ICUS Newsletter

Volume 11 Number 3 Oct. to Dec. 2011

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

The 2011 Great East Japan Earthquake tsunami disaster: its impact and lessons for renovation

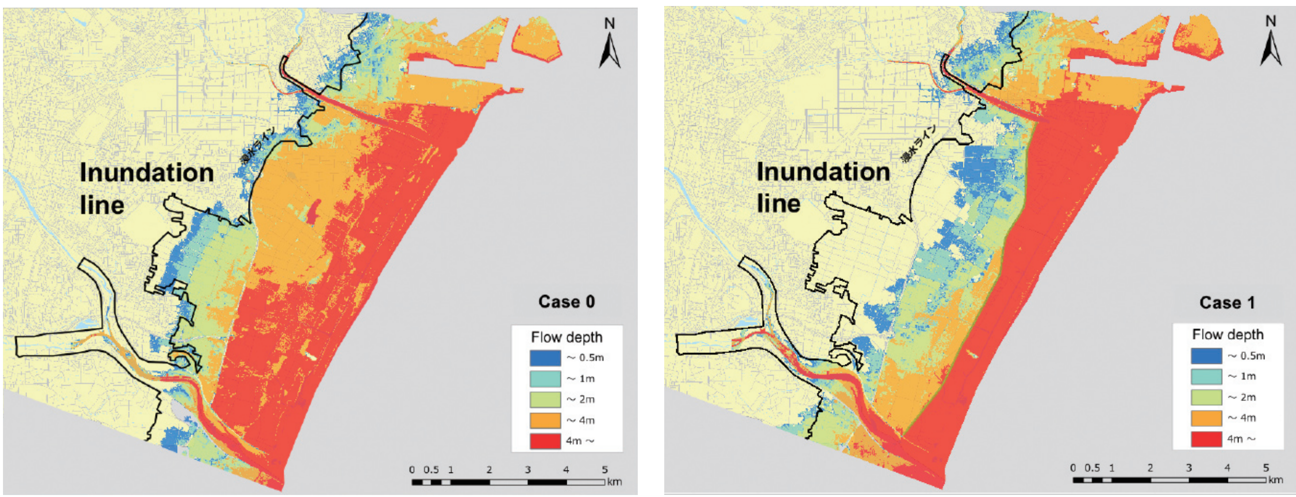
By Shunichi Koshimura

Associate Professor, Disaster Control Research Center, Tohoku University

Introduction

On March 11, 2011, a magnitude M9.0 earthquake accompanied by a devastating tsunami attacked the northern Pacific coast of Japan, totally sweeping away many coastal communities in Iwate, Miyagi, and Fukushima Prefectures. The total area affected by the tsunami was estimated at 561 square kilometers along the Pacific coastline, and the tsunami run-up height reached up to 40 meters. As of September 10, six months after the event occurred, the National Police Agency reported 15,781 dead, 4,086 missing, and 115,151 buildings and houses collapsed or washed-away. The economic impact was estimated at 16-25 trillion yen, compared to the FY2010 national budget of Japan at 92 trillion yen.

Six months after the event, the devastated areas have started moving forward towards recovery and reconstruction - that is, the renovation of their communities. Approximately 82,000 residents who lost houses have moved from evacuation centers to temporary houses and rental housing and 89% of the 23 million tons of tsunami debris have been removed. Though the recovery process is still underway, local governments completed a

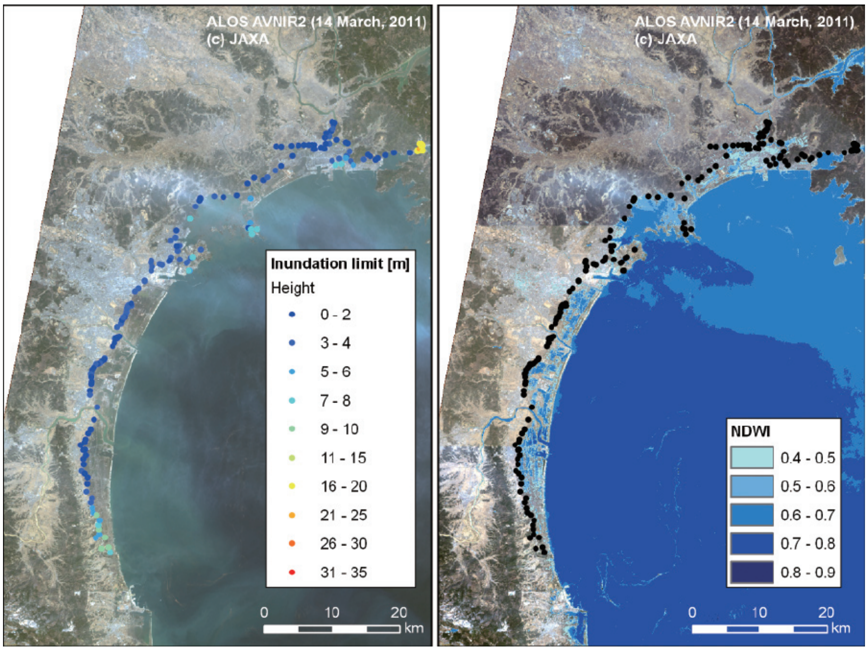


Numerical simulation of how post-disaster reconstruction plans such as coastal levees and elevated roads may be able to minimize tsunami risks draft reconstruction plan including infrastructure design, transportation, land use management, urban design, relocation, and economic and industrial outlooks. Every decision has been made quite fast compared to this wide extent of devastation.

Also in the six months since the earthquake, our team conducted an integrated investigation by field measurement of tsunami heights, optical satellite image analysis, and aerial photo inspection with approach of spatial information sciences in order to identify the tsunami's impact. The preliminary findings are combined with numerical modeling technologies to find out structural vulnerability against tsunami and to provide a guidance for land use management and relocation planning to reconstruct resilient coastal communities.

Mapping tsunami inundation zone

Mapping of the tsunami inundation was conducted through analysis of optical satellite images with calibration from the ground field survey. The significant feature of the 2011 tsunami was the wide extent of the inundation zone. For example, on the Sendai plain, the tsunami reached more than 5 kilometers inland. Our group focused on mapping the inundation limit of the coast of Tohoku region. We conducted high-resolution surveys of the inundation limit and height to an accuracy of a few centimeters using GPS measurement system in Miyagi, Iwate, and Aomori Prefectures. The horizontal measurement interval ranged from approximately 500 meters to several kilometers and we measured nearly 300 sites until the end of April. To



Mapping of tsunami inundation using ALOS AVNIR-2 image acquired on March 14 and the normalized difference water index

draw the inundation line, we applied remote sensing technology using satellite and aerial photographs acquired after the tsunami.

Mapping structural damage and vulnerability

Mapping of the structural damage was conducted through visual interpretation of aerial photos to identify the structural vulnerability against the 2011 tsunami. For visual inspection, we used the aerial photo archives of the Geospatial Information Authority of Japan acquired in the devastated area. Ortho photos with a resolution of 80 centimeters/pixel were composited with mosaic image processing. Combined with the ZENRIN building data (building shape files), the inspection was conducted for each building by comparing pre- and post-tsunami aerial photos, focusing on the existence of houses' roofs to add an classification attribute of either "washed-away" or "surviving" to the damage status. By mapping the structural damage and overlooking its spatial distribution, not only the impact of tsunami but also the effect of coastal protection and vegetation can be seen.

Integrating the structural damage mapping with field survey data, such as flow depths, leads to a new means for identifying structural vulnerability against tsunami in the form of a tsunami fragility curve or tsunami fragility function. The tsunami fragility curve is defined as the structural damage probability or fatality ratio with particular regard to the hydrodynamic features of tsunami inundation flow, such as flow depth, current velocity and hydrodynamic force. Using this fragility curve, the damage probabilities of structural destruction as a function of flow depth can be estimated. Structures in Miyagi Prefecture were especially vulnerable when the local flow depth exceeded 2 meters, and 6 meter flow depth would totally devastate the houses. This fact can contribute to land use planning which considers the effect of coastal protection.

Towards resilient coastal communities

In April 2011, one month after the event occurred, the central government established the reconstruction policy council to develop a national recovery and reconstruction outlook for tsunami-resilient community. Besides, the central government decided the policy of coastal protection such as seawall and breakwater, which would be designed to ensure their performance to potential tsunami level of 150 year recurrence interval. In this sense, the government policy of designing coastal protection is for 150-year tsunami level (this is called "Prevention Level") which ensures to protect lives and properties. And for the tsunami level more than 150-year recurrence interval, so-called extreme event, the government calls "Preparedness/Mitigation Level" to reduce the losses and damage by all of the efforts of coastal protection, urban planning, evacuation, and public education.

Under the limitations and uncertain conditions of funding, prefectural and local governments have developed their own recovery and reconstruction plans, which assume 10 years to be completed. These plans consist of the combination of structural prevention/mitigation, urban planning, preparedness, and suggest their land use management, relocation, housing reconstruction and tsunami disaster mitigation plans. The key role of academia, in engineering point of view, is to verify and evaluate if these plans really work for future disaster reduction.

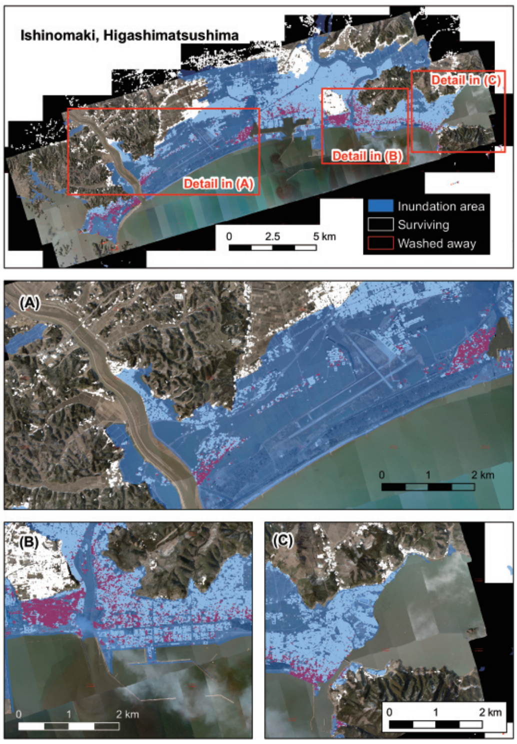
When the proposed reconstruction plan should be verified, numerical modeling is a powerful tool. The figure on the cover page shows an example evaluation of Sendai City's preliminary reconstruction plan that includes 6.2 m levee and 6 m elevated road. As shown in the figure, through the comparison of the 2011 tsunami simulated under the pre-tsunami condition in coastal protection and land use, potential reconstruction plans can be evaluated with regard to tsunami inundation area and flow depth, exposed population and buildings, and reducing risks.

Acknowledgment

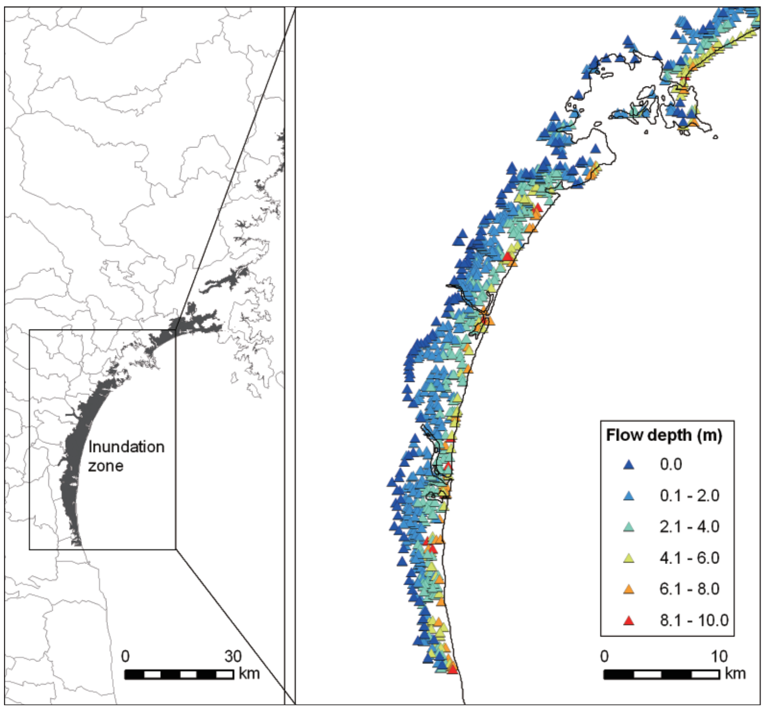
The post-tsunami field survey was conducted by a group of 20 scientists and engineers. All the data of our measurements can be viewed on the web page:
http://www.tohoku-tsunami.jp

This research was funded by the Ministry of Education, Culture, Sports, Science & Technology (MEXT), the New Energy and Industrial Technology Development Organization (NEDO), and the Japan Society for the Promotion of Science (JSPS).

Editor's Note: This article is an abbreviated version of Prof. Koshimura's paper and keynote lecture from USMCA2011.



Mapping structural damage by inspection of post-event aerial photos



Mapping the tsunami flow depth measured by Miyagi Prefecture and our team

Brief overview of expansion process and damage due to Chao Phraya River Flood in Thailand

By A. Kawasaki

Flood expansion process

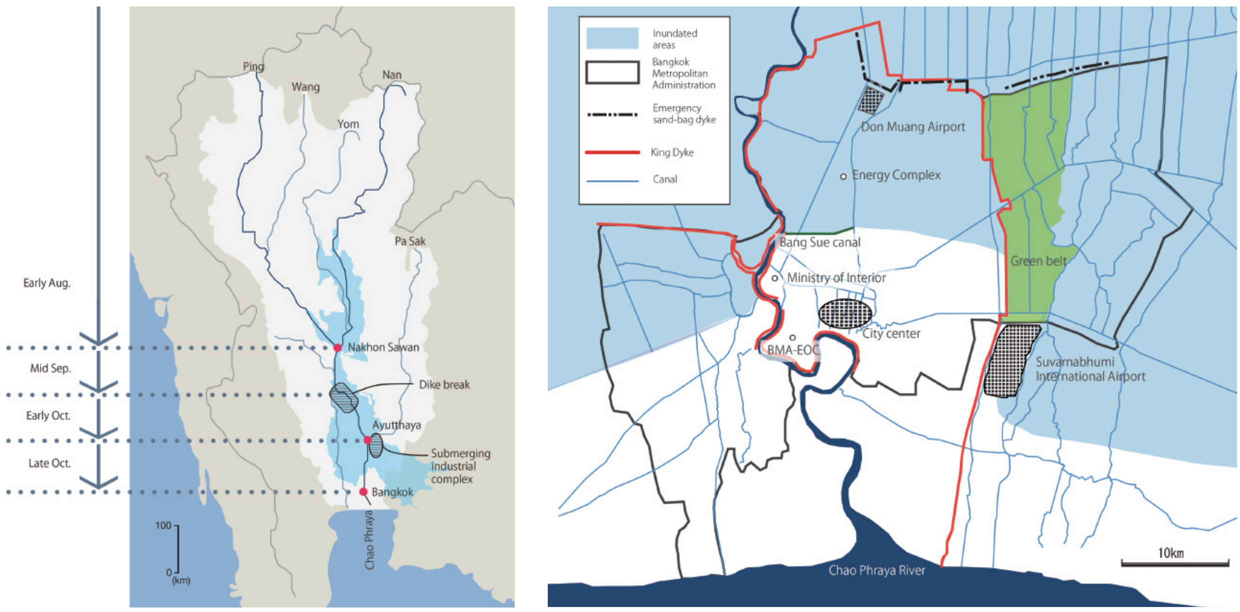
From June to September 2011, the four month precipitation in many places on the Indochina Peninsula was about 1.2 to 1.8 times higher than the average, such as 134% in Chiang Mai, Thailand, 140% in Bangkok, the capital of Thailand, and 144% in Vientiane, Laos. In addition, heavy rain continued over the Chao Phraya River basin into early October.

After causing landslides and flash floods in the northern part of Thailand in August, the floodwaters slowly moved south and the inundation area grew as dikes were destroyed along the Chao Phraya River in Nakhon Sawan Province and Chinart Province during mid- to late September. In early October, floodwaters submerged several industrial complexes in Ayutthaya Province where many Japanese factories such as the Rojana Industrial Park and Hi-Tech Industrial Estate are located. In mid-October, floodwaters approached Nava Nakorn Industrial Estate in Pathumtani Province, located directly north of Bangkok, and submerged academic and research zones where the Asian Institute of Technology (AIT), Thammasat University and Thai Science Park are located.

At the end of October, two flows of floodwater reached Bangkok. The primary flow was caused by overflow in the upstream Chao Phraya River, which flowed southward through town, farms, and channels and reached the capital by overtopping the King's Dike (an outer embankment for protecting the capital). The other flow was caused by the direct overflow from Chao Phraya River where it runs along the Bangkok metropolitan area. Although the Thai government and Bangkok Metropolitan Administration built long sandbag embankments on the outer dike for protecting the capital, the floodwaters still overtopped it.

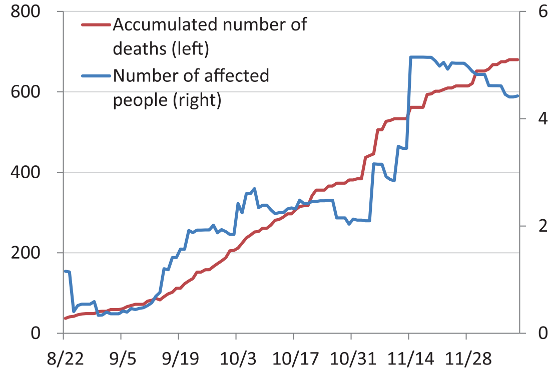
At that time, the headquarters of the Thai government's Flood Recovery Operation Center (FROC) was located at Don Muang Airport, the former international airport in Bangkok which is located about 15 kilometers north of the city center, but it had to be relocated to the Energy Complex Building, about 10 kilometers south of the airport as the airport was flooded at the end of October.

Following the flooding of Don Muang Airport, 6,000 giant 2.5-ton sandbags, called "Big Bags," were used to quickly build an embankment north of Bangkok, and the proper drainage of floodwaters into the Chao Phraya River began as the water level of the Chao Phraya River went down. Then, in mid-November, southward expansion of the floodwaters was finally halted at Bang Sue canal, about 5 kilometers



Estimated inundation area in the Chao Phraya River basin (left) and Bangkok Metropolitan area (right). These images were created by tracing satellite images from GISTDA (Geo-Informatics and Space Technology Development Agency, Thailand). The inundated areas are likely to be overestimated as rice paddy fields and wetland may have been detected as inundated areas.

Makeshift walkway and water taxi in inundated area in Rangsit, Pathumtani on Nov. 5, 2011



Number of deaths & affected people (source: Department of Disaster Prevention and Mitigation, Thailand)

Don Muang Airport (former international airport) on Nov. 16, 2011

Young children enjoying the floodwaters in Thonburi, Bangkok, on Nov. 5, 2011

north of the city center, and flooding of the city center was prevented.

Drainage of several industrial complexes was completed in the middle of November with support from international rescue teams, such as Japan's Ministry of Land, Infrastructure and Transport, using high performance pumping cars.

Damage

As of December 10th, 2011, the floods had killed 680 people and 3 people were missing. The cause of 80% of the deaths was by drowning. Based on the rapid damage estimation by the World Bank, total economic damages and losses from the floods stood at approximately 45.7 billion US dollars as of December 1, 2011, and it was estimated that Thailand's economic growth rate was reduced from 3.5% to 2.4% in 2011. Compared to other past natural disasters, the economic damage by the floods in Thailand in 2011 was the fourth-largest disaster in the world, following the 2011 Tohoku earthquake in Japan, 2005's Hurricane Katrina in the US, and the 1995 Kobe earthquake in Japan. This estimation doesn't include the long-term impact on economic activities in Thailand and overseas impacts such as disruption of the supply chain.

Recovering from this extensive damage is a big challenge in Thailand. The government needs to establish a long-term economic recovery strategy considering the improvement of quality of life and better reliability for foreign investors as well as a master plan for building a flood-safe city against future floods.

During my field survey of this flood, I received the impression that Thai people appeared to be enjoying the flood, and I heard similar opinions from other foreign investigators as well. Many street stalls were opened above the floodwaters, temporary waterways and transportation system were created, and children played in the water. The Thai people's recognition of the flooding seemed quite different compared to other countries - based on their knowledge and experience, Thai people were doing all kinds of things to live with the flood conditions.

JICA (Japan International Cooperation Agency) received a request from the Thai government to conduct an investigation towards creating a master plan for flood management in the Chao Phraya River basin considering the current urbanization and industrialization and climate change. I hope that the collaboration between the Thai government and JICA will produce a suitable recovery strategy and master plan considering these special local characteristics of Thailand.

Fixed-point observation of reconstruction progress in areas affected by the Great East Japan Earthquake

By S. Kondo

Over half a year has passed since the Great East Japan Earthquake occurred. In the affected areas, the life of disaster victims has been improving little by little. As one means of measuring this improvement, ICUS (3.11 net Tokyo) has been regularly conducting fixed-point observations in various locations. This observation aims to record the process of recovery and reconstruction throughout the entire affected area. At this time, a state of affairs in the affected areas is reported, along with a comparison of photos taken at the end of April 2011 and the end of November 2011. The map shown on this page shows where the photos were taken, with all of the reported observations being in either Miyagi or Iwate Prefectures.

The biggest change over the past seven months is disapperance of massive the tsunami debris. By the end of April, only tsunami debris on the roads had been removed, but by the end of November most of the tsunami debris in the residential areas was also removed. The Ministry of the Environment issued a basic strategy in May, which stated: "before the end of August 2011, tsunami debris in the vicinity of residences shall be removed." The current situation is the result of this basic strategy. The removed tsunami debris has been placed at temporary waste dumps for tsunami debris and segregated into types, such as wood or concrete.

Many other reconstruction and recovery initiatives are also progressing. Disaster victims who lost their homes have moved from

Map of survey points in the areas affected by the Great East Japan Earthquake

The end of April, 2011 | The end of November, 2011

1. Arahama, Sendai, Miyagi Prefecture

2. Onagawa, Miyagi Prefecture

3. Okawa elementary school, Ishinomaki, Miyagi Prefecture evacuation centers to temporary houses. Temporary houses include not only one-story prefabricated conventional structures but also three-story stacked containers because the affected areas are surrounded by mountains and the ocean and there is very limited space to build houses. In some areas, temporary stores have been established and are conducting business.

During the survey conducted at the end of April, it was difficult to believe in the possibility of reconstruction because of the enormous volume of tsunami debris. At the end of November, however, I could feel that reconstruction is possible in the future with the efforts of disaster victims (excluding the area around the Fukushima No. 1 nuclear power plant). In order to capture the progress of this reconstruction, we want to continue conducting this fixed-point observation study.

The end of April, 2011 | The end of November, 2011

4. Minamisanriku, Miyagi Prefecture

5. Kesennuma, Miyagi Prefecture

6. Otsuchi, Iwate Prefecture

Temporary waste dump for tsunami debris (Rikuzentakata, Iwate Prefecture)

Temporary houses made of shipping containers stacked three stories high (Onagawa, Miyagi Prefecture)

Temporary store (Ofunato, Iwate Prefecture)

Investigation on the concrete industry and sustainability in Mongolia

By M. Henry

It is difficult to establish a global strategy for concrete sustainability, as related factors such as level of technology, stakeholder culture, available resources, institutional systems, and so forth vary widely around the world and also depend strongly on regional or local conditions. It is therefore necessary to understand the relationship and interaction between the afore-mentioned factors and concrete sustainability. In particular, the Asian region represents a good opportunity to understand this relationship and interaction, as the level of development and regional conditions vary widely.

Currently, the International Center for Urban Safety Engineering (ICUS) is establishing various ties with academics and professionals in Mongolia for developing safe and sustainable infrastructure. Mongolia represents a good case study as its level of development is currently low but explosive growth is expected in the future due to industrial development. This research was therefore carried out to investigate the current state of the concrete industry in Mongolia and how the Mongolia socio-economic conditions affect the potential for sustainable concrete practice and materials.

The Mongolian concrete industry is characterized by strong demand for concrete, particularly for architectural applications, which peaks during the summer months and tapers off during the winter. During the summer peak, demand is so high that the industry experiences shortages, particularly of cement, and this problem is compounded by the limited number of supply routes for importing cement from China. Natural resources for producing concrete are widely available domestically, except for anti-freezing admixtures, which are imported from China. Management of concrete curing during the colder winter months is critical to prevent concrete cracking.

Important issues for sustainability include the conservation of natural resources and management of supply logistics due to the high demand for materials during the summer months, utilization of fly ash which is widely available from coal power plants but unusable at this time due to poor quality, and the implementation of quality control for materials and structures to reduce variation across the concrete industry. Other issues include the development of conformation codes and reduction of air pollution and waste generation.

Curing of a concrete slab-on-grade during the winter months using plastic sheets and felt (left) and a diesel heater (right)

Exposed reinforcement in new construction highlights the importance of improved quality controls

Large amounts of waste timber can be found on construction sites

Report from Van, Turkey: need for better housing after the 2011 Eastern Turkey Earthquake

By T. Matsushita, Master student, Meguro Laboratory

A magnitude 7.2 earthquake struck the eastern part of Turkey 16 kilometers north-northeast of Van at 13:41 local time on Oct. 23, 2011. Initially, only 9 building collapsed in Van, but the number increased due to aftershocks and the final death toll was 604. Officials reported more than 2,300 buildings as 'uninhabitable' after their inspection in the week after the earthquake, and many residents had to evacuate and seek shelters. On Nov. 9, another earthquake (M5.6) hit at 21:30 local time, causing 40 deaths including a Japanese NPO staff member who was buried under a collapsed hotel. An additional 25 buildings collapsed after this big aftershock and, unfortunately, the hotel was one of three that were occupied after the inspection.

I visited Van and its vicinity as a part of an NPO's assessment team. A medical officer at the Van Crisis Center told me the shocking story of how many patients received injuries from jumping off from the upper floors of their buildings due to their fear of the building collapsing. Many people do not want to go back to their own houses even after the government told them that their buildings were safe. It shows how little trust people have in the quake-resistance of their buildings while at the same time demonstrating a lack of proper information or knowledge about evacuation.

In the countryside, the building damage was severer compared to the city, but there were fewer victims because, at the time of the earthquake, most people were outside working on their farms or could run outside before the collapse because many houses were single-story structures.

One observation made at tent camps is that there were many burn patients, especially children, reported after the earthquake. This was caused by spilled boiling water from Chai pots on gas stoves inside the crowded tents. Tents are typically about 13 square meters – not large enough for a typical family with 5 to 10 children. These families are not used to living in such a small, confined space, and it is hard to give up their custom of drinking tea, which is an important part of their lives.

The lack of heating inside the tents was another serious issue. Although a gas stove or electric heater was supplied to almost every tent, those we interviewed complained about the cold. The fabric tents are not made to withstand the severe winter in Eastern Turkey, and it will become worse once it snows.

An urgent issue after the initial response is to relocate people to better housing. The Turkish government responded quickly by distributing about 35,000 tents within 20 hours after the earthquake. However, although a total of 21,000 temporary container housings are needed, only 15,000 of them had been delivered as of Jan. 20, 2012 – three months after the disaster. The government plans to start constructing new permanent housing for those who lost their home when the weather improves in May.

The Turkish emergency response system seemed to work well after the deadly earthquake in 1999. However, the quality of buildings could be improved in the future.

(This report is based on site visits and hearings conducted from Oct. 31 to Nov. 5, 2011, and email inquiries conducted by the Humanitarian Medical Assistance assessment team)

Totally collapsed RC apartment building in the Van city center (Oct. 31, 2011)

Partially collapsed non-engineered house in Alakoy village, north-east of Van (Nov. 1, 2011)

5th IIS alumni party for all University of Tokyo alumni was held in Bangkok, Thailand

By A. Kawasaki

On Oct.15, 2011, the 5th IIS (Institute of Industrial Science, University of Tokyo) Thai alumni party was held in Bangkok. This year's party was expanded to include the entire University of Tokyo (UT) in response to strong demand from IIS alumni, as it would provide a great opportunity not only for IIS alumni who already know each other but also for alumni from the entire university who haven't met before.

Group photo of alumni party participants

On the day of the party, a total of 41 alumni from the 1960s to 2000s were able to reunite at the party even though it was held under bad weather conditions and with the great flood affecting northern Bangkok. Attendees included not only Thai alumni working in various fields such as government, universities, and companies, but also 11 Japanese alumni working in Thai companies and research institutes. The meeting began with the reading of greeting messages from Prof. Yashiro, Director General of IIS, and Prof. Masako Egawa, Executive Vice President of UT. The party was filled with a friendly atmosphere, including short self introduction by all alumni which included current status and memories of the student time in IIS and UT.

In June 2012, the President's Council of UT will be held in Bangkok and will be attended by President Hamada, and the next Thai alumni party is scheduled to coincide with this occasion. Please check the ICUS and RNUS websites for more information regarding this event.

Visit from the Mongolian National Emergency Agency

By Y. Ichihashi

On November 8, 2011, ICUS received 16 visitors from the Mongolian National Emergency Agency, led by M. Sukhbaatar, and other staff from related authorities. They were on a visit to Japan at the invitation of the Japanese government through the JENESYS program (Japan-East Asia Network of Exchange for Students and Youths), an international exchange program undertaken by the Japan Ministry of Foreign Affairs and organized by JICE (Japan International Cooperation Center). At ICUS, the visitors were given a lecture by Visiting Professor Y. Ichihashi on the current overall systems for natural disaster management in Japan, including the basic legal framework for disaster preparedness programs, emergency rescue activities, assistance for recovery and reconstruction, and roles played by various institutions. The visitors also watched videos of the March 11 East Japan Great Earthquake, which reaffirmed the importance of preparations for future natural disasters based on Japan's lessons. Mongolia dispatched rescue teams immediately after March 11, for which the National Emergency Agency was the responsible agency.

ICUS members and visitors from Mongolia at IIS

USMCA2011 was held in Chiang Mai, Thailand

By A. Kawasaki

The 10th International Symposium on New Technologies for Urban Safety of Mega Cities in Asia (USMCA2011) was held from October 12 to 14 in Chiang Mai, Thailand. USMCA2011 was jointly organized by ICUS, the Asian Institute of Technology (AIT), Chiang Mai University, and Chulalongkorn University. The two-day symposium program included 5 keynote speakers, a poster session with 23 poster presentations, and 12 parallel sessions with 52 oral presentations. Including attendance-only participants, 149 people representing 13 countries joined this year's symposium.

The symposium was inaugurated by Mr. Kazuo Shibata of the Consulate-Generl of Japan in Chiang Mai and Dr. Kimiro Meguro, Director and Professor of ICUS. Keynote speakers included Dr. Shunichi Koshimura (Tohoku University, Japan), Dr. Ir Muhammad Dirhamsyah (Syiah Kuala University, Indonesia), Dr. Sidthinat Prabudhanitisarn (Chiang Mai University, Thailand), Dr. Peter Rogers (Harvard University, USA), and Dr. Haruo Sawada (ICUS, University of Tokyo, Japan).

This year featured a new addition to the USMCA schedule: a poster presentation session. Posters covering a variety of topics were on display, and many participants joined the presenters for lively discussion.

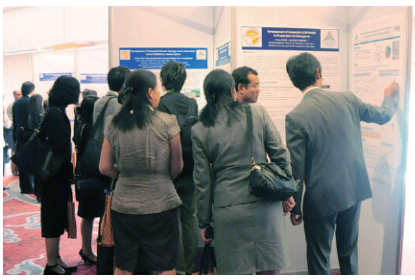
Oral presentations were given in 12 parallel sessions which covered topics including vulnerability and risk assessment of seismic and flood hazards; disaster response and recovery; urban planning and assessment; environmental management of air, forest, and water resources; durability, properties, and performance of construction materials and structures; and assessment of infrastructure health, performance, risk, and vulnerability. A special session on the earthquakes and tsunamis in Sumatra and the Indian Ocean, and in Tohoku, Japan, was also held.

At the end of the symposium, the Excellent Young Researcher Award – prepared by ICUS to encourage the activities of young researchers – was presented to Ms. Tomoko Matsushita (The University of Tokyo, Japan) and Mr. Mahmood Riyaz (Asian Institute of Technology, Thailand) for their poster presentations and Ms. Sho Oh and Mr. Hirotoshi Kishi (both of The University of Tokyo, Japan) for their oral presentations.

On the third day of the symposium, a historical and cultural field trip around Chiang Mai was held. The field trip visited Phuping Palace, the royal family's winter residence, and Wat Phrathat Doi Suthep, a sacred Buddhist temple, among other locations.

Next year, USMCA2012 will be held in Ulaanbaatar, Mongolia, from October 10 to 12, 2012. Please check the ICUS website for future updates and announcements.

Group photo of USMCA2011 participants



Discussions during the poster session

Dr.Choyanon Honsapinyo and winners of the Excellent Young Researcher Award

Group photo during the field trip around Chiang Mai

Building back right: learning from Tohoku

By T. Matsushita, Master student, Meguro Laboratory

During the reconstruction process after the 2011 Great East Japan Earthquake, speed and quality are required to respond to people's immediate needs. Regenerating human activity is a vital part of reconstruction, and we introduce the process of making architecture as a means to promote people's participation and revitalize the local industry.

As a part of the relief effort by the Japan Committee for UNICEF to reconstruct kindergartens, specific methods were introduced and evaluated, such as building with local craftsmen's initiative, building with people's participation, and formation of an expert advisory group to supervise quality for mass production.

We found that the prefabricated structures were able to fully respond to the needs by quickly providing buildings. Some observations of this study are as follows:

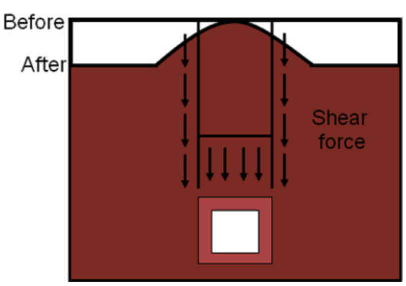
- The pilot project was effective in identifying strong local networks and availability of local players with strong commitment to their own region. This was in contrast to some beliefs that local actors would be too confused to take initiative.
- Active participation by beneficiaries was observed during the meetings and workshops. This invigorated the design process due to the involvement of many actors.
- Basic principles worked effectively to provide guidelines to designers while allowing room for creativity.

The awareness of people changed once they became active participants in the process of making architecture. When designing the actual space and function of their future buildings, people started to speak freely to express concerns for their future and make a difference by taking ownership.

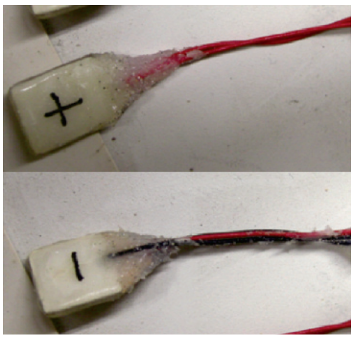
Application of elastic wave measurement to model tests using bender elements

By S. Oh, Master student, Kuwano Laboratory

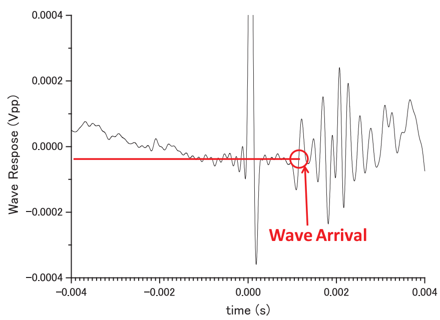
Elastic wave measurement using Bender Elements has been developed as a dynamic measurement method for element testing in the geotechnical field. At this time, we are trying to apply this method to model tests in order to obtain the pressure distribution inside a soil chamber, which is intended to simulate the conditions experienced when uneven settlement occurs around a buried structure. This research aims to obtain the basic performance information of bender elements when applied to model tests. First, in order to more clearly detect the wave arrival, signal analysis was conducted. Low frequency noise was reduced by polynomial approximation, and high frequency noise was dealt with using an FFT filter. Next, the effect of attaching an aluminum block to the bender element was discussed, as this was found to reduce noise and give a clearer wave in element tests. Some change in the received waveform was found, but wave velocity was almost the same. In addition, the wave propagation property was checked using multiple receivers with a single transmitter. Finally, the shear modulus of the obtained data for obtained data for validation. Results showed good agreement with those of element test.



Increment of earth pressure due to uneven settlement



Bender elements

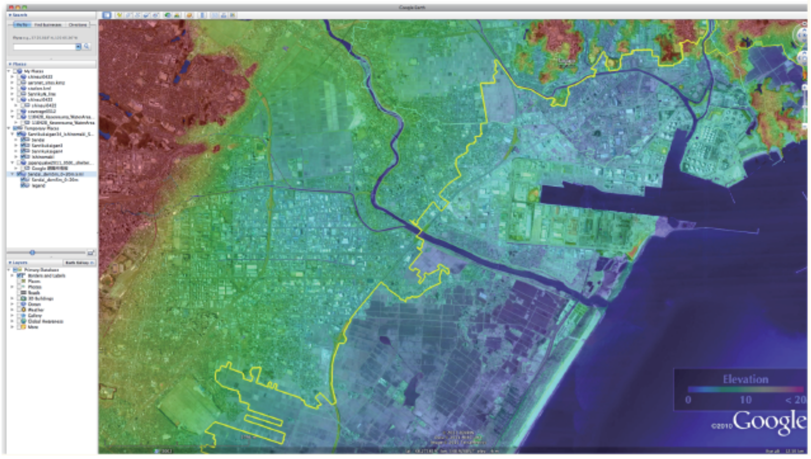


Wave measurement data

Application of spatial information for the reaction of the huge earthquake – supporting recovering activities for the 2011 Great East Japan Earthquake

By H. Kishi, Ph.D. student, Sawada Laboratory

This study developed spatial information products for response activities after the 2011 Tohoku (Great East Japan) Earthquake. First, useful information for the government sector and field investigators in the affected areas was considered by project members. We concluded that the important points were the applicability and accessibility of spatial information. Second, remote sensing datasets such as aerial photos distributed by the Japanese Geospatial Information Authority and GIS datasets were processed for sharing on Google Earth. During this process, the tsunami inundation line was interpreted and digitized comparing aerial photos to satellite images taken before the earthquake on Google Earth. Finally, the tsunami line aerial photo map was published for usage by the governments, field investigators, researchers and volunteers in the affected areas. We plan to keep publishing this map using new aerial photos taken a few months after the earthquake for supporting recovery activities. All these products were distributed through our project website.



Overlaying tsunami inundation data on Google Earth

Development of early warning system in Maldives

By M. Riyaz, Environment Research Centre, Ministry of Environment, Energy and Water, Maldives

In the Maldives, the Early Warning System (EWS) has been developed to address the risks of natural disasters. Before the 2004 Indian Ocean tsunami, people in the Maldives were not aware of disaster risk and there was no consideration of an EWS. Soon after the disaster, a risk profile for the Maldives was developed and emergency response measures for sectors such as tourism, communication, education, defense and so forth were considered.

This study deals with the development of the EWS in Maldives. The National Early Warning System in the Maldives (NEWSM) was developed in three main phases: (1) Phase I, establishment of a monitoring system for surface meteorological conditions and seismic event occurrence; (2) Phase II, strengthening the monitoring system established in phase I through automating the metrological monitoring system; and (3) Phase III, confirmation of the information flow, establishment of backup and alternative electric power and telecommunication systems and linkage with international organizations. Disaster warning messages from the NEWSM are transmitted to national, regional, atoll and island offices through a commercial communication system – mainly computer networks and hotlines (leased lines). The only means of dissemination of disaster advisories and warning to the general public is through raio and television broadcasting. A Radio Trunking Network with TETRA technology is used as backup network.

While the Maldives is exposed to various hazards, such as the risk from rising sea level due to climate change, gale force winds, storm surge, torrential rain, earthquake and tsunami, the established EWS seems to be focused only on tsunami risk and, furthermore, is not very effective for communication and information dissemination. The establishment of a proper mechanism to reach the general public, remote communities and islands is needed by using more user friendly mechanisms.

21st ICUS Open Lecture was held in Sapporo, Japan

By H. Yokota

ICUS members visiting the Otaru Port seawall

ICUS and Hokkaido University co-hosted the 21st ICUS Open Lecture at Hokkaido University in Sapporo, Japan, on October 31, 2011, with 180 participants. The theme of the lecture was "Towards the formulation of sustainable urban infrastructure systems."

21st century Japan is characterized by a low birthrate and aging population, efforts toward the restoration of a sound public finance system, a high-technological society, a focus on environmental load reduction, decentralization of power and balanced contraction. In the series of lectures, participants discussed and exchanged opinions on the development of urban infrastructure systems that create safe, affluent living environments, and will identify future challenges for the continuation of such systems as well as proposed measures to cope with such challenges.

Professor Haruo Sawada (Professor, ICUS The University of Tokyo), spoke first on the role of the remote sensing technology from the perspectiveofmonitoringwidehazard due to environmental changes. Next, Professor Norihiro Izumi (Hokkaido University), a leading researcher on river and environmental engineering, discussed water crisis - depletion of water resources and proposed his thoughts and ideas for how the water resources should be managed. Thirdly, Professor Kimiro Meguro (Director of ICUS, The University of Tokyo), proposed sufficient earthquake disaster management system based on the lessons from the East Japan Earthquake on March 11, 2011. Finally, Professor Seiichi Kagaya (Hokkaido University), one of Japan's leaders in the urban planning field, proposed methods and applications for sustainable infrastructure planning.

The day after the 21st Open Lecture, ICUS members joined a study trip around the Sapporo area. First, they visited the Forestry and Forest Products Research Institute (FFPRI) and visited some sites in the experimental forest. After that, they traveled to the Otaru Port Seawall, which was completed in 1908 and is one of the oldest port structures in Japan.

This first jointly organized open lecture with other university had a successful conclusions. ICUS may seek another opportunity for holding joint open lectures in the future.

Prof. H. Sawada

Prof. N. Izumi

Prof. K. Meguro

Prof. S. Kagaya

Awards and honors

- Ms. T. Matsushita, master student in Meguro Lab, Mr. H. Kishi, Ph.D. student in Sawada Lab, and Ms. S. Oh, master student in Kuwano Lab, all received the Excellent Young Researcher Award at USMCA 2011 in Chiang Mai, Thailand. Their award-winning researches are summarized on Pages 12 and 13 of this volume.

Project on Amazonian Carbon Dynamics (Part III)

By T. Endo

The "CArbon Dynamics of Amazonian Forests" (CADAF) project is now in its second year. During the first year, the remote sensing team of IIS/UT, Japan, and SIGLAB/INPA, Brazil, created an initial environmental map of the Amazonian forest generated from satellite data which can be used to estimate the biomass of the whole Amazon forest. Since the data is still preliminary, we have to improve its accuracy by checking the estimated result against the actual conditions.

In November, Prof. H. Sawada, and Dr. T. Endo visited Sao Paulo in order to get permission to conduct an aerial survey from the Brazilian government. This is because the current government is very sensitive to requests to conduct forest inventory from overseas organizations. We also gave presentations at the CADAF project's international seminar at INPA/Manaus, which was attended by over 150 people including the INPA director, researchers and students.

Discussion with Brazilian researchers

A walking palm

Finally, we conducted a field survey of the Amazonian forest to evaluate the environmental map made during the first year. The survey was carried out using GPS to identify survey points, and we took digital pictures and recorded conditions such as tree height and ground vegetation. From this field survey, we learned that we should improve the classification between natural and secondary forests.

During the field survey, we happened upon a walking palm in the jungle. This unique tree gets its name because it "walks" around in order to get better exposure to sunlight.

ICUS Activities October – December

- ICUS members attended USMCA2011 in Chiang Mai, Thailand, from Oct. 11 to 14.
- Prof. K. Meguro and Dr. M. Numada attended a JST-JICA workshop in Jogjakarta and Padang, Indonesia, from Oct. 23 to 29. Prof. Meguro also attended an international workshop in Singapore from Dec. 6 to 8, and Dr. Numada travelled to Van and Istanbul, Turkey, from Dec. 21 to 27 for an investigation.
- Prof. H. Sawada and Dr. T Endo attended ACRS2011 in Taiwan from Oct. 2 to 8. They also traveled to Brazil from Nov. 12 to Dec. 6 for a meeting with INPE and INPA, and to Cambodia from Dec. 10 to Dec. 22 for a meeting and field trip. Prof. Sawada also attended an international workshop in Beijing, China, from Dec. 22 to 25.
- Dr. T. Kato visited Beijing, China, from Oct. 26 to 29 for a conference on disaster prevention, attended the 29th Taiwan-Japan engineering seminar in Taipei, Taiwan, from Nov. 21 to 24, and conducted an investigation in Chengdu, China, from Dec. 26 to 31.
- Dr. K. Nagai traveled to Paris and Lyon, France, from Oct. 16 to 24 to participate in the Todai Forum.
- Dr. S. Tanaka attended the ITS World Conference from Oct. 17 to 23 in Orlando, USA.
- Dr. A. Kawasaki was at AIT in Bangkok, Thailand, from Sept. 20 to Oct. 24 and from Dec. 7 to 21 for operating the RNUS office and conducting lectures. He also traveled to Bangkok from Nov. 3 to 17 for a survey on the Thai flooding, and to Cambodia from Dec. 11 to 20 for a field survey on forest and land-use change.
- Dr. M. Henry traveled to Ulaanbaatar, Mongolia, from Nov. 19 to Dec. 2 and Singapore from Dec. 4 to Dec. 9 for investigations on the sustainability of concrete.

Editor's note...

Almost one year has passed since the East Japan Earthquake and tsunami disaster and most tsunami-damaged areas have been cleaned up, allowing us to can see vast flatlands and masses of rubble. Therefore, we are now facing the next stage of recovery – that is, reconstruction of towns. However, this is not easy because the ideal recovery is not the same town as it was before. We should consider the future figure of these towns such as industry, community, safety, aging and depopulation society, and so forth which are issues faced by the residents and local governments. Meanwhile, the central government provides funds from a limited budget. In this situation, is construction of very high embankments and new infrastructure the solution? Is mass migration the solution? What is the best for the well being of the residents? The ideal goal is still far although many victims are living in temporary housing shelters.

Recently, an earthquake research group at the University of Tokyo published their estimation of the probability of a M7 Tokyo metropolitan inland earthquake considering the frequency of earthquakes after the 2011 East Japan Earthquake. They say that the probability of the earthquake within 4 years is 70%, which is much higher than the past estimates. This can help to enhance people's awareness against the disaster, and preparation for the earthquake is getting better. However, how do we consider the long-term recovery after the disaster? Disaster countermeasures should include this perspective too.

By. K. Nagai

Deadline for abstracts for USMCA2012 (Ulaanbaatar, Mongolia)

We would like to announce that the deadline for submission of abstracts for USMCA2012 (to be held from Oct. 10 to 12, 2012, in Ulaanbaatar, Mongolia) is May 31, 2012. Further information, including a link to the symposium website, will be available soon on the ICUS website.

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

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.