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Institute of Industrial Science
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FLOW SLIDES OF UNDERWATER SAND DEPOSITS IN JAMUNA RIVER BED

By

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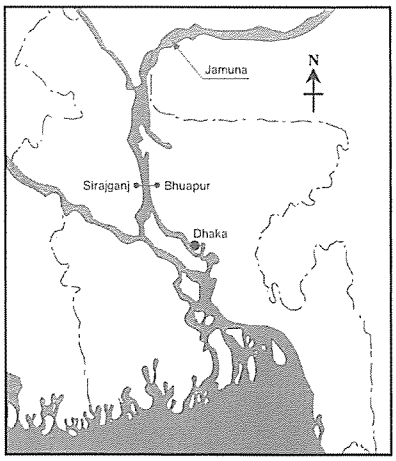
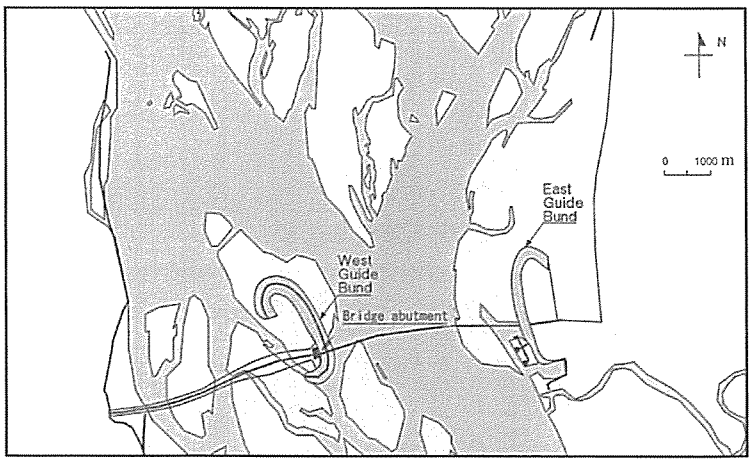
In the middle reach of the Jamuna River in Bangladesh, about 110km northwest of Dhaka, a 4.8km-long bridge called Bangabandhu Bridge connecting the towns of Sirajganj and Bhuapur was planned and constructed in 1995-1999. Its location is shown in the bottom left figure. The Jamuna is a shifting braided river, consisting of numerous channels which change their width and course significantly with the seasons. Thus, training the river to ensure that it would continue to flow under the bridge corridor was the most difficult technical challenge against the project.

As shown in the more detailed map in the bottom right figure, the width of the river channel was about 11km. This area is the vast expanse of flood plain and has suffered severe destruction over the years due to intense flooding over the river channel and its surroundings. Devastation was particularly conspicuous at the time of the flooding in 1987 and 1988. In some areas, river channels are purported to have shifted their courses overnight through several hundred meters. The tendency of the drift is reported to have been westwards whereby involving a huge amount of sandy soils removed by scouring in the riverbed in the west side of the Jamuna River.

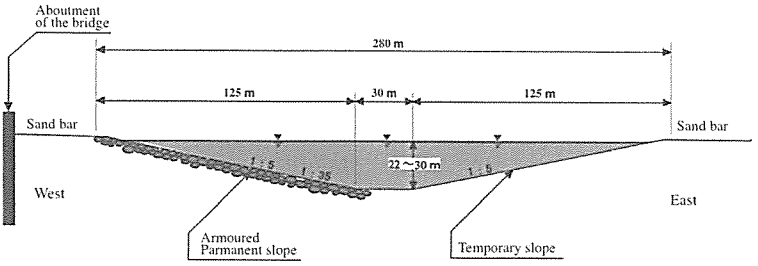
In the large project to construct a long-stretch bridge, it was considered mandatory to protect the bridge abutment, to implement some countermeasures against the deleterious effects due to scouring, and to control the river channel. With this aim, construction of guide bunds was planned on both sides of the river as shown in the bottom right figure. Of particular importance was the construction of the West Guide Bund, as it was intended to protect the bridge abutment behind the river from scouring or erosion of the riverbed. The construction consisted of excavating the riverbed by dredging the sand with ships and placing erosion-protecting armors such as geotextiles and stones over the underwater slopes on the west side. A typical cross section with an armored slope is shown in the figure on top of this page. The location and



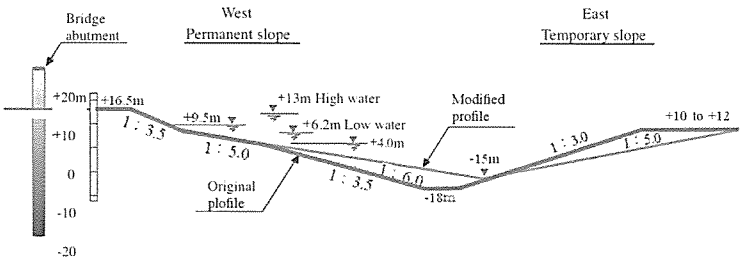
General location map



Locations of the Guide Bunds in Jamuna Bridge site



Cross section for the dredging of West Guide Bund for the bridge at Jamuna River site



East-west section through West Guide Bund Channel (from Hight et al. 1999)

horseshoe-shaped plan view of the Guide Bunds are displayed at the bottom of this page. The trench varying from 22 to 30m in depth was dug below water by means of cutter-suction dredgers which were operated from ships at the site of each guide bund. The sand slope being spread behind the abutment zone after dredging work is shown in the bottom right photo.

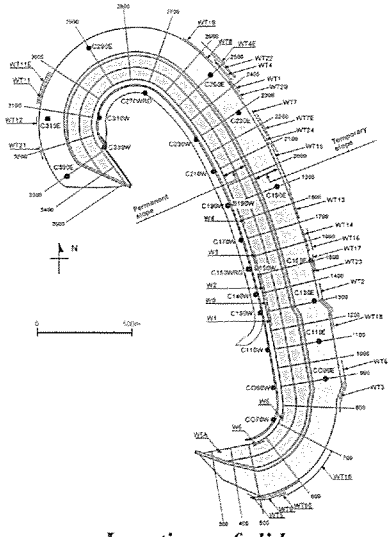
The West Guide Bund was constructed at the site of a recently formed sand island as seen in the figure in the bottom right of the previous page. The materials forming the dredged slopes were composed of young, rapidly deposited sediments. The detailed plan view of the excavation is shown in the figure on the top of this page and a typical section (E-W section) across the dredged channel is displayed in the figure below of it.

The slope on the west side was to be protected by a geotextiles-stone armor against the scouring, because the bridge abutment was to be installed to the west of the West Guide Bund. Thus, the underwater slope on the west side designated as "permanent slope" was designed so as to have a gentle slope of 1:5.0 in the middle portion. On the contrary, the slope on the east side of the dredged channel was to be left unprotected. Even though slides may occur and the sand bar may disappear in the future due to scouring or erosion, it was considered a big matter. Thus, the eastern slope was designed to form a steeper slope with an angle of 1:3.0 and designated as "temporary slope" in the left hand figure.

The dredging work began northwards in October 1995 from the southern rim of the sand bar. As the dredging proceeded, slope failures occurred on the permanent slope on November 19th in 1995 and another on November 22nd. On December 3rd, 1995, the largest-in-scale slide took place on the permanent slope. This slide covered an area of about 150m wide and 150m long over the permanent slope. Afterwards many failures were found to have occurred on the temporary slope in 1996. Many of these slides caused the delay of construction work. The most serious concern was the failures on the permanent slope, because they had to be repaired to construct an erosion-free slope. In recognition of the instability with an angle of 1:3.5, the cross section design on the permanent slope was changed so as to have a slope of 1:6.0 near the bottom. For the temporary slope, the angle was changed from 1:3.0 to 1:5.0 as illustrated in the figure by Hight et al. shown on this page. Then, the dredging work to full depth was resumed to finish excavation of the trench.

A detailed analysis of the possible causes of the slides, based on the results of in-situ and laboratory tests using the sand secured from the site was performed. It was found that the presence of mica minerals in the sand was the potential cause leading to the wide-spread slides in the dredged underwater slopes.

** Professor, Chuo University*



Locations of slides in the West Guide Bund

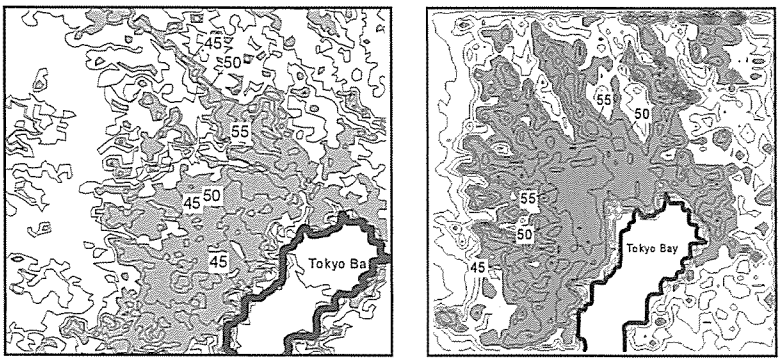
Sand slope behind the abutment zone

Numerical Simulation of Environmental Problems

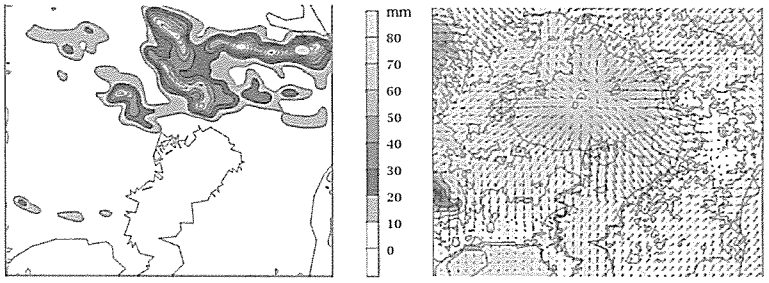
In recent years, more attention has been paid to environmental problems, such as global warming, abnormal weather, urban heat island, air pollution, floods, soil and ground water pollution, biodiversity decrease, etc. In order to settle these problems, firstly, it is very important to predict these phenomena. The recent improvement of computer performance has enabled numerical simulations of various environmental phenomena and promoted the development of various environmental models. For example, the future global temperature can be predicted with some accuracy based on the future conditions of the CO_2 emissions. The global meteorological model can also predict abnormal weather occurring with the global warming.

In urban areas, not only in Japan but all over the world, the urban heat island and air pollution are becoming serious problems. It is possible to determine the reasons behind the heat island phenomena using numerical simulations. The figures on top of this page show a comparison of ground surface temperature over Tokyo metropolitan area according to artificial satellite measurements and numerical simulations. The simulation result agrees fairly well with the measurement. The urban heat island sometimes causes disasters such as local heavy rain. An example of prediction is also shown. This prediction can be used for taking countermeasures for floods. The effects of countermeasures for heat island can also be estimated with the aid of numerical simulations.

To predict air pollution is also very important to guaranty healthy and safe human lives in urban areas. The figure on the right shows the ozone concentration over Kanto area in Japan by a coupled simulation of meteorological and chemical reaction models. In this result, the photochemical reaction is considered. The other figure shows the pollutant dispersion from an expressway. Micro climate models can represent the detailed pollutant distribution in the complex urban geometry. This visualization technique is very useful to image pollution problems.



Comparison of ground surface temperature (July 24, 1995, 13:00)
— left: measured, right: numerical simulation —

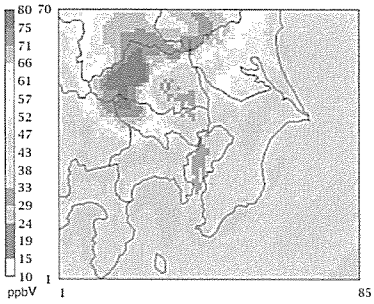


12 h total rain fall **Horizontal Wind Velocity Vector**

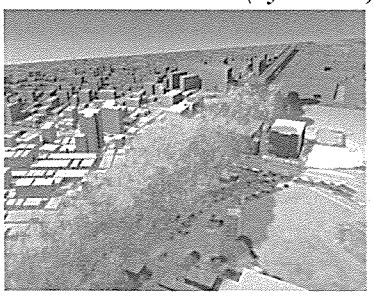
Prediction of local heavy rain (August 15, 2005, 12:00~24:00)

Many environmental problems described above are dominated by transport phenomena, which include convection, diffusion, radiation, hydrodynamics and permeation. Although environmental phenomena have a large variety, the physical principle which describes them is common. It is possible to synthesize various simulation models on one platform. This is a future subject of study in order to settle various urban problems.

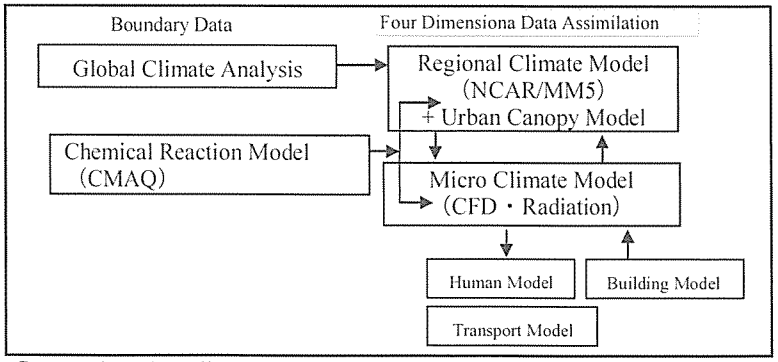
(By R. Ooka)



Ozone concentration over Kanto Area, Japan



Air pollutant dispersion from expressway

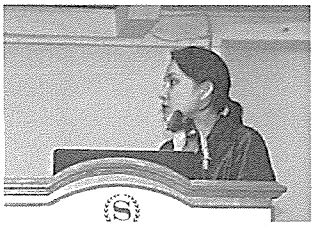


Comprehensive climate model for assessing environmental problems

Recipients of the 2007 USMCA Young Researcher Award Present Their Research Topics

Ms. A. B. Afifa Imtiaz and Dr. Ema Kato received the Excellent Young Researcher Award for performing outstanding presentations and research in the 6th International Symposium on New Technologies for Urban Safety of Mega Cities in Asia (USMCA) held on December 9-10, 2007 in Dhaka, Bangladesh. Ms. Imtiaz presented the paper "Visual Screening Methods for Earthquake Vulnerability Assessment" whereas Dr. Kato introduced her research "Variation of Corrosion Characterization of Reinforcing Bar in Existing RC Structures." In this issue, these outstanding researchers briefly present their study findings.

Ms. Imtiaz, Graduate Student, Civil and Geotechnical Engineering Department (BUET)



Dr. Kato, Senior Researcher, Port and Airport Research Institute

Visual Screening Methods for Earthquake Vulnerability Assessment

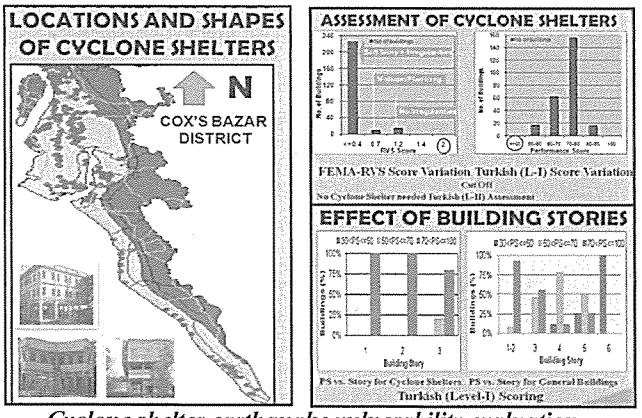
This paper deals with the investigation of two pre-earthquake screening methods for rapid evaluation of seismic vulnerability profiles of the existing building stocks. One of the objectives of the study was to identify, inventory and rank all high-risk buildings in a specified region so that a strategy for prioritizing interventions could be deviced. It also compared existing methods in order to develop a guideline for an ideal screening method in the context of Bangladesh. The methods employed were FEMA-RVS, developed by The US Federal Emergency Management Agency (FEMA) and the Simple Survey Procedure, developed after the 1999 earthquake in the cities of Kocaeli and Düzcec in Turkey.

Both methods were used in the research for seismic vulnerability assessment of buildings of Cox's Bazar district in Bangladesh. The paper critically examined and compared the two methods with reference to the seismic assessment of structures in Cox's Bazar by identifying the key parameters contributing to the vulnerability assessment and the suitability of the methods for Bangladesh. The study concluded that both methods have limitations in terms of incorporating the parameters relevant for Bangladesh and many other countries. Fine-tuning of the significantly contributing technical aspects of these procedures can lead to the development of an ideal Rapid Visual Screening Procedure which would provide more reliable assessment of the seismic vulnerability of the buildings and form the basis for determining need for more complex vulnerability assessment.

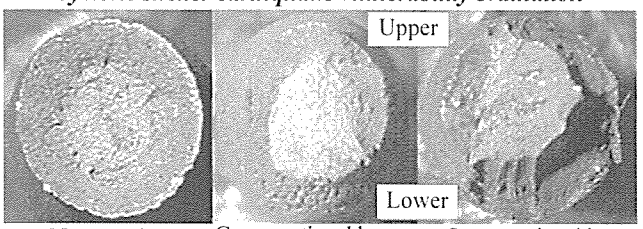
Variation of Corrosion Characterization of Reinforcing Bar in Existing RC Structures

It is important to characterize the corrosion profile of a reinforcing bar embedded in concrete when it has suffered from chloride-induced deterioration. In a real structural member, a reinforcing bar is not uniformly corroded. Although this variation will affect its mechanical properties, an actual corrosion profile has been rarely investigated in real structures and available information is insufficient.

In this study, corrosion profiles of reinforcing bars taken from reinforced concrete slabs of an open-type wharf that has been in service under marine environments for 29 years were investigated. The weight loss of reinforcing bars in the slabs showed extremely large variations along the axis of the bar. The cross-sectional loss of the lower half of the piece was larger than that of the upper half because of the existence of the interfacial transition zone formed due to bleeding. Moreover, tensile tests of corroded reinforcing bars showed that the unevenness of cross-sectional loss had an influence on the mechanical properties because of the lopsided action of tensile stress.



Cyclone shelter earthquake vulnerability evaluation



No corrosion | Cross-sectional loss Ave. 0.8%, Max. 2.0% | Cross-sectional loss Ave. 1.7%, Max. 8.2%

Reinforcing bars at breaking sections

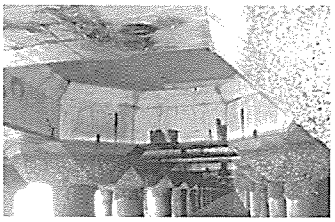
Research committee on technologies for evaluation of aging infrastructure performance degradation (RC-62) is launched

Infrastructure supporting our everyday life is constructed with various kinds of materials, such as concrete, soil, steel, etc. Structural performance of the infrastructure will degrade due to material deteriorations during service, and sometimes may reach their minimum requirement levels. Therefore, it is necessary to implement a suitable maintenance strategy on the infrastructure based on regular assessments of the structural performance during the service period. Unfortunately technologies capable of evaluating quantitatively the structural performance have not yet been well established although lots of research works have been tried to investigate their applicability for prototype structures. Furthermore, no research work has been done to evaluate the performance of an entire structure from its foundation to main body.

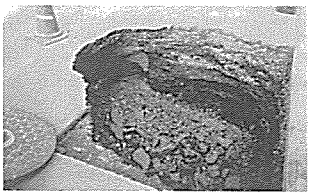
In consideration of the above-mentioned situations, this research committee will start a systematic investigation on the state-of-the-art technologies for the performance evaluation of infrastructure. This will include the assessment of existing measurement and evaluation techniques that are actually being applied in the fields of concrete, ground, and steel. Transfer and application of the latest technological developments from one field to another and integration of all these technologies will be addressed. The committee will also attempt to predict future needs for technological developments in these fields.

The committee organizers are Prof. H. Yokota, Dr. R. Kuwano, Dr. Y. Kato, and Dr. T. Endo.

(By Y. Kato)



Deterioration of pier due to salt attack



Cave-in in road due to the deterioration of underground pipe

RC-58 held meeting

The Research Committee 58 (RC-58) met on March 27. The aim of this committee is to propose guidelines for developing suitable business continuity management (BCM) systems suitable for Japan. In recent years, BCM systems and business continuity plans (BCP) have become increasingly popular. Many guidelines to prepare BCPs have been published in Japan. However, these were originally developed in Europe and US and have been adopted without careful consideration of Japanese conditions such as organization characteristics, social environment, target emergency situations, among others. Because of this, even when BCPs are prepared, a real capability and effective BCM system cannot be implemented. Considering this problematic, ICUS has established the RC-58 and regular meetings have been held with the member companies to discuss these issues.

In the latest meeting, each of the three working group (WG) outcome was introduced. WG-1 discussed the differences among the guidelines in Europe and US and those in Japan. WG-2 compared the Japanese Cabinet Office Guidelines with that of other Japanese Government agencies and WG-3 did the same but the comparison was done with private sector companies. Based upon this year discussion, RC-58 published a report.

After the WG reports, an invited speaker, Mr. Keiichi Ichikawa, delivered the lecture "How can information technology be used to implement a good BCP/BCM?" Mr. Ichikawa is President of Rescue Now Co. Ltd., the first Japanese disaster IT company providing BCP consulting services. He presented the experiences he had when he started his company and its current situation as well as his business model idea. After his lecture, a small gathering was held in which participants exchanged ideas and questions were answered.

(By K. Meguro)

Mr. Keiichi Ichikawa

Announcement of USMCA-7

The 7th International Symposium on New Technologies for Urban Safety of Mega Cites in Asia will be held on October 21-22, 2008 in Tsinghua University, Beijing, China, The symposium is jointly organized by ICUS, Institute of Industrial Science, The University of Tokyo and The Center for Public Safety Research, Tsinghua University. This symposium is organized to provide a forum for decision makers, practicing professionals and researchers to share their expertise in diverse areas such as infrastructure planning and development, application of new technologies, nondestructive evaluation of structures, rehabilitation methods, among others.

Abstracts are welcomed by June 22 and notification of acceptance will be sent by July 20. Full papers must be submitted by August 31, 2008, which is also the early bird registration deadline.

For information regarding this symposium please contact Dr. Wenguo Weng, Center for Public Safety Research, Tsinghua University, Beijing, 100084, P.R. China. (USMCA2008@tsinghua.edu.cn) or visit the following URL: http://www.ep.tsinghua.edu.cn/USMCA2008.

(By R. Ooka)

RNUS Activities

RNUS, GIC, Kyoto University and the University of Tokyo carry out field survey in Thailand

On January 10, 2008, Drs. Takeuchi, Worakanchana (ICUS) and Suzaki (Kyoto University), carried out a field survey at Buriram, northeast of Bangkok. The objective of this field survey was to install soil moisture and temperature probes to validate data along with an estimation of soil moisture using active microwave satellite data for the mitigation of drought impact.

RNUS Seminar

Drs. Takeuchi and Worakanchana organized a seminar on the topic "Toward a partnership on disaster management and remote sensing/GIS technologies" at AIT Center on February 8, 2008. The objective of this seminar was to create the environment for remote sensing/GIS and disaster managing specialists to exchange their opinions, point of views and information.

The seminar started with opening speeches by Professors Kanoknukulchai and Meguro followed by presentations from ten speakers from AIT, GISTDA, IIS, ICUS, JAXA Thailand and Kasetsart University (For more information see www.set.ait.ac.th/rnus/rnusnew). After this, the closing speech was given by Prof. Yashiro, vice president of IIS. Most of the audience in this seminar was from Thai Government organizations.

Group photo of speakers and organizers at RNUS seminar

Survey and Interview for Sustainable Tsunami Disaster Mitigation System Project in Phuket

Prof. Meguro led the team joined by Drs. Takashima and Worakanchana to collect data and interview people for a Sustainable Tsunami Disaster Mitigation System for the Indian Ocean Region Project on February 9-10, 2008. During this trip, the research team visited Mr. C. Sukban, Deputy Mayor of Pathong Municipality, Ms. P. Nootmorn, Director of Andaman Sea Fisheries Research and Development Center, Ms. S. Pinpradab, Director of Tourism Authority of Thailand and Mr. C. Kerdsom, Head of Phuket Disaster Prevention and Mitigation Office.

Short Seminar on Transportation at Chulalongkorn University

A half day seminar focusing on transportation research was held on March 25, 2008 at Chulalongkorn University. The welcome address and opening speech were delivered by Dr. T. Tongthong, Head of the Civil Engineering Department, Chulalongkorn University. Two speakers from the University of Tokyo made presentations: "Urban railway network planning in Tokyo" by Dr. H. Kato and "Feasibility study of peak-hour road shoulder usage in urbanized motorways" by Dr. S. Tanaka. The closing speech was given by Dr. K. Choocharukul.

(By S. Tanaka and K. Worakanchana)

The Center for Integrated Disaster Information Research was created

The Center for Integrated Disaster Information Research (CIDIR) was established at The University of Tokyo on April 1st, 2008. It was launched for integrating humanities and scientific research on disaster information by the Interfaculty Initiative in Information Studies, the Earthquake Research Institute, and the Institute of Industrial Science (IIS). A symposium was held for disseminating the objectives of CIDIR establishment at IIS on March 12 and attended by more than 200 participants. A press conference was held before the symposium.

Welcome speech by Prof. Maeda, Director General of IIS

Panel discussion panelists

Audience snapshot

The symposium started with welcome speeches by Prof. Syunya Yoshimi, Director General of Interfaculty Initiative in Information Studies, Prof. Syuhei Okubo, Director General of the Earthquake Research Institute, and Prof. Masafumi Maeda, Director General of the Institute of Industrial Science. Then, Prof. Yoshiaki Kawata, Kyoto University and Prof. Atsushi Tanaka, Director of CIDIR, gave presentations on the future prospective of the research activities in CIDIR.

The latter part of the symposium was a panel discussion on "the effective use of disaster information for Tokyo Metropolitan Earthquake and expectation for CIDIR." Six panelists and one chairman, Noboru Yamazaki, who is the commentator of Japan Broadcasting Corporation joined. The panelists were Mr. Koji Ikeuchi, Cabinet Office, Prof. Kazuki Koketsu, Earthquake Research Institute, Prof. Kiyoshi Takano, CIDIR, Prof. K. Meguro, ICUS, in addition to Prof. Kawata and Prof. Tanaka who were the presenters in the initial part. ICUS wishes for a collaborative relationship between ICUS and CIDIR.

(By M. Ohara)

BNUS Activities

Short Course

The Directorate of Continuing Education (DCE), Bangladesh University of Engineering and Technology (BUET), in association with BNUS arranged a short course entitled "Disaster and Conflict—What shall we do on it?" The course was held on March 15-16, 2008 with the objectives of successfully managing the situation of natural or man made disasters; developing a scientific method to mitigate disaster casualties; sharing practical experience of SIDR cyclone from the engineering point of view; and making a comprehensive plan for solving urban flooding, earthquake, etc.

A total of forty three people from different organization participated . Prof. Dr. A.M.M. Safiullah, Vice-Chancellor of BUET was present as the Chief Guest in the certificate distribution ceremony. He handed over the completion certificate to the participants, who expressed their feelings on this course. Some of them requested the organizer to arrange such kind of training more as it is the current key issue.

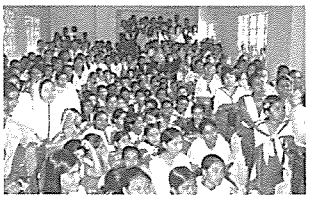
Short course certificate award ceremony

Building Earthquake Resistant Masonry Houses

Most of masonry houses in Bangladesh are not capable to resist small to moderate earthquakes. This is due to the lack of knowledge on how to build an earthquake resistant house. BNUS has been working on this problem for a long time and is in the final stage of publishing an Earthquake Resistant Construction Manual for Mason Training. After it is completed, BNUS will arrange mason training programs in the believe that masons are the key for making earthquake resistant masonry houses.

Prof. Tamura and Japanese Embassy Staff visited BNUS

Kyoto University Professor, Dr. Takeshi Tamura, visited BNUS on March 3, 2008. Mr. Asai, Head of Cultural Wing of Japanese Embassy and Ms. Fujimoto of the NPO Asia SEED accompanied him. They were briefed on BNUS activities. Ms. Jahan introduced the School Earthquake Safety Program and Mr. Das explained the microtremor and Ferroscan survey conducted on the BUET buildings. Prof. Ansary informed them about early warning system in the coastal region in Bangladesh and about the Mason Training Program.



Partial view of school students

SESP in Anandamoyee Girl's High School

BNUS arranged a School Earthquake Safety Awareness Program (SESP) in Anadamoyee Girls' High School situated in ward 68 at old Dhaka. It was attended by around 200 students and was launched on March 24, 2008. Ms. Azijun Nessa, the High School Headmistress, delivered the opening speech and thanked BNUS for selecting her school for such a program. The Chief Guest, Prof. Ansary explained the need for earthquake safety awareness program. A video clip depicting a deadly earthquake was shown to the students, who were much impressed and became eager to learn more about earthquakes and how to tackle them. More of such programs were requested by the school authority. The First Aid Training for the school students will commence when the school reopens.

(By M. Ansary)

ICUS Activities

- *Prof. Meguro visited Thailand from Feb. 7 to 11 to give a presentation at the RNUS Seminar and join the IIS Alumni party. He also made a field survey to Phuket, together with Drs. Takashima and Worakanchana, to collect data and interview people for the project Sustainable Tsunami Disaster Mitigation System for the Indian Ocean Region.*
- *Prof. Meguro traveled to Riyadh, Saudi Arabia to deliver a Keynote Lecture at the Symposium on Disaster Management and Safety of Buildings in Arab Countries.*
- *Dr. Ooka received the Best Poster Award Certificate for his work: "Proposal of New Model House Design with Energy Efficiency for Riyadh in Saudi Arabia" at the AGS Annual Meeting 2008 on Jan. 30.*
- *Dr. Ooka visited New York, USA, to participate in the 2008 American Society of Heating, Refrigerating and Air-Conditioning Engineers Winter Meeting from January 19 to 24.*
- *Dr. Ooka attended the Alliance for Global Sustainability (AGS) Annual Meeting 2008 in Boston, USA, from Jan. 28 to Feb. 1.*
- *Dr. Ooka traveled to Seoul, Korea from Feb. 27 to 29 to inspect the present situation of ground water use for air conditioning and others.*
- *Dr. Tanaka stayed at AIT for his research work and teaching duties at RNUS from Jan. 21 to Feb. 16 and Feb. 26 to March 29.*
- *Dr. Worakanchana stayed at AIT for his research work and teaching duties at RNUS from Dec. 1 to Feb. 21 and Mar. 11 to 26.*
- *Dr. Worakanchana visited Dhaka, Bangladesh from Mar. 15 to 22 to plan a survey to assess the vulnerability of existing building stock.*
- *RC-58 committee held a general meeting on March 27.*

Awards

- *Mr. Tetsuro Fujita received the Tanabe Award for his paper "A Meta-game Analysis of Effective Strategies for Social Movement -The cases of NEN-O EXPWY and Sanbanze Wetlands-" on March 25.*

Editor's Note

Today, May 19, I am at Shenyang, China to join an international workshop. This afternoon at 2:28pm all the people in China prayed silently for the people who died in the huge earthquake that occurred in Sichuan Province a week ago (May 12). In the workshop, presentations were also stopped and all the participants prayed silently for three minutes. The number of lives lost in the event is more than 40,000 at the moment and it is increasing as time passes. Last month a big hurricane attacked Myanmar and also many lives were lost. How can we prevent these disasters? Can we reduce damage? The role of ICUS is getting larger and larger.

I retired from the University of Tokyo last March. During these ten years at the Institute of Industrial Science I had the opportunity to work at ICUS for five years. I appreciate all ICUS members and ICUS affiliated members who kindly and strongly supported me during these years. Also, I would like to thank all ICUS newsletter readers for their contribution to ICUS. I am now working at the National Institute for Environmental Studies and my mission is still to find ways to improve our society and to realize a sustainable society. It has not changed at all from ICUS days. I hope that I can continue collaborating with old friends. Thank you again!

(By Y. Yasuoka)

If you would like to contribute an article to ICUS newsletter or have any comment or suggestion, please contact the editorial committee at icus@iis.u-tokyo.ac.jp.

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