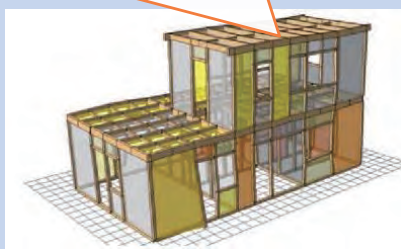
The development of evaluation standards will be used for the structural performance (risk of damage caused by a disaster) of vacant houses combined with a study assessing the application of reasonable reinforcement and renovation methods. This will contribute to an efficient assessment by municipalities on which vacant houses are poorly managed and how they can be effectively utilized.

- The number of vacant houses that are no longer suitable to be lived in has doubled in the last 20 years. That trend appears to be continuing for the foreseeable future.
- In the Vacant Houses Special Measures Act amended in June 2023, a system of guidance and recommendation for poorly managed vacant houses was established.
- Utilizing simulation technologies, the risk assessment method of damage inflicted on a vacant house will be developed based on the appearance, etc. of the vacant house. (Research (1))
- The application of reasonable reinforcement and renovation methods of vulnerable portions of a vacant house will be studied by testing the integrity of the joints. (Research (2))

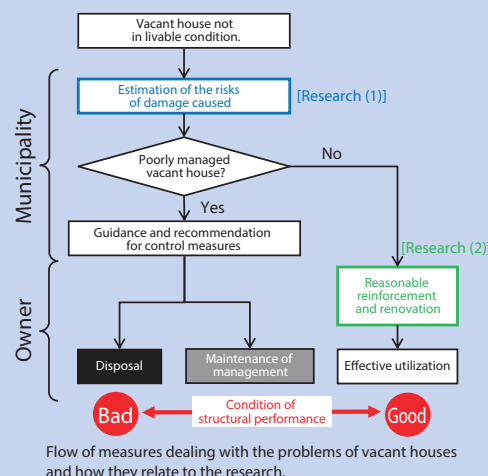
- Simulations will be implemented that assume structural failure during an earthquake or accumulation of snow.
- An effective way of showing the risks of damage caused will be studied, and reasonable judgment criteria for poorly managed vacant houses, will be organized that compensate for shortages of expertise of municipalities.



Example of a vacant house in a precarious condition in terms of security



Example of collapsing simulation (Wallstat) of a wooden house



(Building Department)

5 Efforts to ensure the safety and reliability of living

The effort to promote a more detailed and strategic housing safety net (hereinafter called the Housing SN) policy of a region. A technique for setting the target supply volume of publicly-operated housing will be developed, taking into account collaboration among municipalities and cooperation with the utilization of private rental housing inventory.

- In the Housing SN sector, it is important to proceed with efforts to ensure the safety and reliability of living.
- It is necessary to promote the following, in order to proceed with a more effective and strategic utilization of publicly-operated housing inventory.
 - (1) Collaboration among municipalities in which living spheres are close to one another
 - (2) Collaboration with the utilization of private rental housing inventory
 - (3) Appropriate setting of the target supply volume of publicly-operated housing, taking account of (1) and (2)

- The following techniques will be developed.
 - (1) A technique for estimating the demand for the Housing SN for each living sphere region
 - (2) A technique for estimating the private rental housing inventory that can be utilized for each living sphere area
 - (3) A technique for effectively setting the target supply volume of publicly-operated housing

Image of the effective SN Housing supply through collaboration among regions

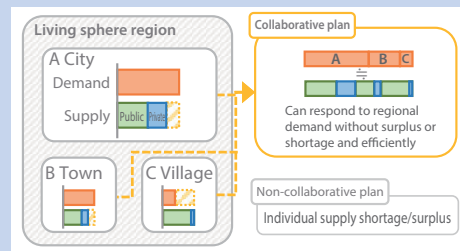
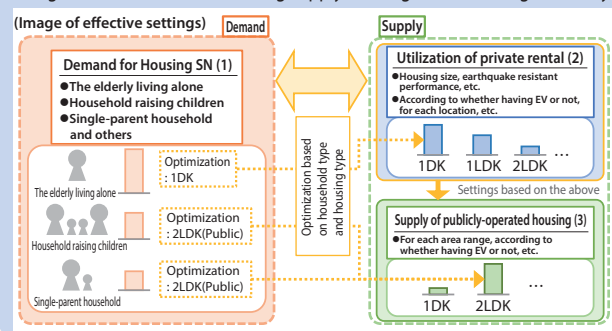


Image of the effective SN Housing supply utilizing rental housing inventory.

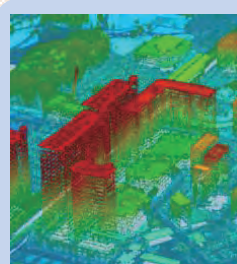
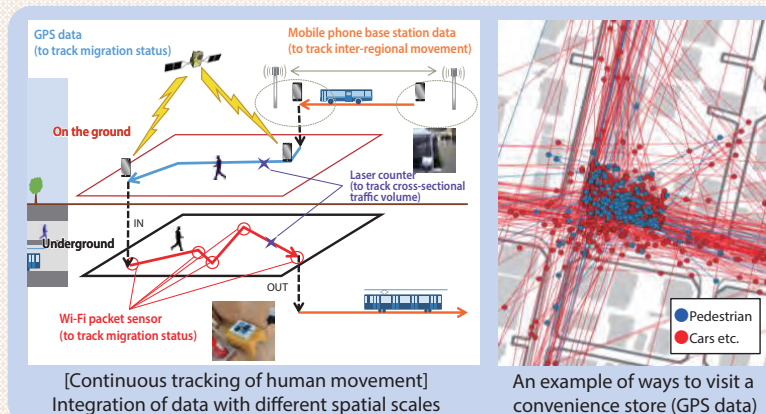


(Housing Department)

6 Initiatives to make cities smarter with digital technology

In urban planning, technologies for effectively using traffic and human mobility big data and 3D city models are developed to contribute to the development of smart cities.

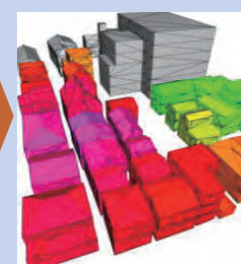
- The use of digital technologies such as big data is effective for local governments to create urban planning and solve urban problems.
- Technology for effectively using big data (GPS and data from mobile base station etc.) that support person trip surveys is developed.
- A method that uses human mobility big data to evaluate the impact of the installation of a building with restricted uses is developed.
- Promotion of the development of 3D city models as basic data for smart cities is necessary.
- Challenges include the reduction of creation and update costs and development of diverse use cases.
- A low-cost creation and updating method that uses existing data is developed.
- Use cases for running advanced simulation of urban environment, disaster prevention, etc. are developed by extending common specifications.



[Reduction of creation and update costs]
Use of 3D point cloud survey data etc.



[3D city model extension]
Creation of detailed specifications for buildings, trees, etc.
(The figure has been created by Plateau View 2.0.)



[Development of use cases]
An example of application to an urban fire (redder buildings show that the spread of fire occurs earlier)

(Urban Planning Department)

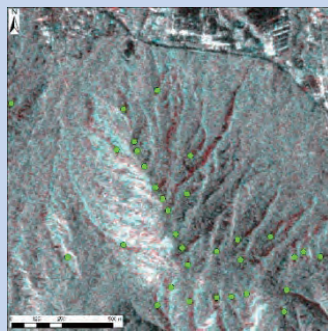
Advanced technical support and countermeasures for

Through the research and development of techniques to estimate a location where a sediment-related disaster occurred based on satellite SAR images, spectrum analysis information in the event of a large-scale earthquake, disaster response technologies for buildings and cities utilizing artificial satellites, an information sharing system for supporting safe and effective flood fighting, etc., contribution will be made to help advance of technologies for disaster preparedness.

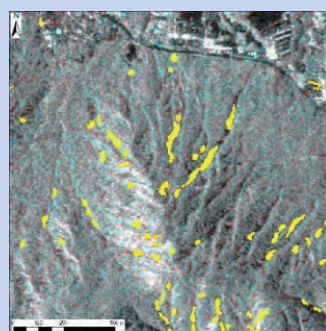
Study on ways to estimate a location of landslide based on satellite SAR images

Satellite SAR images, which can be captured even at night and in bad weather, are used to quickly identify areas where landslides have occurred.

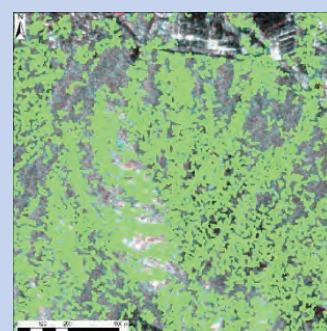
- The observation range of Daichi-4 (ALOS-4) satellite is expanded compared to that of the SAR satellite Daichi-2 (ALOS-2) that is currently in use.
 - Since this increases the amount of data to be processed, the efficiency of the process of interpreting SAR images, for example, needs to be increased.
- ▼
- The reliability of estimating the location of a landslide was compared among multiple methods that excel in processing SAR data of wide area observations and methods that use visual interpretation.



Visual interpretation



Intensity difference analysis



Coherence analysis



Orthophoto

Example of estimation results for each method (Torrential rain in July 2018 in Higashihiroshima City)

Spectrum analysis information in the event of a large-scale earthquake

- By evaluating the acceleration response spectrum of the earthquake using the damage line (line — in the figure) defined by past earthquake records, an assessment of the damage to a given structure, its size, and region were estimated immediately after the occurrence of the earthquake. The information was automatically distributed as "spectrum analysis information" within 8 minutes after the earthquake.
- In the 2024 Noto Peninsula Earthquake, a concern about the possibility of severe damage was distributed immediately after the earthquake struck.
- In an earthquake below the damage line, contributions were made to reduce the burden on the road administrator such as efficiently performing road patrol after the earthquake.

Around 16:10 on January 1, 2024

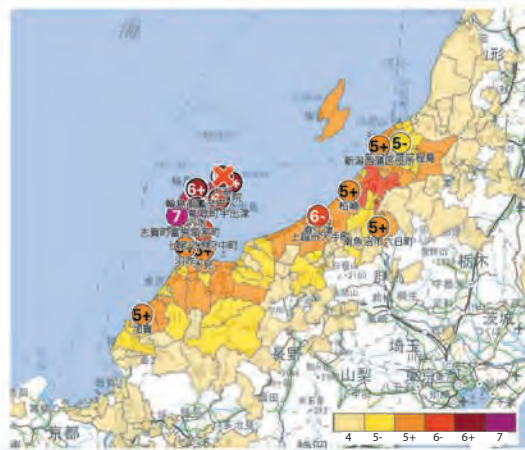
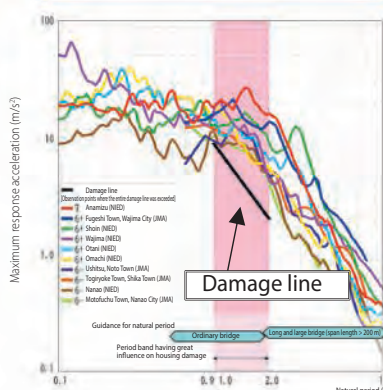
Earthquake with an epicenter in the Noto District, Ishikawa Prefecture Depth of the earthquake source: about 16 km

M 7.6

Maximum seismic intensity: 7

early warning value of the Japan Meteorological Agency

Concern about serious damage



Videos for the explanation of spectrum analysis information are available on YouTube.



Technical basis for estimating the scale of damage is posted on the website (NILIM reference No. 1204).



■ Disaster response technologies for buildings and cities utilizing satellites

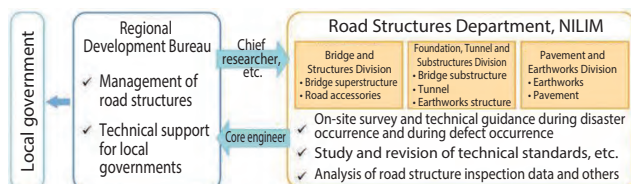
Hosting of personnel

● Accepting people from local governments and private businesses

The NILIM is accepting people from local governments and private businesses as exchange researchers and supporting them in improving their technical skills through technical guidance and workshops. (Number of exchange researchers accepted: 55 as of April 2024)

● Accepting officials from Regional Development Bureaus

We accept officials from Regional Development Bureaus who have realized field issues through their work as researchers or staff holding two posts for a certain period to help improve their skills. The officials who have acquired technical skills would return to their Regional Development Bureaus and actively work as core technicians in their respective regions.



Training of human resources by accepting staff from each Regional Development Bureau to the Road Structures Department



Training assistance program for staff such as those of the Regional Development Bureau engaging in high-level sediment disaster prevention measures

Completing and strengthening training

NILIM holds training sessions and lecture courses and sends out lecturers in order to spread and establish its technical policy and improve the technological level of society as a whole.

(Dispatch of lecturers in FY 2023: 359 cases as of the end of March 2024)

(Number of training courses in FY 2023: 41 courses with 1,537 participants [Yokosuka Office No. 2])



Training scene

Support for local issues

NILIM works with local offices and other local agencies to resolve issues that arise in the field.

NILIM dispatches personnel to the Sediment Disaster Prevention Technology Center of the Kinki Regional Development Bureau to perform research and technical development concerning large-scale sediment disasters.

Technology consultation

NILIM constantly provides national government agencies, local governments, and other organizations with technical support of various kinds for policy implementation and project execution.

● Technical Consultation Office

Covering all fields over which NILIM is in charge, this one-stop service provides consultations regarding all fields and facilities.



■ Contact

Civil engineering field
E-mail: nil-soudanmadoguchi-gijyutu@gxb.mlit.go.jp
TEL: 029-864-4343 (Manager of the Planning Division, Planning Department)

■ Ports and airports field

[Investigation, design, and construction]
E-mail: ysk.nil-46port-tech5091@gxb.mlit.go.jp
TEL: 046-844-5091
[Maintenance and management]
E-mail: ysk.nil-46lcm-center2@gxb.mlit.go.jp
TEL: 046-844-5030

■ Website URL

<https://www.nilim.go.jp/lab/bbg/tec-soudan> (Civil engineering)
https://www.ysk.nilim.go.jp/kakubu/kouwan/sekou/lcmmadoguti_20230510.pdf (Ports and airports)



Civil engineering



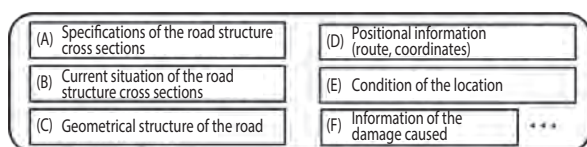
Ports and airports

Collection, analysis, and management of data forming the technical basis of policy formation and return to society

In addition to our initiative to promote infrastructure DX, the NILIM is reorganizing data related to housing and social capital collected for administrative purposes and using it for research and to support field operations.

Support for the disaster risk management of roads

From the collected and accumulated data of actual records of restrictions on roads damaged by disasters and of the specifications, etc. of road structures, a technique for evaluating the disaster resistance of roads is developed. Proceed with the verification and utilization of the evaluation technique, and at the same time provide support for the automation of evaluation (development of apps) that utilizes a huge amount of varied data.



Evaluated automatically from database

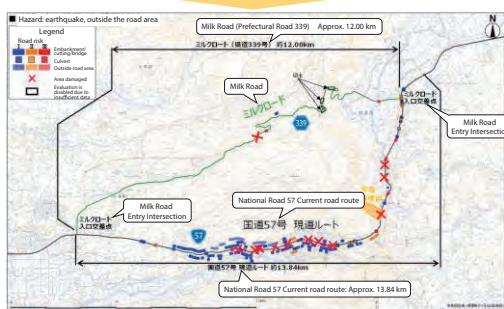


Image of automation of disaster resistance evaluation utilizing data (example of the 2016 Kumamoto Earthquake)

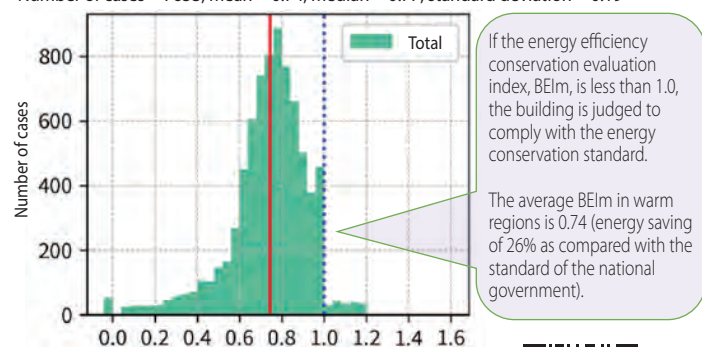
Support for planning of energy conservation measures for office buildings etc.

Information related to applications for energy conservation standards based on the Act on the Rational Use of Energy (15,000 cases/year).

Energy conservation performance and design specifications (heat insulation performance, efficiency of air-conditioning equipment, etc.) were organized for office buildings etc. and posted on the website as the NILIM Reference Data No. 1229.

The study also contributes to the promotion of the government's energy-saving measures established in response to the 2050 Declaration on Carbon Neutrality.

Number of cases = 7653, mean = 0.74, median = 0.77, standard deviation = 0.19



Energy conservation performance evaluation index BEIm

Examples of published data

Distribution of energy conservation performance evaluation index (warm regions)



Support for promoting physical asset management of sewerage

The database of sewers deterioration, which collects the results of inspections by local governments and organizes information such as deterioration assessment results, is published. The database covers approximately 310,000 spans from 60 local governments as of May 2021.

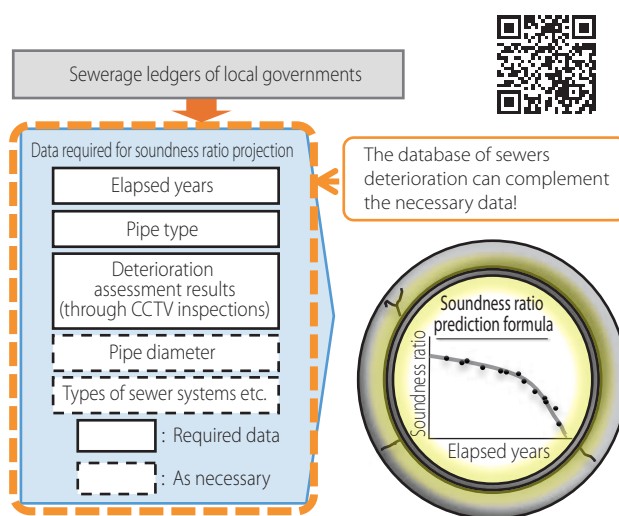
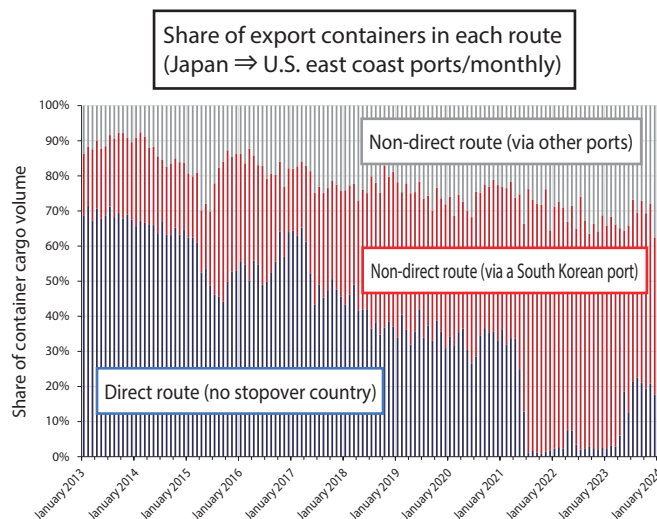


Image of the database of sewers deterioration

Support for port policies through the analysis of maritime meta data

Analysis, etc. of maritime meta data such as cargo flow data (Datamyne), global ship dimension data (Lloyd's, Clarkson), ship location data (land-based and satellite-based AIS data) is carried out regarding the ocean transport trends, ship specifications, and navigation situations, and the results will be publicized on the NILIM website, etc.

Example: Container cargo flow analysis of North American major sea routes



Source: Created by the National Institute for Land and Infrastructure Management from the data of Descartes Datamyne

International research activities

NILIM is promoting international research activities based on the perspectives of its technical contribution to domestic policy, technical cooperation with developing countries, and overseas deployment of infrastructure systems.

Major multinational cooperation [relevant departments and centers]

ISO (International Organization for Standardization) [Water Quality Control/Road Traffic/Building/Housing/Infrastructure Management]
ICOLD (International Commission on Large Dams) [River]
WMO/UNESCAP [Sabo] (World Meteorological Organization/United Nations Economic and Social Commission for Asia and the Pacific)
Japan, United States and Europe Trilateral ITS Conference [Road Traffic]
PIARC (World Road Association) [Road Traffic/Road Structures]
RILEM (International Union of Laboratories and Experts in Construction Materials, Systems and Structures) [Building]
PIANC (World Association for Waterborne Transport Infrastructure) [Port, Coastal and Marine]
ICAO (International Civil Aviation Organization) [Airport]
IMO (International Maritime Organization) [Administrative Coordination/Port, Coastal and Marine]

Legend

Agreement	Research agreement with overseas research institutions
Disaster survey	Example of expert dispatch for disaster survey
Technical cooperation	Technical cooperation, workshop, etc. such as support for devising technical standards
	Countries where any of the above activities was carried out from FY 2018 to FY 2022

South Korea

Agreement	Agreement with the KRIHS (Korea Research Institute for Human Settlements) (2012 -)
Technical cooperation	<div>Urban Planning</div> <div>Sabo</div>
	Joint research on smart cities
	Promotion of joint research on the prevention of sediment-related disasters



Turkey

Disaster survey	Dispatch of the Japan Disaster Relief Team/expert team for earthquake damage in Turkey (2022)
	<div>Road Structures</div> <div>Building</div> <div>Urban Planning</div>

Germany

Agreement	Agreement with the BBSR (Federal Institute for Research on Building, Urban Affairs and Spatial Development)
	<div>Building</div> <div>Housing</div> <div>Urban Planning</div>

Italy

Technical cooperation	Technical cooperation on the prevention of sediment-related disasters
	<div>Sabo</div>

Sri Lanka

Agreement	Agreement with the NBRO (National Building Research Organisation)
Technical cooperation	<div>Sabo</div>
	Holding a technical seminar based on the agreement
	Dispatch of experts to a JICA project
Disaster survey	On-site survey of a sediment-related disaster (2018)



United States

Agreement	Agreement with the USACE (U.S. Army Corps of Engineers)
	Agreement with the FHWA (Federal Highway Administration)



Technical cooperation	<div>River</div> <div>Road Traffic</div> <div>Road Structures</div> <div>Infrastructure Management</div>
	Technical cooperation on flood control and water resources management
	Technical cooperation on road policies
	Technical cooperation on technical standards/maintenance and management of bridges, tunnels and pavement

Vietnam

Agreement	Agreement with the DRVN (Directorate for Roads of Viet Nam)
	Agreement with the ITST (Institute of Transport Science and Technology)
Technical cooperation	<div>Sewerage</div> <div>Sabo</div> <div>Road Structures</div> <div>Port, Coastal and Marine</div>
	Japan-Vietnam Technical Seminar on Sewerage
	Japan-Vietnam Disaster Prevention Collaboration and Dialog
	Technical cooperation on technical standards/maintenance and management of bridges and pavement
	Cooperation on the devising of national port standards

Indonesia

Agreement	Agreement with the DRBE (Road and Bridge Development Engineering Bureau, Ministry of Public Works and Housing)
Technical cooperation	<div>Sewerage</div> <div>Building</div> <div>Infrastructure Management</div>
	Workshops, etc. at the Vice-Ministerial Level Meeting in the Construction Sector between Indonesia and Japan
Disaster survey	Investigation on the Sulawesi earthquake (2018)



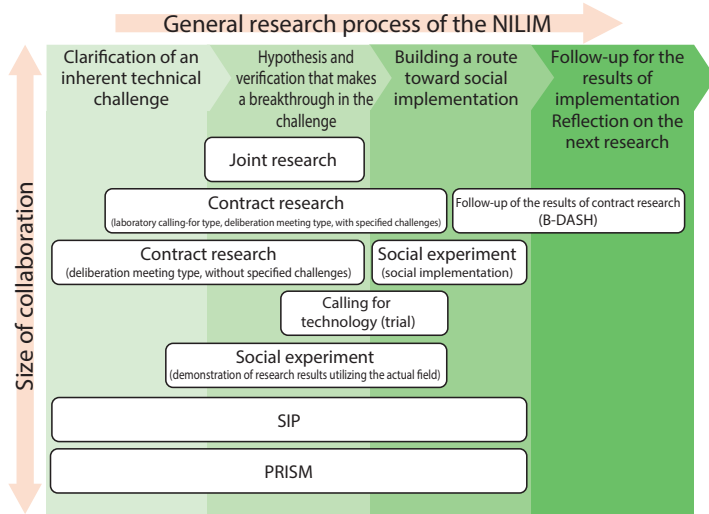
Chile

Technical cooperation	Dispatch of experts for the JICA Disaster Risk Reduction Training Program for Latin America and the Caribbean
	<div>Road Structures</div> <div>Building</div>

Management initiatives supporting high-quality research

Cooperation with external organizations

By implementing joint research, contract research, calls for technologies, and social experiments and by concluding agreements and leveraging technologies provided by industry and academia, as well as knowledge of different fields such as social science and the humanities, NILIM strives to improve the efficiency and quality of its research.



Domestic cooperation

The aim is to develop education and research on the university side and to contribute to the activities of NILIM through coordination and cooperation between universities and NILIM.

University of Tsukuba, Kansai University, Tokyo University of Science, etc.

International cooperation

The aim is to improve the quality of research results of NILIM and to give technical support to other countries (international contribution) through joint research, as well as regular information exchange between overseas research institutes and NILIM.

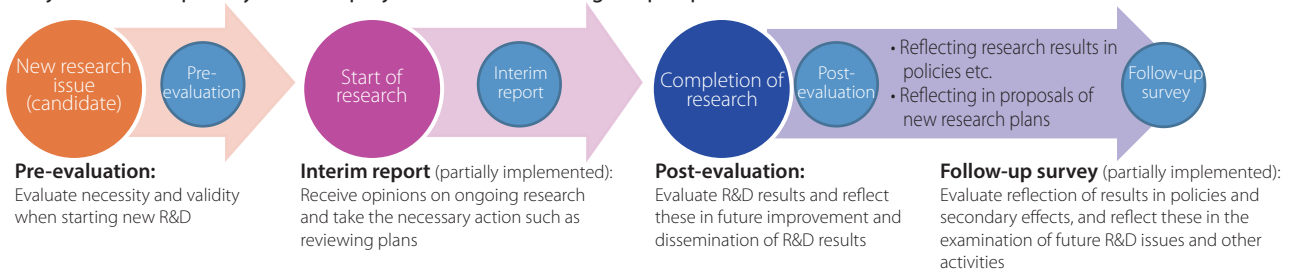
Road and Bridge Development Engineering Bureau of the Ministry of Public Works and Housing of Indonesia, Directorate for Roads of Viet Nam of the Ministry of Transport of Vietnam, Korea Research Institute for Human Settlements of South Korea, National Building Research Organization of the Ministry of Disaster Management of Sri Lanka, Federal Institute for Research on Building, Urban Affairs and Spatial Development of Germany, etc.

Research evaluation

Internal evaluations and external evaluations of individual research subjects, achievements, and the operation of institutions are performed on the basis of the General Guidelines on the Evaluation of National R&D to build an independent and individual management cycle, promote, and improve the quality of research activities.

External evaluation of individual research subjects

NILIM strives to improve the quality of research results by introducing systems allowing external experts to evaluate individual research subjects that are priority research projects from a wide range of perspectives.



External evaluation of R&D organization

Outside experts evaluate research activities as a whole at NILIM, as well as environment improvement initiatives that support the research activities, and NILIM strives to improve its operation based on these results.

National Institute for Land and Infrastructure Management
Report of the "Evaluation of the Research and Development Institutes" (FY 2018 - FY 2022)



Internal training

The research and administrative divisions work together to effectively combine off-JT and OJT to systematically develop young personnel. In-house research presentation sessions are held for young researchers who have little experience in presenting their research. Study groups led by young researchers are also held to strengthen their development through mutual learning.

Experience and Know-how Transmission Lectures are held in order to make use of the accumulation of research, experience, and know-how of predecessors for improving the skills of each staff member.



Internal presentation meeting for young researchers

Compliance

We conduct compliance activities according to the promotion plan for the current fiscal year while giving due consideration to the monitoring results and advisory opinions of the Compliance Advisory Committee (External Expert Committee).

Response to misconduct in research

In addition to establishing NILIM Guidelines for Responding to Misconduct in Research, NILIM makes efforts to improve awareness of research ethics to prevent misconduct (fabrication, falsification, and plagiarizing).

To promote a deeper understanding of NILIM

Website

NILIM actively provides information, including an outline of NILIM, direction of research activities, research subjects, results, and event information.

Visit this site to view information about lecture meetings, open houses, open experiments, and other PR information.



(URL: <https://www.nilim.go.jp/>)



VR NILIM



(URL: <https://www.nilim.go.jp/lab/bbg/vrkokusouken/index.html>)

SNS (X (formerly Twitter) and Facebook)

Using the official SNS (X (formerly Twitter) and Facebook) of NILIM, we are distributing various information such as press releases, website update information, research outcomes, including publication information, and events and lectures.



List of NILIM social media



Official X (formerly Twitter) of NILIM

NILIM YouTube channel

Videos of experiments and lectures in the field of housing and social capital of NILIM are available on YouTube with easy-to-understand explanations.



NILIM Report

This annual publication introduces and explains research trends and examples of how they are reflected in policies and compiles recommendations for technological policy issues. (The full report is published on NILIM website.)



NILIM Reference etc.

A Comprehensive Research Report of NILIM is a report of the research results that have academic value, contribute to the planning and enactment of policy, or present the results of surveys, testing, observations, etc. that are deemed valuable enough to be released to the public

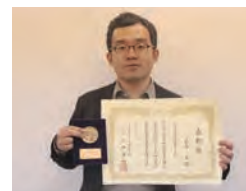
(The full report is published on NILIM website.)



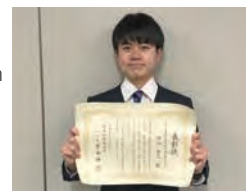
Presenting papers

The NILIM is publishing approximately 500 papers per year and receiving awards for papers in many fields, both from inside and outside of Japan.

- Winner of the Incentive Paper Award of the Japan Society of Civil Engineers for FY 2022 (June 2023)



- Winner of the Excellent Lecture Award in the Research Discussion Meeting of the Japanese Association for Coastal Zone Studies (November 2024)

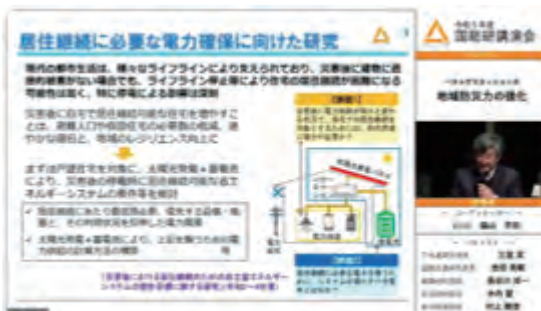
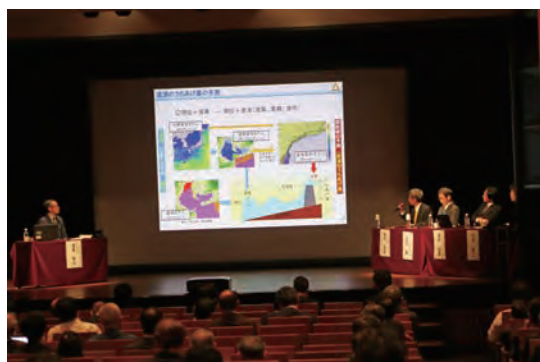


and others

Lectures

NILIM Lectures

NILIM Lectures are held annually to introduce the activities of NILIM such as presenting its research outcomes and making recommendations to solve technology-related policy challenges.



NILIM Lecture Meeting (December 2023)

Materials of the lecture meetings and lecture videos until the present are available on the websites of NILIM.

NILIM also holds specialist lecture meetings and symposiums in each field whenever necessary.



Lectures on demand

Lectures on demand are held with the aim of having NILIM researchers go directly to schools etc. to explain research contents and answer questions while holding open communications with people. (Results in FY 2023: 46 cases)

Please visit our website for more information.

* Online lectures are also available in order to prevent the spread of COVID-19.



View of a lecture



Open house

Open houses are held to introduce NILIM facilities and research projects to visitors.

Please visit our website for more information.



FY 2024
Open house schedule
• Tsukuba Little Scientists:
August 2 (Fri.)
• Civil Engineering Day:
November 16 (Sat.)
(• Science & Technology
Week: April)

A scene of the open house
(Civil Engineering Day 2023)



Facility tour/study tour

Facility tours are held to introduce NILIM facilities and research projects to visitors (for the general public/for those related to local governments).

Please visit our website for more information.

- Facility tour (for the general public)



- Study tour (for those related to local governments)



Scene of study tour implementation



Recruiting activities

NILIM is recruiting people who work with us to realize a safe, reliable, vibrant, and attractive national land and society.

Please visit our website for more information.




Introduction to facilities


Asahi Office Tachihara Office

Asahi Office and Tachihara Office are in Tsukuba City, and numerous experimental facilities are deployed in the enormous compounds.

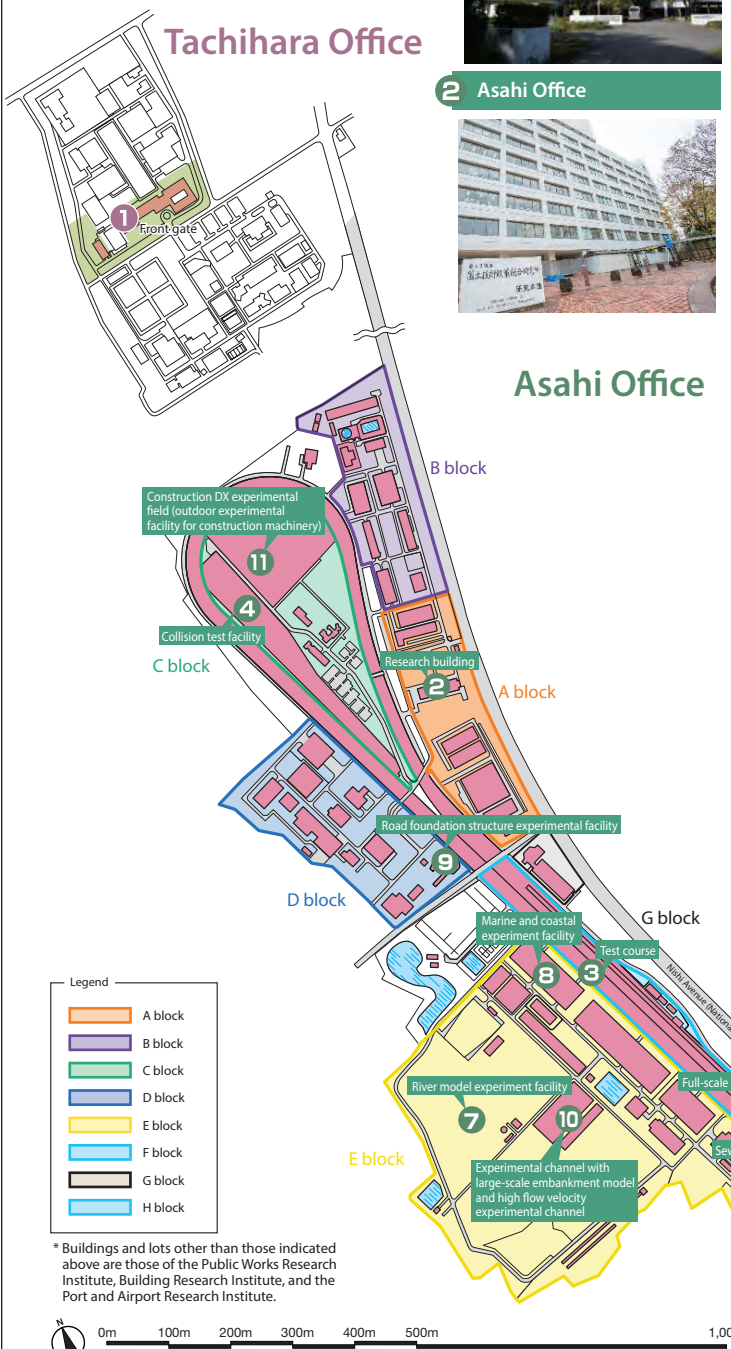
1 Tachihara Office



2 Asahi Office



Asahi Office




Legend

- A block
- B block
- C block
- D block
- E block
- F block
- G block
- H block

* Buildings and lots other than those indicated above are those of the Public Works Research Institute, Building Research Institute, and the Port and Airport Research Institute.

3 Test course

Test course with the length of 6,152 meters. Tests are carried out on road drivability, safety, road-to-vehicle coordination technology, etc. Findings are reflected in road-related technical standards such as the Road Structure Ordinance.




Specifications

- Total length: Approx. 6.2 km
- Number of lanes: 3
- Curve section
- North loop design speed: 100 km/h
- South loop design speed: 120 km/h

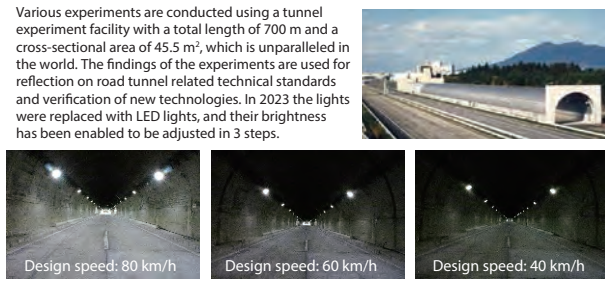
4 Collision test facility

In this experimental facility, vehicles are crashed into traffic safety facilities such as guard fences (guardrail, etc.), to develop, improve, and examine the functions of such traffic safety facilities. Vehicles are moved using the power of winches so that it can accelerate unmanned. The facility is used for the experiments necessary for the revision of technical standards such as setting the strength performance of guard fences and examining their structure and specifications. It is also used for experiments by the private sector for the development and improvement of new types of guard fences.



5 Full-scale tunnel experiment facility


Various experiments are conducted using a tunnel experiment facility with a total length of 700 m and a cross-sectional area of 45.5 m², which is unparalleled in the world. The findings of the experiments are used for reflection on road tunnel related technical standards and verification of new technologies. In 2023 the lights were replaced with LED lights, and their brightness has been enabled to be adjusted in 3 steps.



Design speed: 80 km/h Design speed: 60 km/h Design speed: 40 km/h

LED lightings adjustable in 3 steps

Videos of various experiments conducted at the NILIM and information videos are available on the NILIM YouTube channel.



Rental of research facilities at the Asahi Office

Research facilities of NILIM can be rented for a fee by outside organizations within a range that does not obstruct the operations of NILIM.

Inquiries: Planning and Research Administration Department, Research Facilities Division

Email address: nil-shisetsu-rental@gxb.mlit.go.jp

Reference website: <https://www.nilim.go.jp/lab/bbg/rental/rental.html>

Yokosuka Office

1 Yokosuka Office

The main building was completed in April 2004. It has a light court in an atrium to allow natural ventilation and natural lighting to enter the research laboratories. The building also has solar panels and rooftop greening. These and other features are designed to protect the global environment.



2 Typhoon experiment wind wave channel

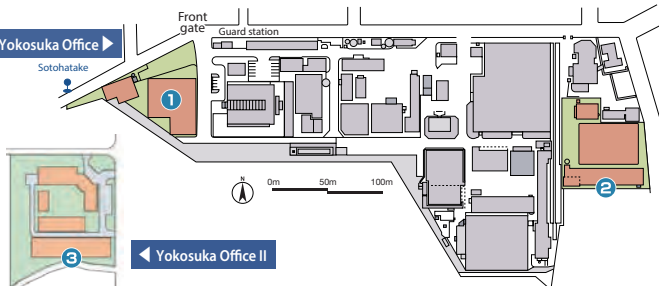


This is one of the largest wind wave channels in Japan where model tests on storm surges, high waves, strong winds, and tsunamis are conducted. We are conducting research to protect large cities and ports from natural disasters using a wind blower, a wave maker, and a pump to generate typhoon-level winds, waves, and currents.

In recent years, model experiments are implemented to study wind resistance measures and anti-floating measures for containers during a typhoon.

3 Airport Pavement Test Field

Test pavements are constructed in an outdoor field to confirm long-term durability, deformation resistance, and other properties of materials used in airport pavement.



6 Sewers experimental facility

This full-scale experimental facility can artificially reproduce various defects such as joint misalignment and cross-sectional cracks, which occur in sewers. Under uniform conditions, the performance of inspection equipment can be examined and comparatively evaluated more safely and efficiently than conducting experiments with sewers in use.



7 River model experiment facility

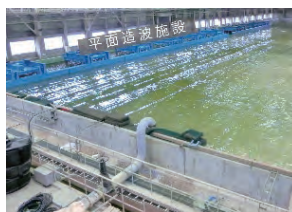


This is a sprawling 15-hectare facility located outdoors. Up to 15 river models can be set up on the site.

For example, the hydraulic model of Arakawa No. 2 and No. 3 Regulating Ponds is a large-scale model that is 180-meter long and 40-meter wide. Using the 1/50 scale reproduction of river topography such as the Iruma River confluence and levee shapes, researchers are checking how river water flows into a regulating pond and how the water spreads after entering the regulating pond by conducting experiments.

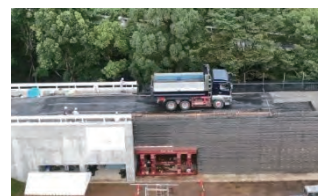
8 Oceanic and coastal experiment facility

This facility is used for hydraulic model experiments concerning coastal protection in order to protect the lives of people from the danger of storm surges, high waves, tsunamis, and coastal erosion.



9 Road foundation structure experiment facility

This facility reproduces damage to roads (such as the generation of road surface bumps) and uneven subsidence during earthquakes to verify road technology that is resistant to ground deformation.



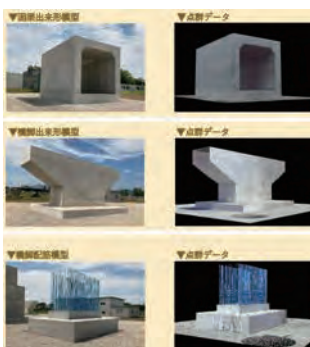
10 Experimental channel with large-scale embankment model



The experimental channel with a large-scale embankment model uses models close to actual size to study the external forces acting on river structures such as levees and their failure mechanisms and to study rational design methods for river structures.

In recent years, researchers are conducting overflow experiments by creating a levee model with the height of 4 meters to study the structure of persistent river levees that are resistant to collapse even when overtopped by water. Based on findings gained at this experimental channel, we created the Technical Reference for Examining the Structure of Persistent River Levee (draft).

11 Construction DX experimental field



The construction DX experimental field is a research facility aimed at promoting digital transformation (DX) in the infrastructure sector. This facility consists of full-scale complete-shape models to develop technologies for construction management and inspection of structures using technologies, including 3D measurement technology, and an earthwork field to develop technologies for unmanned construction and automatic/autonomous construction using 5G and other tools.

* Other facilities include a sediment hydraulic test channel, a river hydraulic model test facility, a high velocity test channel, and a full-scale aeration test facility.



Ministry of Land, Infrastructure, Transport and Tourism National Institute for Land and Infrastructure Management

NILIM is the acronym for the National Institute for Land and Infrastructure Management.

The triangle indicates three fields covered by the former organization: the field related to rivers and roads, the field related to the city and housing, and the field related to ports and airports. The logo represents our commitment to be in charge of housing and social infrastructure development through the cooperation of these three fields. The orange color represents our expectations that the National Institute for Land and Infrastructure Management will make many contributions to national land policy and create a bright Japan in preparation for the coming age of the 21st century.

List of NILIM social media



Access

