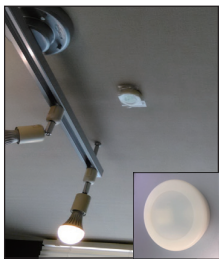
NILIM News Letter
No.67
2019

Aiming to establish a method to visualize barrier-free effects based on life stage

Housing Department, Housing Production Division

We are examining technologies that may lead to barrier-free solutions based on citizens' life stages, visualizing the ease of performing activities in the living environment while using the amount of physical activity as an indicator.

With a super-aging society, making homes barrier-free has become a pressing matter in Japan. In reality, while quite a lot of progress toward barrier-free designs can be seen in new buildings in recent years, existing homes, on the other hand, tend to undergo only individual repairs, with even the installation of simple handrails being covered by nursing insurance (90% of 200,000 yen), for example.



The iBeacon by itself (bottom-right) and installed on the ceiling

Additionally, for repair works that are reasonable from the point of view of barrier-free designs, it is indispensable that their results can be visualized as they alleviate activity and nursing burdens in daily life, as well as repair and nursing costs.

With this in mind, in 2018 we started a 3-year project at NILIM to develop this subject under the title "Establishing a method to visualize barrier-free effects based on life stage".

The aim is to evaluate the barrier-free capacities of homes, using METS (metabolic equivalents) as an indicator of the amount of physical activity to visualize the ease of performing activities in the living environment.

In the first year, we are conducting an investigation by using a physical activity monitor and iBeacon, a device that records where residents are at any given moment as well as the time, to monitor the actual state of their daily lives (places where they stay, period of stay, number of visits to the place, physical activity, etc.). The picture here shows a preliminary experiment at the house of this article's author.

In the second year, we plan to build a barrier-free environment evaluation program from the monitoring data obtained, and to propose barrier-free repair projects that are based on life stage.

Also, in this research, we are working to efficiently spread the results by collaborating and sharing information with members of related academic societies, etc.

Measurement of the amount of activity while cleaning, as well as location and time spent, with a smartphone capable of receiving signals from both the iBeacon and the physical activity monitor attached to the waist

Current state and changes in roadside trees across Japan

Research Center for Infrastructure Management Landscape and Ecology Division

We have gathered and published the latest survey results (as of March 31, 2017) regarding the current state and changes in roadside trees across Japan.

In order to sustain road greening measures that address the state of times we live in, with the diversification of Japanese citizens' needs and vast changes in socioeconomic conditions, the NILIM has conducted a nationwide survey every 5 years since 1987 to grasp the actual situation of road greening.

The total number of roadside trees in Japan is around 6,700,000 (trees managed to grow to 3 meters or taller). Looking at the changes every 5 years, we can see this number has grown consistently between 1987 and 2002, leveling off thereafter (Fig. 1).

Analyzing the data by prefecture, Hokkaido, which has an extensive road network, has the largest amount of trees, followed by the metropolitan areas of Tokyo, Hyogo, Aichi, and Osaka, making apparent the results of the strong demand for road greening functions (landscape improvement, shade tree formation, environmental preservation, etc.) in urban areas with many pedestrians and intense road traffic.

As for the number of trees by species, among the 545 species found across Japan, ginkgo is the most numerous, followed by different types of cherry trees, and then by Japanese zelkova, flowering dogwood, and trident maple (Fig. 2). These species likely appear at the top of the list because of their strength, for example, seeing how they grow relatively easily even in places as unsuitable for plant development as alongside urban roadways, and how they can germinate even after the heavy pruning that may occur in order to bring them in line with the space allowed for growth; or because of the beauty of their flowers or autumn foliage, which can add color to the cityscape.

Based on the results of this survey, we hope to organize efficient and effective methods to manage and maintain roadside trees, and to continue contributing to urban planning that is greener and more pleasant.

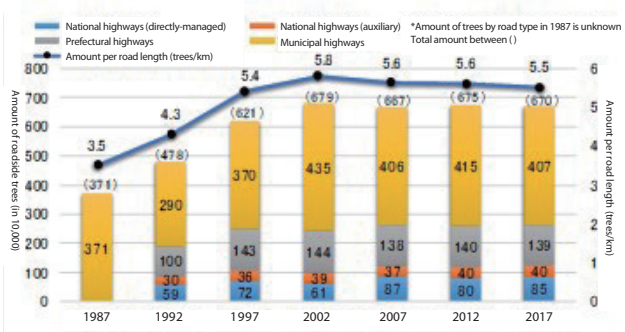


Fig. 1 Amount of roadside trees in Japan

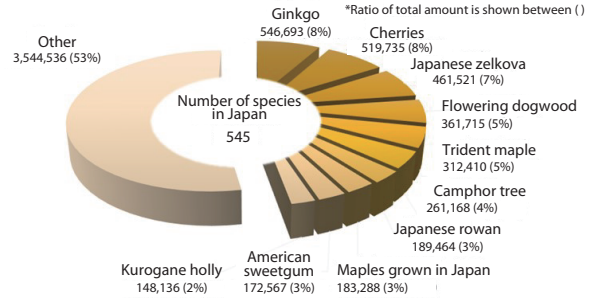


Fig. 2 Amount of roadside trees in Japan per species

Details ☛ NILIM website: "NILIM Research Materials, 1,050th Edition"
http://www.nilim.go.jp/lab/bcg/siryou/tnn/tnn1050.htm

Revolutionary wastewater management technology - With effective down-sizing, cost and energy demands are greatly reduced

Water Quality Control Department Wastewater and Sludge Management Division

We have performed empirical research on water treatment techniques that make it possible to reduce cost and energy demands in response to a reduced amount of inflow caused by population decline, and we have formulated draft guidelines for the introduction of this revolutionary technology.

The amount of wastewater produced by homes, etc. (volume of inflow to treatment facilities) has diminished due to population decline and current efforts to conserve water, which not only reduces revenue from wastewater fees, but also lowers treatment efficiency at wastewater treatment plants. This happens because the capacity of most machinery in wastewater treatment methods employed up to now is determined according to the volume of the water tank (civil engineering structure) used to treat sewage, and even if the amount of flow diminishes, it is difficult to reduce only the capacity of machinery when replacements are carried out, since their lifespan is shorter than that of civil engineering structures.

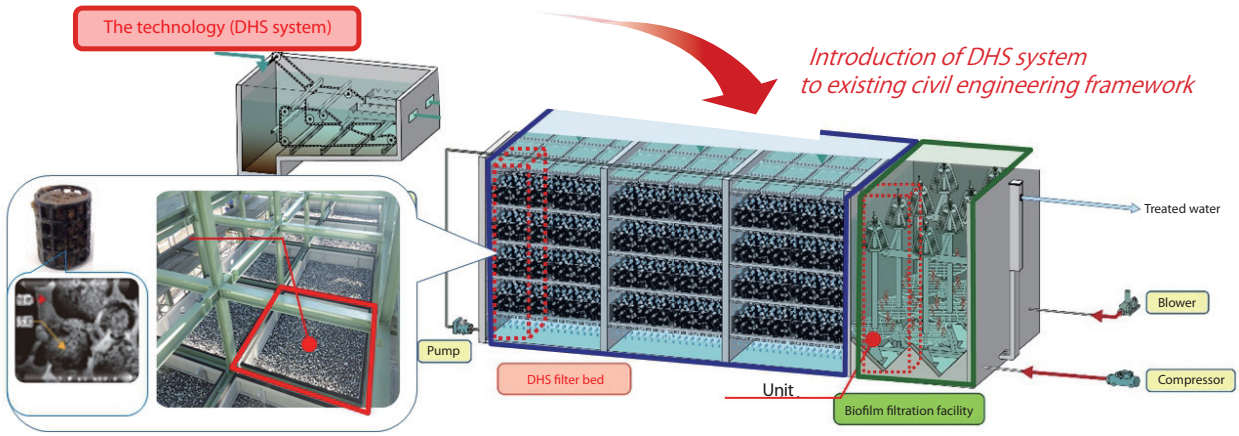
For this reason, as part of the B-DASH Project, we have conducted empirical research to evaluate wastewater treatment plant technologies by building and operating facilities of the same scale as actual plants as Susaki, Kochi, considering a "water treatment technology following water amount fluctuation and utilizing DHS system" (hereafter referred to as "revolutionary technology").

The DHS system refers to water treatment technology that serves as an alternative to conventional activated sludge processes, combining a DHS (Down-flow Hanging Sponge) filter bed and a biofilm filtration facility.

As a result of the NILIM's empirical research, trial calculations have shown that it is possible to reduce life cycle cost by 37% and greenhouse gas emissions by 76% in comparison with the conventional activated sludge process, which is one of the conventional wastewater treatment methods, while securing standard quality for treated wastewater. Also, the experiments have shown that this revolutionary technology is easy to manage and maintain, making it an especially effective solution for suburban cities where the workforce has diminished noticeably due to population decline.

Furthermore, based on the empirical research results, in December of last year we formulated guidelines organizing contents regarding the consideration of simple introduction of the system, as well as its installment, maintenance and management, to serve as a reference for wastewater operators considering introduction of this revolutionary technology. By utilizing these guidelines to foster the introduction of the technology, we expect to contribute to improvement of operation of sewage works.

More information ☛ NILIM homepage (press release materials of January 10, 2019)
http://www.nilim.go.jp/lab/bcg/kisya/journal/kisya20190110.pdf



Overview of DHS system, where downsizing is simple since capacity can be adjusted according to the number of units

Improving productivity in airport ground support services - Aiming to introduce self-driving technology to GSE

Airport Department, Airport Planning Division

Here we introduce ongoing efforts aiming to introduce self-driving technologies to the variety of ground support equipment (GSE) being used at airports.

Following the increase in air passenger demands and in the number of flights, the shortage of aviation business personnel has become an issue. In particular, the scarcity of employees for ground support services (ground handling) is severe, making it difficult to operate in accordance with airline companies' desired schedules.

For this reason, the MLIT's Japan Civil Aviation Bureau (JCAB) is working under public-private partnerships to introduce advanced technology aimed at making ground support services more efficient. As one of these measures, efforts are being made to introduce self-driving technology to GSE such as the buses and towing tractors that are necessary for aircraft operation.

The JCAB has made a public invitation this year for private business wishing to perform practical experiments at actual airports, to which eight groups responded, leading to ongoing tests with self-driving vehicles alongside manned GSE being driven during operating hours at the airports of Sendai, Narita, Haneda, and Chubu.

Left: Bus operation

Right: towing tractor carrying out air cargo

Based on the state of implementation of the JCAB's practical experiments, the NILIM is currently developing self-driving simulation models in order to verify aspects such as the effects upon introduction, influence on other manned vehicles, facility structure, and safety in the case where self-driving GSE comes to be employed. This year we are utilizing actual operation data for each GSE to verify reproducibility of GSE operation simulations, and from next year we plan to inspect in detail the effects of having self-driven vehicles alongside manned vehicles in accordance with development trends for self-driving technologies, as well as possible issues that may arise and relevant countermeasures.

NILIM Lecture Meeting 2018

Planning and Research Administration Department, Planning Division

This year's "NILIM Lecture Meeting" had "disaster prevention and mitigation" as its main theme, and it included a special lecture by Mr. Takatoshi Hashitsume, the Head of NHK's Disaster and Weather Center, a panel discussion by NILIM's researchers, general lectures, and poster exhibition.

The "NILIM Lecture Meeting" is held every year with the objective of introducing to the public at large, via lectures and reports, the latest research results and research trends at NILIM.

The main theme this year was "disaster prevention and mitigation", with the event being held on December 4, 2018 at the Japan Education Center (Hitotsubashi Hall) in Hitotsubashi, Chiyota, Tokyo.

Special lecture by speaker Mr. Hashitsume

The special lecture, entitled "The evolution of disaster news coverage: Aiming for a press that protects lives and livelihoods", was given by the Head of NHK's Disaster and Weather Center, Mr. Takatoshi Hashitsume.

Afterward, research status on disaster prevention and mitigation technologies, as well as efforts toward disaster management at NILIM were introduced to the public in a panel discussion held under the title "How should we confront large-scale disasters?"

On the day of the event there were 767 participants, mainly consisting of people from private businesses and local public bodies involved in civil engineering or architecture.


Poster exhibition regarding main activities at NILIM

The participants shared some of their thoughts on the special lecture as follows: "The use of actual examples and video made it easy to understand", "Thanks to this lecture, I was able to start thinking about the type of 'information' that can be linked to the evaluation of citizens". One participant commented on the panel discussion as follows: "It was easy to grasp the contents of the debate, since it followed a chronological order starting from the initial response system to disasters, and because the topics related to each field of expertise were extremely well organized".

Also, this lecture meeting saw the addition of a poster exhibition, where explanations regarding "the focus of NILIM's main efforts in 2018" were provided mostly by young researchers.

Videos of the lectures and presentation data (slides), along with the posters that were exhibited, are available on the NILIM's website. Please feel free to take a look.

Details ☛ NILIM website: "National Institute for Land and Infrastructure Management Lecture Meeting 2018"
http://www.nilim.go.jp/lab/bbg/kouenkai/kouenkai2018/kouenkai2018.htm

Overview of NILIM's supplementary budget for 2018

Planning and Research Administration Department, Planning Division Administrative Coordination Department, Planning and Coordination Division

As the second supplementary budget of 2018, NILIM allocated a sum of 2.5 billion yen for expenses with, for example, investigative research to improve national resilience based on the results of an emergency inspection of vital infrastructure.

Recent disasters such as the heavy rain of July 2018, Typhoon No. 21 of 2018, and the 2018 Hokkaido Eastern Iburi Earthquake led to damage caused by river sediment and water flooding, by inundation due to high tides and waves, and by soil liquefaction resulting from sediment runoff.

Based on the results of an "emergency inspection of vital infrastructure" implemented in response to these disasters, the NILIM allocated, as its second supplementary budget of 2018, the largest resources to date for expenses with facility development and investigative research in order to examine countermeasures and clarify the disaster-response mechanisms.

List of implemented items

• Investigative research (6 topics, budget of 1.519 billion yen)

Topic	Overview
Making infrastructure liquefaction damage estimation methods highly accurate	Development of highly accurate liquefaction damage estimation methods for infrastructure, etc., taking into account detailed seismic motion based on 3D ground models, in order to consider priority order of countermeasures for liquefaction of infrastructure, etc.
Trend analysis and data gathering regarding pipelines damaged by liquefaction and other disasters	Trend analysis and data gathering for sewage pipelines damaged by the 2018 Hokkaido Eastern Iburi Earthquake, and recording of damage data in existing database.
Consideration of groundwater level real-time surveillance methods	Analysis of investigation regarding damage risks to earth-fill levees due to rising groundwater level, and consideration of groundwater level surveillance methods from the point of view of levee management.
Creation and provision of a risk map for complex disasters involving earthquakes and floods	Development of easy-to-understand risk display methods and of scenario-setting methods for complex disasters involving, for example, occurrence of floods due to heavy rain after an earthquake.
Research concerning the development of wave run-up surveillance technologies based on a crisis management model	Development of coastal wave run-up surveillance technologies in order to facilitate prompt evacuation of citizens from high tides and waves caused by typhoons.
Development of an flood prediction system for disaster mitigation countermeasures in the case of complex flood disasters due to both high tides and heavy rain	Development of a prediction system for complex flood disasters due to both high tides and heavy rain in order to allow smooth pre-evacuation of citizens from high tides.

Details ☛
1) NILIM website (press release materials of December 21, 2018)
http://www.nilim.go.jp/lab/bcg/kisya/journal/kisya20181221-2.pdf
2) Ministerial conference on the emergency inspection of vital infrastructure (Prime Minister's Official Residence website)
http://www.kantei.go.jp/jp/singi/jyuyouinfura/index.html

• Facility development (5 experiment facilities, budget of 984 million yen)

Facility name	Overview
Facility to investigate the effects on sewage pipes of liquefaction caused by sediment runoff	Development of an experiment facility to enable reproduction of liquefaction caused by sediment runoff in order to examine the effects on sewage pipeline facilities in the case of liquefaction caused by sediment runoff.
Facility to inspect road base structure peculiarities	Development of an experiment facility to allow reproducing pavement deformation due to liquefaction in order to, for example, develop followable pavement or evaluate vehicle transitability after liquefaction.
Test field for electric pole elimination technologies	Development of a test field for verification and evaluation of disaster prevention capabilities and constructibility in order to advance the utilization of new electric pole elimination technologies in actual roads.
Upgrade of river model experiment facilities	Functional upgrade of existing facilities to allow reproducing a large volume of sediment influx, in order to elucidate how water flooding due to large volume of sediment influx into rivers occurs, and to consider plans for alleviating related damage.
Experiment facility for debris flow / slope failure	Development of an experiment facility to allow reproducing and analyzing the process from when a debris flow starts until the occurrence of sediment and water flooding, or the fluidization process of earth and soil collapsed after an earthquake or heavy rain.

Publications (research results)

Download here ☛ http://www.nilim.go.jp/lab/bcg/siryou/index.htm

NILIM Research Reports

No.	Title	Department/Division
61	Research concerning standards for residential conditions in share house-type rental housing based on the utilization of existing stock (Draft)	Housing Department

NILIM Materials

No.	Title	Department/Division
1038	Development of life cycle cost calculation tool for coastal protection facilities	Coastal Disaster Prevention Division
1039	Influence of typhoon parameters on estimates regarding storm surge flowing into the three major bays	Coastal Disaster Prevention Division
1040	Probability evaluation of expression relating radius of maximum wind and typhoon's central pressure	Coastal Disaster Prevention Division
1041	Analysis of trends in demand for cruise ships calling at Japanese ports and consequent effects	Port Systems Division
1042	Report on damages to port facilities, etc. due to the Kumamoto earthquake of 2016	Port and Harbor Department
1043	A study on improving accuracy of deterioration predictions for mooring facilities	Port Construction Systems and Management Division
1044	Analysis by air route of the amount of domestic flow of foreigners visiting Japan	Airport Planning Division
1045	Consideration of flatness evaluation of asphalt paving in airports utilizing BBI (Boeing Bump Index)	Airport Facilities Division
1046	Report on collaborative research concerning evaluation of the influence of initial deformations in pre-stressed concrete bridges and countermeasures (Part 2)	Bridge and Structures Division
1047	Inspection of consideration of improvement methods based on depth increase improvement of gravity-type quay walls (Part 2)	Port Facilities Division
1048	Guidelines regarding considerations of construction of sabo facilities as countermeasure for sediment and water flooding utilizing riverbed variation calculation (Draft)	Sabo Planning Division
1049	33rd report of the Landscape and Ecology Division, National Institute for Land and Infrastructure Management (Ministry of Land, Infrastructure, Transport and Tourism)	Landscape and Ecology Division
1050	Japan's Roadside Trees VIII	Landscape and Ecology Division
1051	B-DASH Project No. 21 Guidelines for introduction of water treatment technology following water volume fluctuation and utilizing DHS system (Draft)	Wastewater and Sludge Management Division
1052	Analysis of actual harborage conditions of vessels in Osaka Bay at the time of Typhoon No. 21 of 2018 utilizing AIS data	Port Planning Division
1053	Trial calculations regarding the effects of trade conflicts caused by United States Trump administration's protectionist trade policy on seaborne freight volume	Port Systems Division
1057	NILIM report regarding the "Evaluation of Research and Development Institutions" (2013-2017)	Research Administration and Evaluation Division
1058	B-DASH Project No. 23 Guidelines for the introduction of technologies to convert sewage sludge to fuel and fertilizers based on a dewatering and drying system (Draft)	Wastewater and Sludge Management Division
1061	B-DASH Project No. 24 Guidelines for the introduction of self-heat recuperation model, heat pump-type high-efficiency sewage sludge drying technologies (Draft)	Wastewater and Sludge Management Division

Receive information on research performed at NILIM

- NILIM email service
  Twice a month, we deliver the latest information introducing various research activities conducted by NILIM and lecture meetings, etc. Register here (URL and QR code) ☛ http://www.nilim.go.jp/lab/bcg/mailmag/index.html

- 2018 Annual Report of NILIM
  This website introduces NILIM research activities and achievements, as well as details of the latest research activities to be formally initiated in the future. Go to this website: ☛ http://www.nilim.go.jp/lab/bcg/siryou/2018report/index.htm

Please take our reader survey: http://www.nilim.go.jp/lab/bcg/siryou/newsletter/nwslttr.htm

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