

### Four selected fields and twelve research topics for the creation of the future society

Planning and Research Administration Department, Planning Division

In FY 2015, the NILIM will conduct research with priority on four fields. We skillfully apply advanced technologies of civil engineering and architecture in order to respond to social needs and to resolve problems in the fields. Major research topics in each field (total of 12 topics) are introduced below.

#### [1. Infrastructure Maintenance]

We will conduct research to develop methods to evaluate soundness of road structures, and to design repair and retrofitting for them considering actual strength of materials and traffic conditions, and sewer pipe survey and condition assessment methods, in order to keep people's daily lives secure and safe even as infrastructures deteriorate.

- [1] Develop methods to evaluate soundness, and to design repair and retrofitting road structures
- [2] Research to support asset management for sewer pipes
- [3] Research to advance runway pavement inspection and repair technologies (improving precision and shortening time)

#### [2. Disaster prevention and mitigation, and risk management]

To protect human lives from floods, sediment disasters and tsunami, we will develop technologies to support residents' evacuation, including inundation prediction systems applying observed and predicted information obtained by a new type of radar etc., and tsunami observation techniques applying oceanographic radar.

- [4] Development of super short-term inundation warning information systems for people in underground space
- [5] Research on high precision sediment disaster occurrence prediction methods applying real time observation and monitoring data

- [6] Development of safety evaluation methods and repairing and retrofitting technologies for buildings struck simultaneously by strong seismic motion and fire

- [7] Research to improve safety from tsunami in port areas

#### [3. Intelligent use]

We will develop technologies to more effectively and intelligently use existing road networks, port and harbor facilities, and urban districts, such as clarifying movement during disasters, preventing congestion, and conducting logistics more efficiently through the use of ETC2.0.

- [8] Research on road information innovations to use roads "more intelligently"
- [9] Development methods of quantitatively evaluating diverse energy saving design technologies for housing envelope characteristic of various regions
- [10] Development of methods of evaluating low carbon urban planning by improving thermal environments of cities through the use of greenery
- [11] Development of container vessel route network prediction methods in response to structural change of ocean transport

#### [4. Execution procedure's innovation]

To execute public works projects more efficiently by innovating construction production systems, we will conduct research on new public works execution procedures through government-private sector cooperation.

- [12] Research on new public works project execution procedures through government-private sector cooperation.

Details ● Press release on April 27, 2015 (NILIM Web Site)

<http://www.nilim.go.jp/lab/bcg/kisya/journal/kisya20150427b.pdf>

### Software development to support the creation of liquefaction hazard maps

Urban Planning Department, Urban Planning Division

The Division has developed housing land liquefaction hazard map technology to help regional public bodies provide liquefaction information. The software can be obtained by applying to the NILIM web site.

In response to damage to housing and public infrastructure by wide-spread liquefaction phenomena caused by the Great East Japan Earthquake of March 2011, the National Government has revised liquefaction damage possibility estimate methods in the "Technical Guidance for Estimating Liquefaction Potential of Housing Lands" (April 2012). To be able to easily perform liquefaction estimates based on the technical guidance, the NILIM has developed an Excel-based calculation sheet and provided it on the NILIM Housing Land Disaster Prevention web site where it is downloadable.

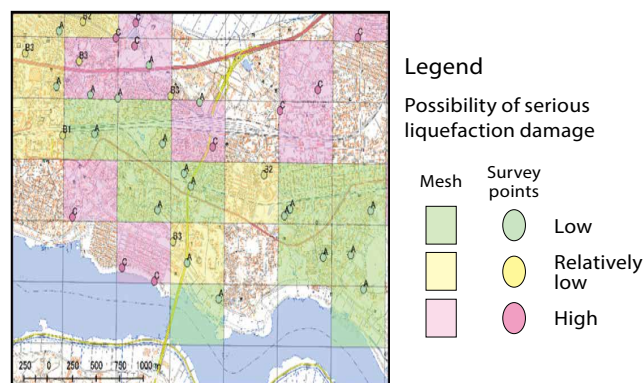


Figure: Sample display of a housing land liquefaction map

The NILIM has developed software that applies this calculation sheet to create housing land liquefaction maps based on judgments under the above technical guidance. This software displays the possibility of liquefaction damage on a map in three ranks in mesh units 250m or 500m as determined by judgments of the possibility of liquefaction damage at survey points obtained by entering past boring survey results to the calculation sheet. It can also be used to update wide area and high survey density liquefaction maps of object areas by adding new boring survey results.

An application to obtain this software can be submitted through

the NILIM Housing Land Disaster Prevention web site. The use of this software is counted on to further advance the creation of housing land liquefaction maps by regional public bodies and expand the provision of information concerning the possibility of liquefaction damage to residents etc. and to advance countermeasures to protect housing land from liquefaction.

**Details** • NILIM “Housing Land Disaster Prevention” web site  
<http://www.nilim.go.jp/lab/jbg/takuti/takuti.html>

## ■ Collision experiments using actual vehicles to test guard fences for community roads

Road Traffic Department, Road Division

The division has created a prototype small section guard fence to improve safety on community roads and confirmed its performance by performing collision experiments using actual vehicles.

In recent years, the number of fatalities caused by traffic accidents in Japan has been falling, but deaths of pedestrians and cyclists account for half of these fatalities, and the per capital rate of such fatalities is relatively high among industrialized countries. And about half of fatal accidents that claim the lives of pedestrians etc. occur within 500m of the victims' homes.

Based on such statistics, the NILIM is conducting research to develop new kinds of guard fences to efficiently take traffic safety countermeasures on community roads. Collision experiments using actual vehicles to test prototype guard fences were carried out in February 2015.

The features of the prototype guard fences that were made are broadly categorized as two points.

- ① Because one characteristic of traffic on community roads is a low percentage of large vehicles, their design strength withstands the impact of medium-size vehicles. (Generally, guard rails are provided with design strength that withstands the impact of large vehicles.)
- ② Its structure features a section width that is more compact than normal guard rails, so it can be installed easily on narrow community roads.

The experiments were performed at a collision test facility at the



Photo: View of a Collision

NILIM by having medium size vehicles with total weight of 8 tons collide with the guard fence at an angle of 10 degrees while traveling at a speed of 40km/hour. The results confirmed that while the guard fences were deformed about 10cm towards the sidewalk, they prevented the vehicles from penetrating any further into the sidewalk area, so that they can protect pedestrians under this condition.

In the future, this study will continue in order to introduce guard fences for community roads on actual roadsides.

**Details** • Road Division web site

(A video of the experiments can be viewed at this site.)

<http://www.nilim.go.jp/lab/gbg/kenkyu/20150210syoutotsujikken/20150210jikkendouga.pdf>

## ■ Advancing Earthquake Research -- Publication of the Damage Database of Sewer Pipes Damaged by Past Earthquakes

Water Quality Control Department, Wastewater System Division

In order to advance earthquake resistance and enact BCP for wastewater facilities by local governments, and to facilitate research by earthquake researchers, the Division has created a Sewer Pipe Earthquake Damage Database of information useful as reference information to improve pipe damage prediction precision and judge seismic retrofitting priorities and has opened the database for use by the public.

The ratio of completed earthquake resistance retrofitting of important sewer pipes is low at about 44% (end of 2013), resulting in severe damage by the recent Great East Japan Earthquake. There is, therefore, an urgent need to encourage earthquake resistance work to prepare for large earthquakes such as the Nankai Trough related earthquake that is predicted to occur in the near future or for



Photo: Manhole pushed up by Liquefaction

a large earthquake directly under the Tokyo region.


But earthquake resistance improvement of facilities requires a large budget and considerable time. Therefore, It is important to appropriately combine “damage prevention” with “damage mitigation” in the analysis of past damage data, to implement earthquake resisting countermeasures efficiently and effectively to minimize damage.

Local governments are advancing earthquake resistance improvement of sewer pipes, but they have no information about damage to facilities caused by past earthquakes so it is difficult for them to predict the likelihood or scale of damage and to decide priority countermeasure locations.

The NILIM is now conducting research on rational planning of earthquake resistance improvement works, and through the process of this research, has collected varied data about damage to sewer pipes. These data have already been released to the public as a

data base, because they can be used to study earthquake resistance improvement countermeasures by regional public bodies or researchers whose goal is secure and safe urban development.

The data base that has been released for public use contains information about damage to sewer pipes on approximately 5,000 spans (pipes upstream from, downstream from, and between manholes) caused by the Noto Peninsula Earthquake (2007), the Niigata Prefecture Offshore Earthquake (2007), the Great East Japan Earthquake (2011), and the Nagano Prefecture North Earthquake (2011). The damage information includes pipeline specification data (soil cover, pipe diameter, manhole type, etc.), earthquake related data (seismic intensity, SI value, microtopography categories, etc.), and pipeline damage data (state of damage).

Details  Wastewater System Division  
[http://www.nilim.go.jp/lab/ebg/zishin\\_db.html](http://www.nilim.go.jp/lab/ebg/zishin_db.html)

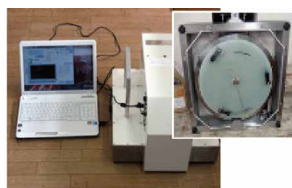
## ■ Study on Measuring method of Friction Coefficient for Runway Surface

Airport Department, Airport Construction Systems Division

To more easily measure the friction coefficient of runway surfaces at airports that has been done in the past by driving a Surface Friction Tester (SFT) at high speed (95km/h) over the runway, the applicability of driving the SFT at 65km/h and using a DF tester is being studied.



SFT  
(Surface Friction Tester)



DF tester

The adhesion of tire rubber on runways and the decline of their surface drainage properties are accompanied by the decline of the runway surface friction coefficient, which causes problems ensuring safety of aircraft when taking off and landing on runways. The International Civil Aviation Organization (ICAO) requires that target runway surface friction coefficient values be set and publicized so that every airport must regularly perform measurements to manage its friction coefficient, but it is necessary to simplify this measurement in order to ensure their ability to obtain measuring instruments and personnel to operate them. To drive an SFT (95km/h) at high speed on a runway at night when visibility is poor requires a high level of technical experience, so it is difficult for airports to make this measurement frequently. We have, therefore, studied measurements by lower speed (SFT

(65km/h)). We have also studying the applicability of the relatively widely used road friction coefficient measurement device (DF type) to runways.

In 2014, we performed runway surface friction coefficient measurements on the runway at Tokyo International Airport using SFT (95km/h and 65km/h) and a DF tester (50km/h) and studied the correlations between the measured friction coefficients obtained by each instrument.

The measurement results confirmed that there are correlations between SFT (95km/h) and SFT (65km/h) and between SFT (95km/h) and the DF tester (50km/h).

In the future, we will perform measurements at multiple airports under differing conditions to prepare to introduce 65km/h travel by SFT and using DF testers to confirm their applicability to runways.

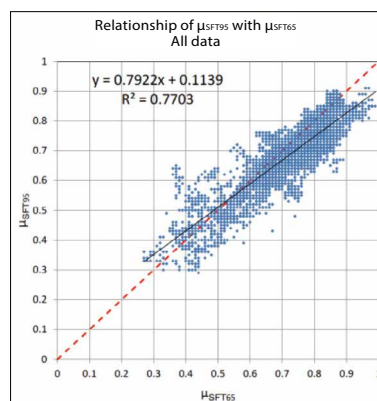


Figure: Correlation of Friction Coefficients  $\mu$

## ● Publication (research achievements) < March, 2015-May, 2015 >

Download from here  <http://www.nilim.go.jp/lab/bcg/siryuu/index.htm>

### RESEARCH REPORT of NILIM

No.	Title of Paper	Names of Divisions
56	Study on the Planning Method of the Elderly Housing with Life Support Service	Research Coordinator for Housing Performance

**PROJECT RESEARCH REPORT of NILIM**

No.	Title of Paper	Project Leaders
47	Development of Building Seismic Performance Evaluation Technologies in Response to the Advance of Earthquake Motion Information	Director of the Building Department
48	Research on facilitation measures for expanding international ferry transport services in Asia	Director of the Port and Harbor Department

**TECHNICAL NOTE of NILIM**

No.	Title of Paper	Names of Divisions
814	Reconnaissance Report on Damage to Road Bridges by the 2011 Great East Japan Earthquake	Bridge and Structures Division
815	Tsukuba Science City's Problems on Formation Process through a Present State and Subjects	Urban Development Division
816	Damage to Ports and their Surrounding Areas in the Philippines due to Storm Surge and Waves of 2013 Typhoon Haiyan	Coastal Disaster Prevention Division
817	A Logit Model of Cargo Flow of International Ferries and RORO ships	Port Systems Division
818	Study on Relationship between Lift-thickness and Mat Density of Airport Asphalt Pavement's Surface Course	Airport Facilities Division
819	Report for the joint research on the next generation Cooperative ITS	Intelligent Transport Systems Division
820	US-Japan Collaborative Research on Probe Data: Assessment Report	Intelligent Transport Systems Division
821	Report of the 1st Evaluation Committee of NILIM in FY 2014	Research Administration and Evaluation Division
822	Annual Report of Basic Data on Road Structures In FY 2013	Bridge and Structures Division
823	FY2013 Annual Report of Wastewater Management and Water Quality Control	Wastewater System Division Wastewater and Sludge Management Division
824	Landscape and Ecology Division, Annual Research Report (29th)	Landscape and Ecology Division
825	Study on planning method of effective house modification and adaptation for the elderly	Research Coordinator for Housing Performance
826	Report of the Lecture Meeting of NILIM (2014)	Planning Division
827	Study on the strength of high strength bolted friction joints with super high strength bolts for application to steel highway bridges	Bridge and Structures Division
828	Study on Evaluation of Rust by Appearance Properties for Weathering Steel Bridge	Bridge and Structures Division
829	Basic Textbook for Bridge Inspection, 2014	Bridge and Structures Division
841	Study on rationally analytical design method of steel highway bridges —Design method for steel highway bridges mainly using "the constant shear flow panels"—	Bridge and Structures Division
842	4. Noise 4.1 Noise Caused by Road Traffic (Revision of FY 2014) Environment Impact Assessment Technique for Road Project	Road Environment Division
846	Study on Plan for Facilitating Provision of Publicly-Operated Housing after the Great East Japan Earthquake — Cases Examples of Basic Plan for Publicly-Operated Housing —	Residential Environment Planning Division
848	Cooperative Research on method of Creating and Updating of Large Scale Road Map	Maintenance Information Technology Division

**● We provide you with research information.**
**• Annual Report of NILIM**

This web site introduces NILIM activities throughout the year, including research activities and achievements, future initiatives, etc.

Go to this web site: <http://www.nilim.go.jp/english/annual/index.htm>



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