# ICUS Newsletter

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**International Center for Urban Safety Engineering**
**Institute of Industrial Science, The University of Tokyo**


## Robust fiber reinforced cementitious composites for infrastructure

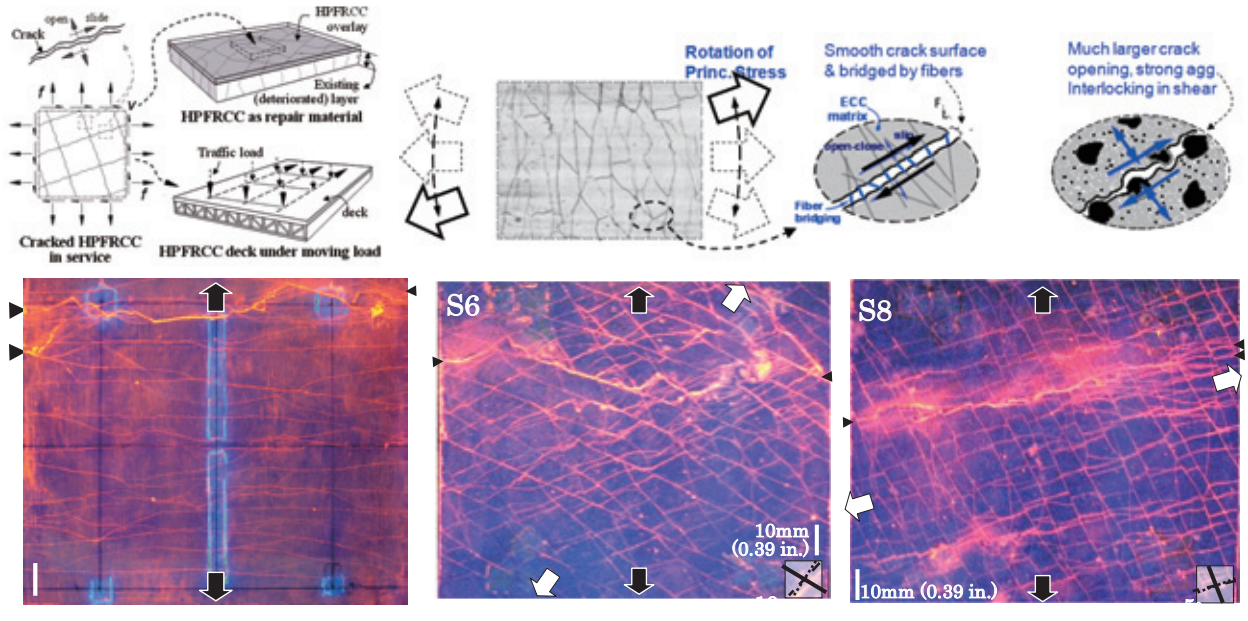

By Kohei Nagai

Associate Professor, International Center for Urban Safety Engineering
Institute of Industrial Science, the University of Tokyo


### Introduction

Concrete is weak and brittle in tension. To resist tension, concrete needs complimentary companion steel reinforcement. Nevertheless, a large number of reinforced concrete structures still suffer from extensive cracking and damage. To improve the ability of cracked concrete to resist tension, it is not uncommon today to add fibers to the concrete. In concrete, fibers can act as a kind of crack arrester, delaying the propagation of a crack, and thus reducing the severity of cracking.

In the past two decades, considerable work has been done relating to the development of high performance fiber-reinforced cement-based composite (HPFRCC), a cement based material that is more ductile than concrete. One major difference of HPFRCC compared to conventional concrete is its ductile tensile behavior and its self-generated multiple cracking characteristic in tension. Unlike concrete, current typical HPFRCC excludes the use of coarse aggregate. This material has




*Multi-direction cracking of HPFRCC under principal stress rotation*

been applied mainly for repair and strengthening of existing structures. Recently, however, it has started to be used for structural members, so it is necessary to understand the mechanical behavior of HPFRCC for the wider application of this material.

## Vulnerability of fiber reinforced cement-based composite

Wheel movement was found to be responsible for increasing risk of fatigue damage in highway bridge deck structures. The wheel movement not only produces more extensive fatigue damage and a grid-like cracking pattern, but also continuously alters the magnitude and inclination of concrete principal stress direction at different locations on the deck. The rotation of concrete principal stress field, in particular, implies not only tensile stresses, but also shear stresses develop at the cracks.

To apply HPFRCC for deck-type structures, it is anticipated that the resistance to transmitting shear across multiple cracks is as important as the ability of the material to exhibit superior tensile performance, such as the unique characteristic of HPFRCC with ductile tensile behaviour and multiple fine cracks.

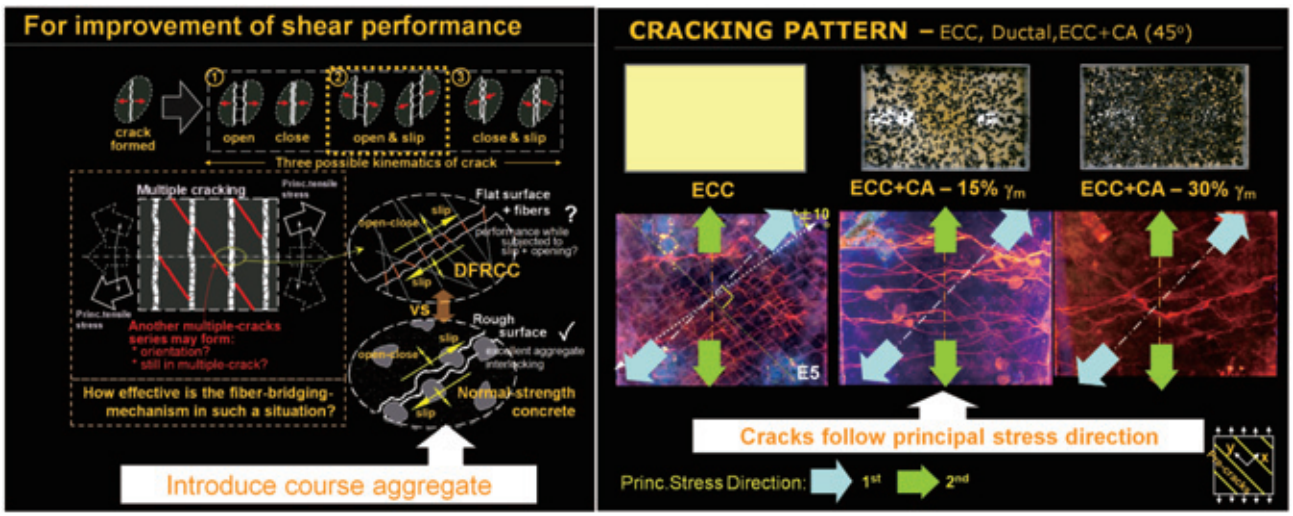
Nevertheless, tests of pre-cracked PVA-ECC, which is one kind of HPFRCC, plates subjected to principal stress rotation demonstrated that even during its strain-hardening the ability of the material to transmit shear across the cracks is limited. It was observed that regardless of the orientation of the pre-cracks and the change in principal stress direction, a somewhat orthogonal cracking pattern was always observed.

This is attributed to the fact that the material was developed to maximize the performance under uniaxial loading condition; as a result, it shows weakness in shear due to the absence of coarse aggregate. It is a vulnerable material that is not preferable for structural member of infrastructure. Robustness is important for the sustainable infrastructure.

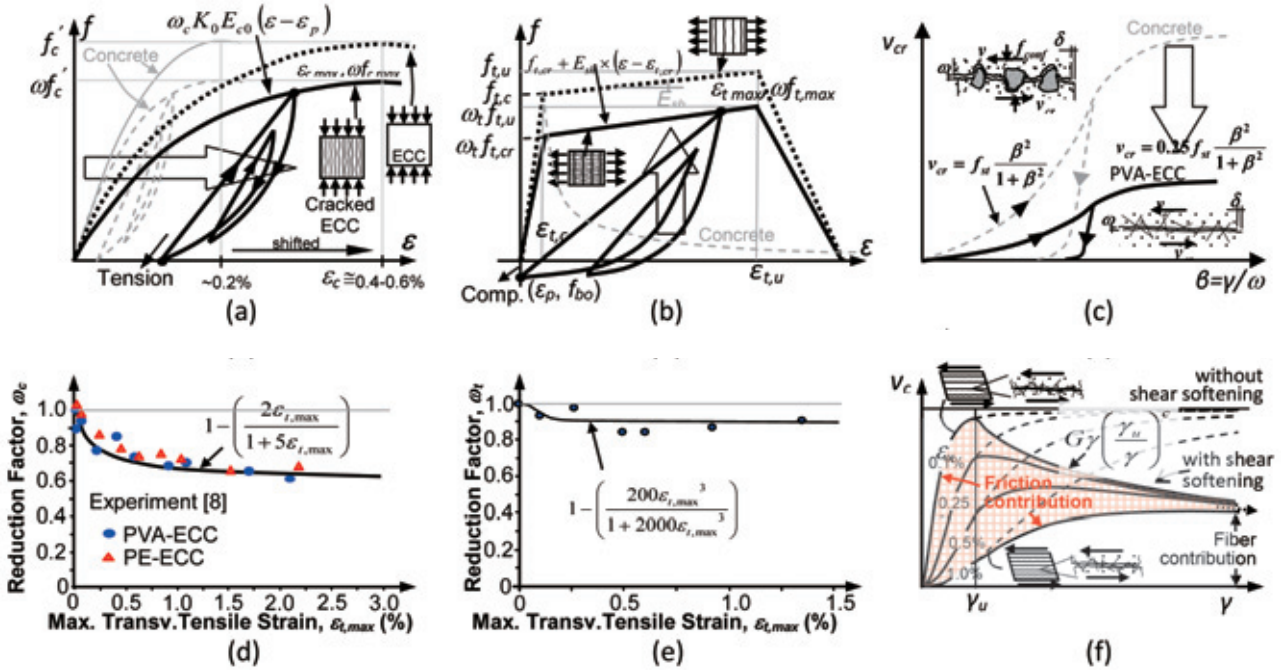
One of the approaches against this issue is to add a certain amount of aggregate to improve the shear performance. In this case, tensile performance and workability is lost. However, the shear performance is improved where the aggregate prevents the sliding of cracks. Balance of the above factors needs to be taken account for the robust material.

## Attempt to develop a robust model

Here shows an endeavor to improve interface shear transfer of HPFRCC made by collaborating aggregates to a normal HPFRCC mixture. From the test, the addition of proper amount and size of aggregate can substantially change the behavior of the material, the crack pattern, and more importantly, the performance of the material. The response of the material with this aggregate fraction becomes stable, nearly resembled to that of the non pre-cracked HPFRCC. This enhancement was attributed to the reduced anisotropy due to the synergic collaboration of fibers and coarse aggregate, as well as the increasing probability of cracking. The synergic collaboration of fibers and coarse aggregate was evidently seen from the orientation of the secondary crack that became less dependent on the pre-crack orientation. Moreover, it was found that it is still possible to attain high ductility even if coarse aggregate is added.



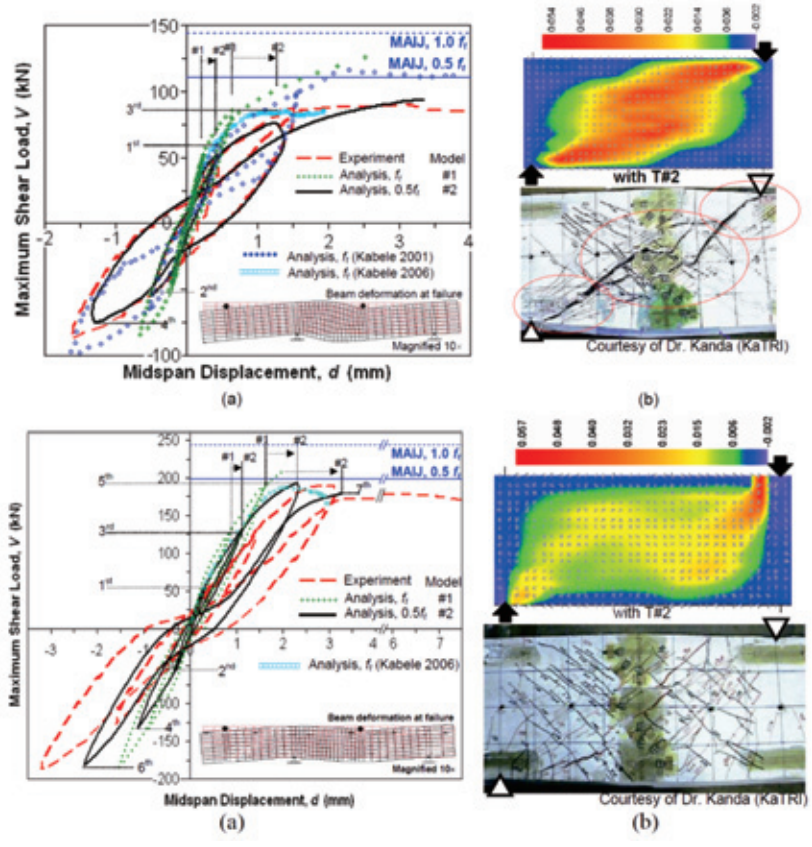

*Cracking control by aggregate*




*Modeling of HPFRCC for space-averaged fixed crack approach*

## Numerical simulation

Once logical fundamental mechanics of the complex behavior of pre-cracked HPFRCC are captured, phenomenological material models can be proposed based on that of normal concrete where the tensile and shear models are mainly modified. The models were incorporated into the analytical platform for reinforced concrete based on smeared fixed crack modeling. The models are then used to predict the response of the structure after the verification at the material scale. Here shows a model and results of simulations by COM3 developed by concrete laboratory at the University of Tokyo. Numerical simulation scheme is significant not only to investigate the behavior of structure but to develop new materials because it can propose the necessary material property though parametric analyses.




*Numerical simulation of HPFRCC members*

## Summary

For wider application of fiber reinforced cementitious composites, especially as structural members, mechanical behavior under principal stress rotation should be understood; then, the robustness of the material should be improved based on the mechanics and through numerical simulations.

*Editor's Note: Dr. K. Nagai became a member of ICUS from July 15. Please see Page 11 of this volume for his introduction and background.*

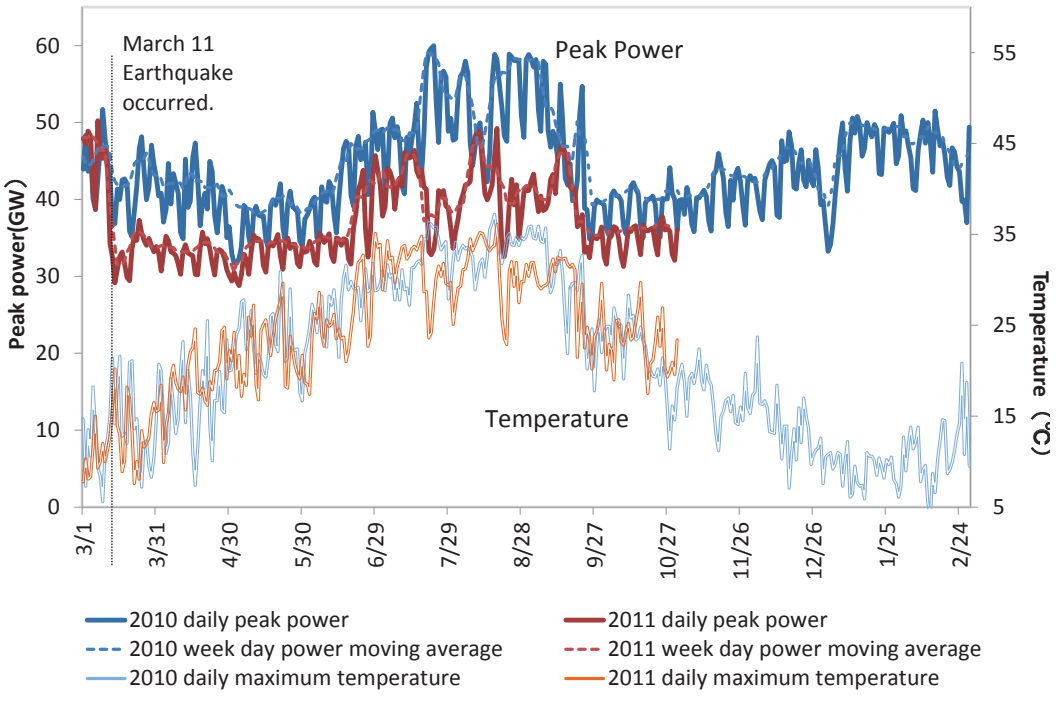
# Summer 2011 power saving activities and future prospects in Japan

*By Y. Iwafune, Associate professor, Collaborative Research Center for Energy Engineering (CEE), Institute of Industrial Science, The University of Tokyo*

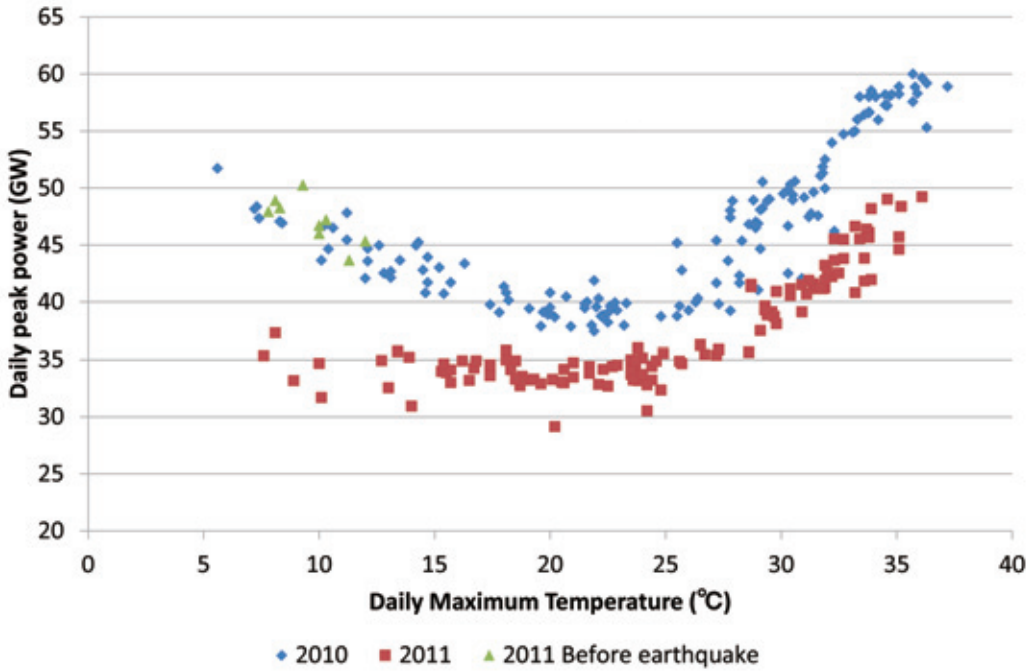
The Fukushima nuclear power plant accident after March 11 caused the fear of power blackouts, and the Japanese government promoted a campaign for "setsuden," which means power saving in Japanese. Although setsuden measures worked over this past summer, power shortage is also a concern in the coming winter, particularly if the circumstances do not allow the resumption of operation of nuclear power plants. Our team launched a website, "Kinkyu Setsuden" (power saving in a hurry), which called for the power savings from April, and has been promoting setsuden by providing information and answering questions from the general public.

The Ministry of Economy, Trade and Industry (METI) announced that peak power over the summer was reduced by 18.0% in the area managed by Tokyo Electric Power Company (TEPCO) and by 15.8% in the area managed by Tohoku Electric Power Company. Both of these reductions were significantly above the target reduction of 15%. In the industrial sector (including manufacturing), which accounts for more than 80% of power consumption at the peak power, a significant reduction was achieved by shifting operations to the night or holidays, limiting production activities, and the introduction of private electric generators. The cost burden of these activities was great. In the commercial sector, steady power saving was achieved by changing the operations of air conditioners, light equipment, escalators and elevators, and so forth; these costs were relatively low compared to those of the industrial sector. In the residential sector, the same trend was seen as in the commercial sector. In the future, it will be necessary to carry out power savings through well-thought-out measures depending on the characteristics of consumers mainly in the commercial and residential sectors, while giving due consideration to the industrial sector, in order to minimize the impact on economic activity.

Let's take a look at the trends in daily maximum demand and daily maximum temperatures up to October 31 as reported by TEPCO. The effect of power saving is significant. TEPCO's maximum demand was 4.9 million kW on August 18, which was much smaller than the expected peak demand of 5.5 million kW. The power-saving effects of the summer have been




*Trend of daily peak power and temperature for TEPCO in 2010 and 2011*




*Relation between daily maximum temperature and daily peak power on weekdays for TEPCO in 2010 and 2011*

sustained and the state far below the demand in the last year can be observed in October.

Next is the correlation between the daily maximum demand and daily maximum temperature for TEPCO on weekdays during the summer. It is clear that demand this year was smaller than last year by nearly 10 million kW on days with the same temperature. The weather was on TEPCO's side this year, however, because there were only 39 extremely hot days with temperatures exceeding 30 degrees Celsius in July and August, which is fewer than the 52 days during the previous summer.

What will happen this coming winter? The government sought to reduce power by more than 10% in the Kansai Electric Power Company and 5% in the Kyushu Electric Power Company compared to last winter's peak power from December 19th. Both companies are, however, highly reliant on nuclear power, and many plants were stopped for the periodic inspection and there is no prospect of them running again soon. They will need to implement power saving discounts for small business consumers and call for cooperation by presenting a power saving menu in the residential sector. In my view, the tight winter power problem will eventually be solved by power interchange inside the western area and a certain amount of consumers' efforts. Under these circumstances, we should not push excessive power saving options such as a fuel conversion from electricity to oil or gas, but rather options which lead to energy saving which can eliminate inefficiency and waste. The real problem is the increase in generation costs.

If thermal power plants were to replace all nuclear power plants, the increase in fuel costs are said to exceed 3 trillion yen for all utilities in Japan, corresponding to an increase of about 3 yen per kWh (electricity price in Japan is about 22 yen / kWh for residences and about 10 yen / kWh for industry). Future electricity rate hikes are unavoidable and consumers will have to continue working to save power nationally in the long term.

While supply-side measures such as strengthening the network are important, demand-side measures are also important to realize efficient, economical and stable electricity supply in the future. Trading of power savings, demand response including households and energy management can be considered on the demand side.

The era in which consumers use energy (electricity) as they like and letting the responsibility for supplying and covering any fluctuations fall to the utilities has ended.


*Image of Kinkyu Setsuden site http://kinkyusetsuden.jp/*

# Typhoon Talas – quick report from the Kii Peninsula, Japan

By S. Kondo

On September 3rd, 2011, Typhoon Talas made landfall on Shikoku Island and reached the Sea of Japan the next day after crossing the Shikoku and Chugoku regions. Due to the large scale of the strong wind area and the slow movement speed, Typhoon Talas induced moisture advection for many hours, causing record-breaking heavy rainfall over a wide area from western to northern Japan, especially along the mountains. In particular, a wide area of the Kii Peninsula was hit hard, with the total amount of precipitation on August 30th exceeding 1,000 mm. An observation station on the Kii Peninsula measured 1,652.5 mm rainfall in 72 hours, setting a record high in Japan.

The record-breaking heavy rainfall brought by Typhoon Talas caused sediment disasters, inundation and river flooding in a wide area from Hokkaido to Shikoku. Overall, 77 casualties occurred and 18 people went missing, mainly on the Kii Peninsula. In addition, substantial property damage including residential damage, agricultural damage, and damage to transportation systems were reported.

On the southeastern part of the Kii Peninsula, debris flows caused severe damage to mountain settlements along the river. The people who evacuated early survived, but people who delayed their evacuation were swept away by the debris flow. Some of those people had moved to these settlements from the coastal regions due to fear of a potential tsunami caused by the Tonankai earthquake; in addition, most people had never experienced such a large sediment disaster. Kumano Nachi Taisha, a World Heritage site, was also affected by the sediment disaster, although it has now recovered.

Other affected areas were also inundated by river flooding. Some houses along the Kumano River were flooded up to the second floor. People in the flooded areas could not use mobile phone, internet, or cable television because the base stations were inundated; furthermore, due to the mountainous terrain, it was also difficult to listen to the radio. As a result, people had difficulty obtaining information about the rainfall amount and water level of the river. In this area, because of damage to major roads, it took much longer to travel outside the area than normal.

Difficulties observed in this disaster may also occur in other mountainous areas, so I would like to summarize the lessons of this disaster to improve disaster response around the world.

*Roadway damage in the mountainous area*

*Flooding up to the second floor of a local residence*

*Kumano Nachi Taisha (photo courtesy of Wakayama Prefectural Board of Education)*

*Debris flow*

*Severe road damage caused by landslide*

# 10-year anniversary of the Sept. 11, 2001 terrorist attacks in New York

*By M. Henry*

September 11, 2011, marked the 10-year anniversary of the 9/11 terrorist attacks in the United States which destroyed the Twin Towers of the World Trade Center in New York, damaged the Pentagon in Virginia, and caused the deaths of nearly 3,000 people. The anniversary was commemorated with a ceremony at the former site of the Twin Towers in downtown Manhattan, where a new memorial, upon which all the names of those killed in the attacks are written, was unveiled. The ceremony was attended by President Obama and former president George W. Bush.

Nearby, construction continues on the One World Trade Center building (1WTC). 1WTC is being built on the site of the former 6 World Trade Center building and, at a planned 105 stories and 1,776 feet (at the top of the radio antenna), will serve as the centerpiece of the new World Trade Center complex. As of September 11, 2011, 82 stories of steel superstructure had been erected, with construction estimated to be completed sometime in 2013.

# 3.11 net Tokyo activities report

*By M. Ohara*

After the Great East Japan Earthquake Disaster on March 11, 2011, researchers in IIS launched a network for supporting recovery and reconstruction activities called "3.11net Tokyo." The core members were the ICUS staff, with volunteer members joining from the Collaborative Research Center for Energy Engineering (CEE), The Underwater Technology Research Center, Earthquake Resistant Structure Research Group (ERS Group), The Advanced Mobility Research Center (ITS Center) in IIS. Outside IIS, other members joined from The Center for Integrated Disaster Information Research (CIDIR) in the University of Tokyo.

As a part of the activities of 3.11net Tokyo, researchers held regular meetings for exchanging information about disaster situations and discussing what researchers could do to contribute to recovery and reconstruction. After several discussions, the aims of the network were set as follows: sharing of disaster investigation studies from various fields and information dissemination related to the disaster, recovery and reconstruction.

After the earthquake, many research groups or academic organizations conducted field surveys in the damaged areas. Unfortunately, duplicate surveys caused excessive burden to those affected. In the future, these duplicate surveys should be avoided through information sharing before the planning of field surveys. In order to share disaster investigation studies, 3.11net Tokyo carried out three approaches.

The first approach was the sharing of academic society activities at the regular meetings, whereby members reported the plans and results of investigations by the academic societies to which they belong.

The second approach was the sharing of photos taken during field surveys. Using a free sharing website, members uploaded their photos along with GPS coordinates; as of August 2011, 15,702 photos were shared. These photos are useful for understanding the total damage in the Tohoku area.

The third approach was the sharing of opinions through workshops. Three kinds of workshops were held in order to discuss the social problems in the tsunami-affected areas, the areas affected by the accident at the Fukushima nuclear power plant, and the Tokyo metropolitan area. At each workshop, the social problems which emerged or would emerge in these areas were anticipated and the ability of researchers to contribute to solving these situations was discussed.

For the dissemination of disaster, recovery, and reconstruction information, 3.11net Tokyo opened a website with links to various research results. As of August, links to 438 websites were available, although most of these are in Japanese. In addition, 3.11net Tokyo started to collect various references such as newspapers, books, reports, and so forth. These references will be preserved for future studies. The URL for 3.11net Tokyo is:
http://icus.iis.u-tokyo.ac.jp/rnet_edr/

# Report on the 4th Joint Student Seminar on Civil Infrastructures in Bangkok, Thailand

*By K. Tachibana, Ph.D. student, Koshihara Laboratory*

The 4th Joint Student Seminar was successfully held at the Asian Institute of Technology (AIT) on August 1 and 2, 2011. This seminar had two main sessions. On the first day, a presentation session was held at AIT, where three professors and 16 students gave presentations on research from various fields such as transportation, geotechnical, concrete and timber structures, disaster mitigation and applied remote sensing. The next day, a tour of PRUKSA PRECAST, a precast concrete factory, and a sightseeing tour of Ayutthaya were held.


*Group photo of participants in the 4th Joint Student Seminar*

This seminar provided many precious experiences. First, overseas presentations are a rare opportunity for some students, and we were able to build good relations and have interesting discussions with people from Japan, Thailand, Korea, China, Nepal, and Vietnam. On the second day, the factory tour gave us valuable information about how to make and use precast concrete. Finally, the tour of Ayutthaya gave us a sense of Thailand's history.

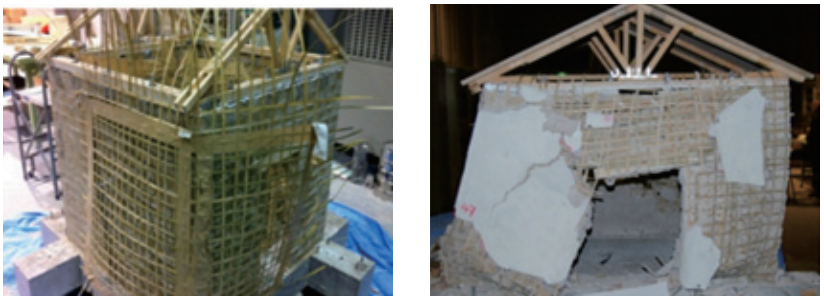
I would like to express my appreciation to the organizers, Dr. A. Kawasaki, Dr. K. Park, and Ms. A. Suwannasuk of AIT, and to all the participants in this seminar. I hope next year's Joint Student Seminar will also be successful and fruitful.

**The winner of the Best Presentation Award at the 4th Joint Student Seminar presents his research below.**

# Dynamic testing of masonry houses retrofitted by bamboo band meshes

*By R. Soti, Master student, Meguro Laboratory*

The collapse of unreinforced masonry structures, which are widely distributed around the earthquake prone regions of the world, is one of the greatest causes of death in major earthquake events. This research presents an innovative retrofitting method for masonry structures which uses bamboo bands arranged in a mesh fashion and embedded in a mortar overlay. In order to determine the effectiveness of the proposed retrofitting technique, shaking table tests were conducted using retrofitted and non-retrofitted 1/4 scaled masonry houses and each house was subjected to sinusoidal ground motion inputs. Based on the experimental results, the dynamic behavior of models was analyzed and failure behaviors and performances were evaluated. The result showed that the bamboo-band mesh retrofitting technique enhances the seismic resistant capacity of the masonry building model significantly. The retrofitted masonry building could withstand more than twice the input energy of non-retrofitted specimen. Bamboo is a widely available construction material and its use for retrofitting works not only enhances the seismic resistant capacity of new and existing building but also promotes the local business.

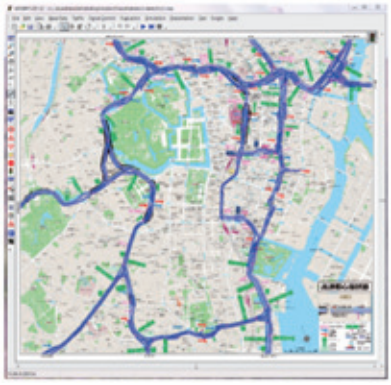


*A building outfitted with bamboo mesh (left) and the failure behavior after shaking test (right)*

# Multi-objective assessment and optimization of highway monitoring system

By T. Jiang, Ph.D. student, Oguchi and Tanaka Laboratory

While there are many research works focusing on the use of available traffic data sources to improve traffic models and operation systems, less work is devoted to answering the question of how and where to collect traffic data, such that control systems can perform in an optimal and cost-efficient manner. In this research, I present a framework to assess traffic detection systems by introducing the level of detection as a value to allow for an objective comparison of multiple detector placement scenarios. In contrast to existing studies, which propose new or alternative detector locations based on errors of travel time or traffic state estimators, our approach is solely based on network parameters, detection technology, and traffic demand, which allows the usage of the framework for network operations as well as planning purposes. By translating traffic operation goals into data demand functions, and detector capabilities, combined with their location, into data supply functions, it is possible to optimize detector locations with well know tools from operations research. The latter one is important, since it allows for including additional boundary conditions, such as costs.



*Simulation-based case study of the Tokyo Metropolitan Expressway*

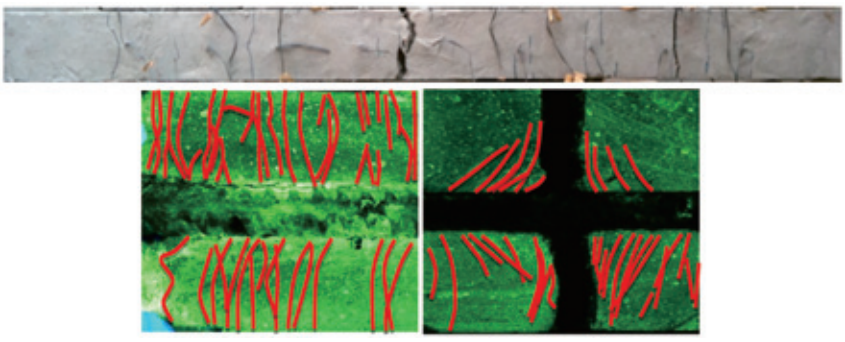
# Development of tension stiffening model for pre-and post-yielding behaviors of R/HPFRCC

By D. Mahyarudin, Master student, Nagai Laboratory

This research focused on developing a tension stiffening model of reinforced high-performance fiber-reinforced cementitious composites (R/HPFRCC) under direct tension force. HPFRCC is a composite material that has high ductility, good tensile strain hardening performance, and shows multiple micro cracking. In recent years, rebar has been used together with HPFRCC, so it is very important to understand the behavior of these materials together.

Specimens 1.7 meters and 0.5 meters in length with 0.7%, 1.7%, and 3.0% reinforcement ratios (ρ) were prepared and tested. Test results showed that, except in the 1.7 meter specimen with ρ = 0.7%, which failed due to rebar pull-out, the HPFRCC was capable of compatible deformation with the rebar prior to yielding. The results also showed that R/HPFRCC material has a higher tension force compared to RC. Crack localizations were formed in the 1.7 meter specimen (2 in ρ = 1.7% and 5 in ρ = 3.0%).

The stress response of rebar in R/HPFRCC showed linear response at pre-yielding stage and at post yielding stage the steel stress has early strain hardening stage compared to the bare bar response. HPFRCC response was obtained by extracting the average response of R/HPFRCC with the steel response. The analysis showed that HPFRCC has good tension contribution at the post-yielding stages. Hence, the proposed HPFRCC tension model was successfully developed.



*Observed HPFRCC cracks*

# Sept. 18, 2011 earthquake in Sikkim, India, and its effects on the cities of Bangladesh

By M. Ansary, BNUS

A magnitude 6.9 earthquake occurred near Gangtok, the capital of the state of Sikkim in India, on September 18, 2011. The earthquake killed around 150 people in India and Nepal, and a total of 100,000 structures were reported to have been affected out of which 2,000 collapsed completely. Around 100,000 people were made homeless.

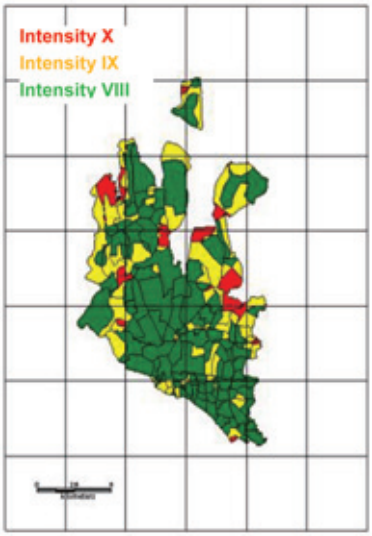
Earthquake risk in Dhaka city has been discussed in different quarters for the last couple of years. The 6.9 magnitude Sikkim earthquake of September 18, which was located almost 600 kilometers away from Dhaka city, created a prolonged vibration for almost all buildings, although no damage has been reported so far. This earthquake lasted almost 100 seconds. The intensity in the epicentral area was between VII and VIII; in Dhaka it was between III and IV.

In the case of either a magnitude 7 earthquake occurring on the Modhupur fault located 90 kilometers away from Dhaka or a magnitude 8 earthquake occurring on the Dauki fault located 230 kilometers away from Dhaka, the 60% of Dhaka which is situated on red Modhur clay may suffer an intensity of VIII and the 40% of Dhaka situated on reclaimed land may suffer an intensity between IX and X. These reclaimed areas are filled with 12 to 30 meters of loose sand or soft clay. Similar conditions exist in Mexico City, which is underlain by 30 to 50 meters of soft clay. During the 1985 Michoacan Earthquake (M=8.1) which occurred 350 kilometers away from Mexico City, around 500 high-rise buildings collapsed, killing 10,000 people.

Many techniques exist to improve these lands, such as vibroflotation, sand compaction piles, dynamic consolidation, chemical piles, injection hardening, gravel drain, and so forth, and some of these techniques can be used below an existing building. Before construction on reclaimed areas, such poor-quality soils need to be improved utilizing the above methods. Then, after improving the land, the building needs to be made earthquake resistant. The stirrups of a column should be placed at 135 degrees, and at the top and bottom and left and right sides of the junction between beams and columns the stirrups have to be put in a more dense fashion. In addition, open car parking should be avoided in buildings. If open car parking is kept then, through computer modeling of the building, either the columns need to be strengthened or shear walls or bracing has to be placed in suitable locations.

To make a building earthquake resistant, proper design is essential at the same time as construction of the building in order to ensure quality control of the materials and proper implementation of the structural design in the field.


*Earthquake epicenter*




*Microzonation map of Dhaka city*

*Collapsed buildng*

*Shear cracks on the wall*

## ICUS welcomes Dr. Kohei Nagai

*By K. Meguro*

ICUS is pleased to welcome Dr. Kohei Nagai as an Associate Professor starting from July 2011. Dr. Nagai will be joining the Social Infrastructure Management Division.

Dr. Nagai comes to ICUS from the Concrete Laboratory (Hongo Campus) in the Department of Civil Engineering, the University of Tokyo, where he was a project lecturer. His major fields of research include the mechanics of fiber reinforced cementititous composites (as described in detail in the main article of this issue), the mesoscopic simulation of failure of concrete and reinforced concrete, and simulation of press-in driving in soil. As the newest member of the ICUS faculty, Dr. Nagai will be applying his expertise in the concrete field to the management of infrastructure in a developed society.

*Dr. K. Nagai*

We again welcome Dr. Nagai to ICUS and the Institute of Industrial Science, and we are looking forward to his excellent contributions towards the establishment of safer and sustainable urban systems.

## ICUS Activities July – September

- Dr. T. Kato traveled to Sichuan, China, from July 9 to 17 to investigate the recovery from the Sichuan earthquake disaster.
- Dr. K. Nagai visited Korea and China July 13 to 16 for meetings on student mobility.
- Dr. A. Kawasaki was in Bangkok, Thailand, from July 16 to Aug. 8, from Aug. 24 to Sept. 6, and again from Sept. 20 to Oct. 26 to operate the RNUS office, coordinate USMCA2011 preparations, and conduct lectures.
- Prof. K. Meguro went to Bangkok, Thailand from Aug. 1 to 3 for the 4th Joint Student Seminar at AIT.
- Dr. K. Nagai traveled to Vietnam from Aug. 2 to 5 to visit a construction site.
- Dr. R. Kuwano attended the International Symposium of IS-SEOUL2011 in Seoul, South Korea, from Aug. 31 to Sept. 3.
- Dr. T. Endo went to Brazil from Sept. 5 to 27 for meetings with INPE and INPA.
- Prof. K. Meguro and Dr. M. Numada were in Jogjakarta, Indonesia, from Sept. 14 to 19 for presentation and investigation related to PP-band technology.
- Dr. S. Tanaka traveled to Brisbane, Australia, for the International Workshop on Traffic Data Collection and its Standardization from Sept. 21 to 26.

## Awards and honors

- Mr. R. Soti, master course student in Meguro Laboratory, received the Best Presentation Prize at the 4th Joint Student Seminar on Civil Infrastructures in Bangkok, Thailand, for his paper and presentation "Dynamic testing of masonry houses retrofitted by bamboo band meshes." His award-winning research is summarized on Page 8 of this volume. He also received the Best Presentation Prize on Aug. 26 from the Japan Society of Civil Engineers.

*Mr. R. Soti with his prize at the 4th Joint Student Seminar*

## *Editor's note...*

We can say that we have entered "the time of mega-risk." In the 21st century, we have already experienced mega disasters such as the 2001 terrorist attack in New York, the 2004 Sumatra Earthquake tsunami disaster in southeast Asia, the 2008 Wenchuan Earthquake in China, and the 2011 East Japan Earthquake tsunami disaster including the nuclear power plant catastrophe. Moreover, flood hazard has been increasing due to climate change and we will face even more serious situations in this century. This mega risk is caused not only by the increase in hazards but also the vulnerability of the environment. The responsibility of engineering and planning is significant.

We have to redefine the concept of safety according to "the time of mega-risk," consider how to coexistence with various kinds of risk, and combine risk reduction with other factors such as adaptation to global change and response to the aging society. The East Japan Earthquake disaster is one opportunity to do so.

The first keyword for the near future will be "resilience." But it cannot be said that the meaning of the word "resilience" is understood well enough; it is still abstract. We have to interpret it from the perspective of engineering and establish technologies of "resilience" in our society. I think that this is one of our missions and an important social role of ICUS.

"Learn from the past and make the future." We pray sincerely for the repose of victims' souls in the past disaster.

***By. T. Kato***

## Announcement of USMCA2012 (Ulaanbaatar, Mongolia)

We would like to announce that the 11th International Symposium on New Technologies for Urban Safety of Mega Cities in Asia (USMCA2012) will be held in Ulaanbaatar, Mongolia, on Oct. 10-12, 2012. Further information will be available on the ICUS website as details are decided.

International Center for Urban Safety Engineering (ICUS)
Institute of Industrial Science, The University of Tokyo
4-6-1 Komaba, Meguro-ku, Tokyo 153-8505, Japan
Tel: (+81-3) 5452-6472, Fax: (+81-3) 5452-6476
http://icus.iis.u-tokyo.ac.jp

**PRINTED MATTER**

*The International Center for Urban Safety Engineering (ICUS) is a research center located at the Institute of Industrial Science, The University of Tokyo.*

*The purpose of ICUS is to identify, investigate, and resolve issues towards the realization of sustainable urban systems for the prosperity and safety of society considering challenging socio-economic problems.*