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## Study on resilient structures for coastal dikes - Support for coastal dike restoration by issuing technical bulletins -

River Department, Coast Division

To support the restoration of coastal dikes damaged by the tsunamis of the Great East Japan Earthquake, we are studying resilient structures for coastal dikes.

The River Department of the National Institute for Land and Infrastructure Management is, in cooperation with the Seacoast Office of the Water and Disaster Management Bureau and with the Tohoku Regional Development Bureau of the Ministry of Land, Infrastructure, Transport and Tourism, performing model experiments of structures permitting the effectiveness of facilities to remain resilient, even when a coastal dike is destroyed or overturned when a tsunami higher than the tsunami height hypothesized for the design overtops the crest of the coastal dike. The results have been published in 2012 as NILIM Technical Bulletins No. 1 and No. 3 on May 14 and on August 10 respectively.

The Technical Bulletins focused mainly on scouring of the toe of the landward slope and on the stability of the landward slope armor of dikes with trapezoidal sections.

They point out the importance of first clarifying the distribution of flow speed

or pressure on the landward slope and landward slope toe then, to prevent scouring of the landward slope toe, varying the flow direction of the overflowing water so it would not strike the ground by altering the shape of the foundation work, and on the other hand, to prevent exposure of the uneven surface struck fully by the fluid body force, proposed a landward slope armor structure made by interlocked blocks with notches at their top edges and bottom edges. In addition it points out the importance of considering uplift pressure or negative pressure occurring when the tsunami overflows the dike.

[http://www.nilim.go.jp/lab/fcg/lab0/02\\_02.html](http://www.nilim.go.jp/lab/fcg/lab0/02_02.html)

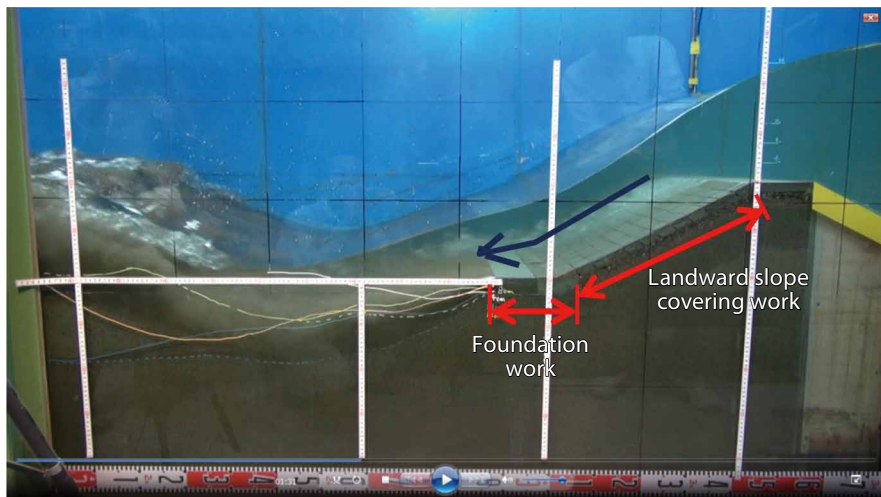


Photo Example of an Experiment Using a Structure with Innovative Measures Taken on its Landward Slope Toe and Landward Slope Armor

## Publication of "A Guide to the Discharge and Treatment of Wastewater during a Disaster (Draft)"

Water Quality Control Department,  
Wastewater and Sludge Management Division

We have announced a guide summarizing concepts of methods of taking emergency measures to ensure wastewater drainage and treatment functions which are necessary during a disaster causing large-scale damage, and methods of treatment of wastewater during staged emergency restoration works.

The Great East Japan Earthquake of March 11, 2011 damaged sewerage treatment plants at 120 locations, and the tsunami inflicted disastrous damage so severe it caused the failure of all functions at many sewerage treatment plants and pumping stations along the coastlines of the prefectures of Iwate, Miyagi and Fukushima in particular. More large earthquakes such as the Tonankai and Nankai Earthquakes are predicted, so there is a growing need to prepare for



Example of the use of sandbags to guide sewage to a nearby channel

disasters that will cause the loss of sewerage discharge and treatment functions.

Basic concepts for emergency measures and staged emergency restoration concerning sewerage system functions which must be ensured during a disaster have been presented in the Report by the Sewerage Treatment System Earthquake / Tsunami Countermeasure Technology Study Committee established in response to the Great East Japan Earthquake, and local governments where the earthquake



State of disinfection by solid chlorine at the early emergency restoration stage

caused damage have been carrying out staged emergency restoration based on this report.

The Sewerage and Wastewater Management Department of the Ministry of Land, Infrastructure, Transport and Tourism and the Water Quality Control Department of the National Institute for Land and Infrastructure Management are taking advantage of knowledge gained responding to the Great East Japan Earthquake by surveying the impacts on treatment functions of sewerage treatment plants and on the waters receiving discharged treated wastewater, at the emergency restoration stage in fiscal year 2011 and are studying methods of appropriately managing sewerage during disasters, in order to clarify concrete measures to ensure sewerage system functions during disasters. And they have also surveyed and analyzed cases of emergency measures and emergency restoration of sewerage systems operated by local governments in the disaster region. Based on knowledge gained from the results of these studies, and considering the results of investigations by the Committee to Study Appropriate Management of Sewerage Treatment at the Restoration Stage following a Disaster (Committee Chairman: Professor Omura Tatsuo of Tohoku University), they have prepared “A Guide to the Discharge and Treatment of Wastewater During a Disaster (Draft)” and announced it in September of this year. We anticipate that it will be applied to prepare for future disasters and to response to disasters.

- Wastewater and Sludge Management Division web site  
<http://www.nilim.go.jp/lab/ecg/index.htm>



## Development of Life Cycle Environmental Assessment Methodology for Infrastructures

### -How to utilize Infrastructures LCA -

Environment Department, Road Environment Division

Life Cycle Assessments (LCA) for infrastructures can now quantitatively assess emissions of carbon dioxide (CO<sub>2</sub>) by construction works. It is possible to realize low carbon provision of infrastructures by aggressively adopting planning, design, and execution methods and materials which cause low CO<sub>2</sub> emissions.

Infrastructure LCA can be used to calculate the quantity of CO<sub>2</sub> emitted by infrastructure provision and other construction work, and can now be used to add CO<sub>2</sub> emission quantities to items studied to propose design and execution.

Table 1 shows examples of studies of the design of a certain plane road (proposal 1: only embanking and cutting, proposal 2: concrete block masonry, proposal 3: rebar reinforcing in cut sections and terre armee in embanked sections).

The results of calculations have revealed that in this case, the quantity of CO<sub>2</sub> emissions in proposal 1, which uses small amounts of materials such as concrete and steel, is the lowest of the three proposals. Aggressively adopting design and execution methods which produce small quantity of CO<sub>2</sub> emissions is counted on to realize low carbon infrastructure provision.

A benefit of proposals 2 and 3 on the other hand is that they narrow each construction area. To study actual design and execution, it is necessary to reach decisions by comprehensively judging constructability, safety, economic efficiency, etc. in addition to CO<sub>2</sub> emissions.

<http://www.nilim.go.jp/lab/dcg/lca/top.htm>

	Proposal 1	Proposal 2	Proposal 3
Cross section			
CO <sub>2</sub>	○ t-CO <sub>2</sub>	△ t-CO <sub>2</sub>	□ t-CO <sub>2</sub>

Table 1. Three Proposals for the Design of a Plane Road

## Development of a Method of Evaluation to Ensure Seismic Safety of External Wall with Wet Finishing

Building Department  
Housing Department

Our departments are researching and developing a method of evaluating the seismic safety of external walls with wet finishing such as tiles or mortar, which were extensively damaged by separation and falling during the Great East Japan Earthquake, and methods of diagnosing the soundness of external walls with wet finishing after an earthquake.

Building use external walls are potentially in danger of separation and falling as a result of deterioration over years. Buildings where the danger of separation has been pointed out already exceed 10% of all buildings according to a survey by the national government, and it is feared that there is a danger of the separation and falling of external walls of more than 10,000 apartment buildings, just in the three giant metropolitan regions, and it can be stated that there is an urgent need for technological support and for countermeasures to prevent these disasters from happening. Under such circumstances, there have been a few reports of damage to main structural parts by the Great

East Japan Earthquake, but there have been many reports of damage such as the separation and fall of external walls. It has also been confirmed that tiles, mortar or other external walls with wet finishing in particular, have been damaged by even slight deformation of a building under the impact of a medium scale or smaller earthquake.

Concerning finishing materials including external walls with wet finishing, structural categories are stipulated by Article 39 of the Enforcement Order of the Building Standard Law and by Ministry of Construction Notification No 109 of 1971. But because technical standards including attachment methods have still not been enacted, the state of damage to structural members and the state of damage to external walls in the event of a large earthquake have been compared, increasing concern as a new social problem.

This research was a study of tile or mortar and other external walls with wet finishing inadequately covered by laws and regulations or technical standards for seismic safety intended to (1) establish technical standards to prevent separation considering the seismic safety of external walls with wet finishing and to (2) establish a method of evaluating the soundness of external walls with wet finishing after an earthquake. (Research period: 2012 to 2014).

- Surveying and **experimentally studying** seismic safety evaluation technologies and methods



- Confirming the characteristic values of various kinds of material and work methods needed to evaluate seismic safety and **providing various technological documents** concerning the seismic safety evaluations of exterior finishing materials

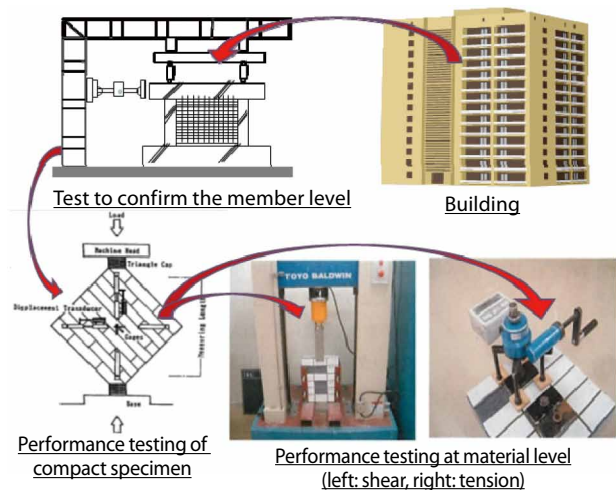


**Establishing technical standards and soundness evaluation methods to prevent falling of exterior finishing materials**



New Construction, repairs and renovations based on technical standards

→ **preventing damage caused by falling of exterior finishing materials**



## Port and Airport Technology Lecture 2012 The Lecture Meeting to Commemorate the Fiftieth Anniversary of the Establishment of The Port and Harbor Research Institute (PHRI) "The Future Roles of the PARI and NILIM"

Administrative Coordination Department,  
Planning and Coordination Division

The Port and Harbor Research Institute, the predecessor of the NILIM and the PARI, celebrated its fiftieth anniversary this year, and the PHRI held the Port and Airport Technology Lecture 2012 titled "The Lecture Meeting to Commemorate the Fiftieth Anniversary of the Establishment of the Port and Harbor Research Institute (PHRI)"

The Port and Harbor Research Institute, which is the predecessor of the National Institute for Land and Infrastructure Management (NILIM) and the Port and Airport Research Institute (PARI), was established as an organization of the Ministry of Transport 50 years ago on April 1. The NILIM, the PARI and the Port and Airport Research Institute, Independent Administrative Institution jointly held the Port and Airport Technology Lecture 2012 which was titled "The Lecture Meeting to Commemorate the Fiftieth Anniversary of the Establishment of the Port and Harbor Research Institute (PHRI)" on September 28 in the Annex of the Sabo Kaikan.

At this year's lecture meeting, in addition to reports on research

activities to the participants including private companies, associated corporations and the like, the usual lectures were given by 3 research departments of the NILIM and by 7 research departments of the PARI. They lectured on topics and prospects and on themes concentrated on issues they will address in the future.

To celebrate the milestone of the fiftieth anniversary, two special lectures concerned with the past and future of NILIM and PARI were given. Former director of the Port and Harbor Research Institute, Mr. Tsuchida Hajime, gave a talk titled "Looking back at the activities of the Port and Harbor Research Institute". Professor Isobe Masahiko of the Graduate School of Frontier Sciences of the University of Tokyo gave a lecture titled "Expectations of the PARI and NILIM". Thanks to the special lectures, about 340 people attended the meeting. This was more than in past years.

At the close of the meeting, the participants appreciated the accumulated research achievements of a half century and the further growth and continuing progress of these research institutes. In addition to that, the participants were hopeful that these research institutes will work on the study and development of technologies

to apply the lessons learned from disasters (for example, the recent Great East Japan Earthquake) and to tackle the problems which they have left for us.



View of the Lectures

### Schedule of Principal Events (November-December, 2012)

Scheduled Dates	Event Name
November. 19	Special Conference on Port and Airport Technologies in Kyushu
November. 22	13th Tokyo Bay Symposium
November. 29	Special Conference on Port and Airport Technologies in Chubu
December. 4	2012 Conference of the National Institute for Land and Infrastructure Management

### TECHNICAL NOTE of National Institute for Land and Infrastructure Management (August-October, 2012)

No.	Title of Paper	Names of Divisions
685	Survey on Deterioration and Damage of Road Attachment Facilities – Inspection Manual of Road Attachment Facilities (draft) –	Bridge and Structures Division
687	Report of the Evaluation Sub Committee of NILIM in FY 2011 Evaluation Committee of NILIM	Research Administration and Evaluation Division
688	Sediment conditions for restoration of eelgrass ( <i>Zostera marina</i> ) in Miyako Bay	Marine Environment Division
689	Analysis on World Container Ship Movement and Containerized Cargo Flow (2012)	Port Planning Division
690	Computable General Equilibrium Analysis on Economic Effects brought by Productivity Improvement of Air Transport Industry	Airport Department
692	Report of the research activities of International Research and Promotion Division in FY 2011.	International Research and Promotion Division

- Visit the following website for documents published by the NILIM: (<http://www.nilim.go.jp/lab/bcg/siryoun/index.htm>)
- NILIM research activities and achievements are now available on the following website as NILIM Annual Report 2012: (<http://www.nilim.go.jp/english/annual/annual2012/ar2012e.html>)



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

Asahi 1, Tsukuba, Ibaraki, 305-0804, Japan  
 (Tachihara) Tachihara 1, Tsukuba, Ibaraki, 305-0802, Japan  
 (Yokosuka) Nagase 3-1-1, Yokosuka, Kanagawa, 239-0826, Japan  
 TEL:+81-29-864-2754 FAX:+81-29-864-4322  
<http://www.nilim.go.jp/english/eindex.htm>

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