ICUS NEWSLETTER

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MODELLING VOLCANIC RISK IN TOKYO

By

Christina Magill[1]

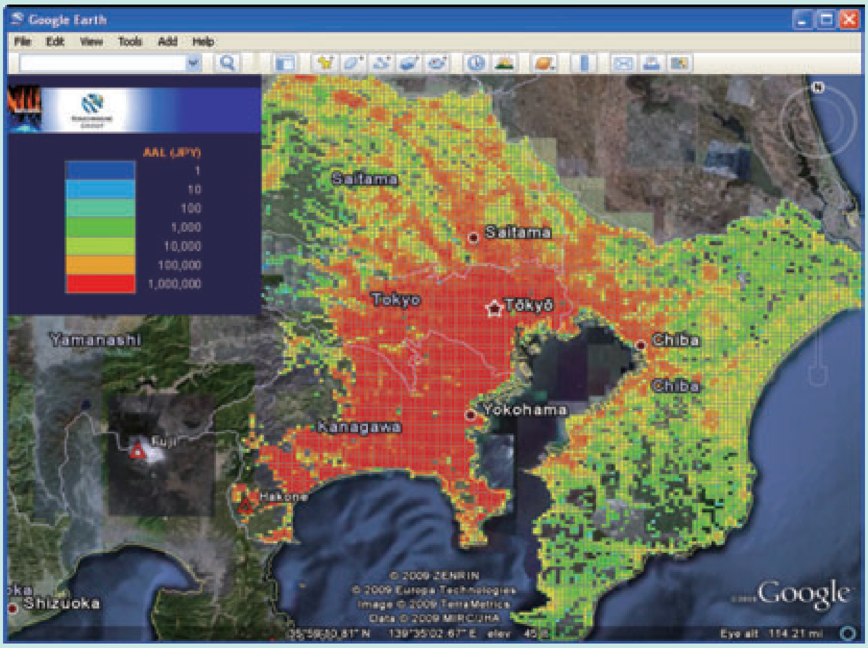
The 1707 Hoei eruption of the Mount Fuji deposited four centimetres of tephra in central Tokyo with much larger thicknesses falling in Western Kanagawa. A repeat of this event would have severe economic consequences for the Greater Tokyo area, causing follow-on effects to Japanese and global economies. But what is the probability of such an event? Should Tokyo prepare for more likely scenarios? And what resources will be required to manage future volcanic crises? Risk Frontiers, in conjunction with the International Center for Urban Safety Engineering, have developed *TokioKazanRisk*, a volcanic hazard and risk model that provides a framework for investigating questions such as these. Support for this project was provided by Tokio Marine & Nichido Risk consulting Co., Ltd.

TokioKazanRisk incorporates a catalogue of tephra dispersal simulations from six volcanic centres - Fuji, Asama, Hakone, Haruna, Kusatsu-Shirane and Kita-Yatsugatake - located to the west of Greater Tokyo. To calculate building damage and to estimate clean-up requirements and costs, hazard information is combined with a building, road and land-usage database describing Tokyo, Kanagawa, Saitama and Chiba prefectures. New visualization techniques allow hazard and risk results for these areas to be viewed within mapping applications such as Google Earth.

TEPHRA DISPERSAL MODELLING

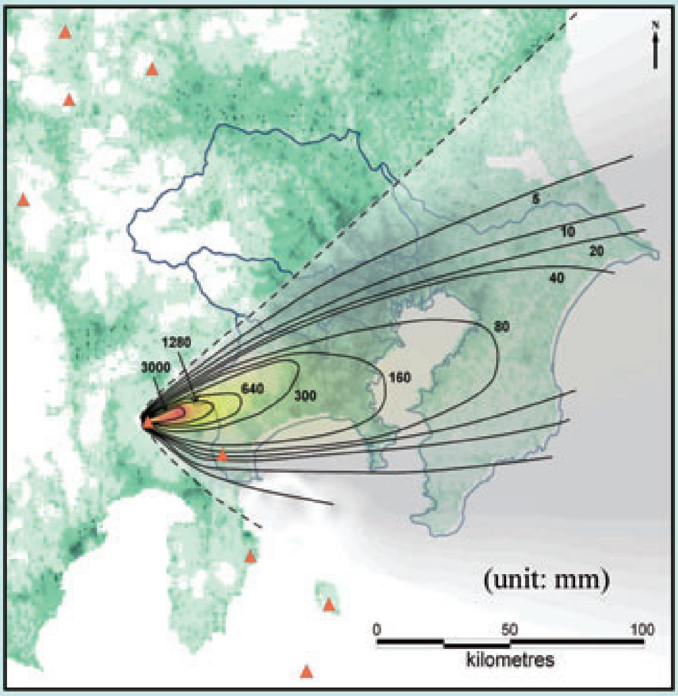
The tephra dispersal catalogue contained within *TokioKazanRisk* was developed with the use of *TEPHRA2* – an analytical tephra advection diffusion model developed at the University of Southern Florida. Using stratified wind speed and direction information, *TEPHRA2* calculates particle dispersion, transport and sedimentation, and estimates tephra accumulation at specified locations surrounding the source location.

Extensive calibration was carried out to refine the constants used in *TokioKazanRisk*. In particular, the Hoei eruption was intensely studied.



Average Annual Building Loss (AAL) in Japanese yen mapped on a 1 km grid

The six volcanoes and four prefectures considered with TokioKazanRisk



Isopacs of the 1707 Hoei Eruption (depths of air-fall tephra in mm)

Parallel computing techniques were utilised to simulate large numbers of eruptions for each volcanic centre. Wind speed and direction profiles with height were sampled randomly and volcanological parameters selected from magnitude/frequency curves were developed to describe previous activity, current eruption trends and to account for the volcanoes inherent future unpredictability. Hazard results with corresponding probabilities are stored within *TokioKazanRisk* on a 1 km mesh grid.

SAMPLING EXTREME EVENTS

Volcanic centres are capable of producing explosive volcanic events that may vary by more than five orders of magnitude. Traditional hazard modelling samples a fixed time period and simulates the expected events within this period. Using this approach, all events are assigned an equal probability of occurrence and therefore small magnitude events are sampled preferentially.

In developing magnitude/frequency relationships, event magnitude is represented by tephra volume, which we assume has a direct logarithmic relationship to the Volcanic Explosivity Index (VEI) scale. In the modelling carried out to create the *TokioKazanRisk* tephra catalogue, VEI is sampled uniformly with probabilities retained and utilised in later calculations. This methodology is more economic in its storage requirements and provides better sampling of the entire range of eruption possibilities.

RISK CALCULATION

TokioKazanRisk currently focuses on two major outcomes from air-fall tephra – building damage and the necessity for clean-up activities. Exposure information is either a user portfolio or the included database that describes building characteristics, roads and land-usage on a 1 km grid covering the entire Greater Tokyo area. This database incorporates an extensive survey of buildings, where characteristics including building condition and roof construction were collected.

Building damage and associated losses due to three causes are calculated:

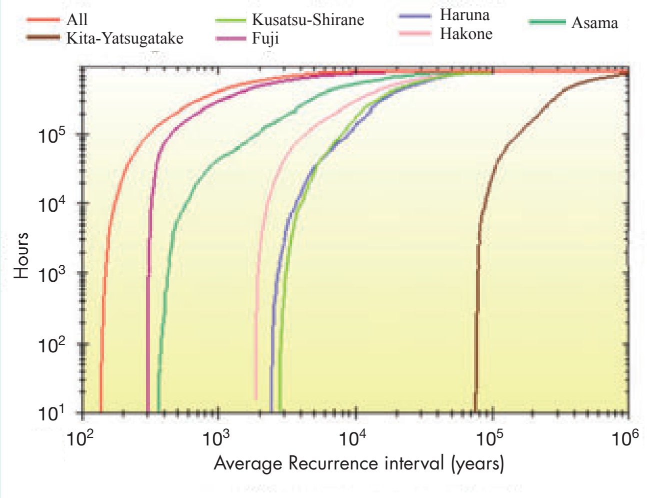
- structural damage - the partial or complete collapse of buildings due to the weight of tephra.
- non-structural damage - the corrosion and abrasion to walls, roof surfaces and exterior fittings caused by tephra particles.
- clean-up costs - the removal, transport and disposal of tephra from properties and the cleaning of building exteriors.

VISUALISING PROBABILISTIC HAZARD AND RISK

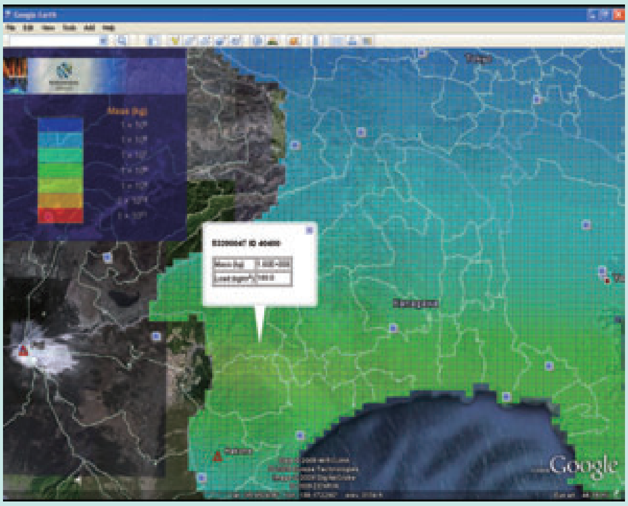
Probabilistic hazard and risk results for particular locations may be plotted against their annual probability of exceedance or average recurrence interval. Statistics, such as average annual loss or expected annual probability for a given volume of tephra, can also be recovered and the output presented in Keyhole Markup Language (KML) allowing easy mapping within applications such as Google Earth.

A PLATFORM FOR HAZARD MANAGEMENT

As well as building damage, *TokioKazanRisk* calculates impacts to various land-usage types, e.g. the built environment, agricultural areas and roads. The probable volumes of tephra to fall on each of these land use categories are calculated and, in the case of roads and the built



Vehicle hours required for cleaning roads against Average Recurrence Interval



Tephra mass mapped on a 1 km grid for a single event from Fuji volcano

environment, the model estimates the personnel, equipment and hours needed for clean-up activities. Data analysed to allow these calculations were provided by the Kagoshima and Tarumizu City Halls who have experienced frequent tephra-fall events from Sakurajima volcano.

To aid in emergency management planning, individual eruption scenarios may be mapped with hazard presented on a mesh grid. This allows for various scenarios to be studied in detail.

The modular nature of *TokioKazanRisk* means that the model will be a useful tool for many future risk applications. By incorporating additional exposure and vulnerability information, probabilistic estimates of impacts to utilities, transport, agriculture, business and health can all be made.

(Support for this project was provided by Tokio Marine & Nichido Risk consulting Co., Ltd)

[1]Risk Frontiers,
Macquarie University,
Sydney, Australia

Flood Damage in Japan

Strong rain hit the southern part of Japanese island during July 19 and 26. This caused 31 deaths, 55 injured, 48 totally damaged houses and more than 10 thousand flooded houses in the affected area.

Especially, Boufu City in Yamaguchi Prefecture recorded rainfall of 72.5mm per hour around 9:00 A.M. on 21st July. Total rainfall amounted to be almost twice the average monthly rainfall in July. In Manao region of Boufu City, landslide due to the heavy rain hit a special nursing home for the aged and killed 7 people. At that time, 100 aged people were in the middle of their breakfast. Debris flew from mountain side buried dining space on the first floor. The home was located in the red zone of landslide disaster. Yamaguchi Prefecture provided warning information of landslide disaster to Boufu City at 7:40 A.M. in the morning. However, the city didn't announce the warning to a special nursing home and evacuation before the landslide was not achieved.

Recently technologies increased the possibility of early warning before disasters. However, these warning should be conveyed to the proper facilities and persons and used for mitigation of damages. The strong rain in the summer 2009 in Japan reminded the difficulty of successful use of early warning.

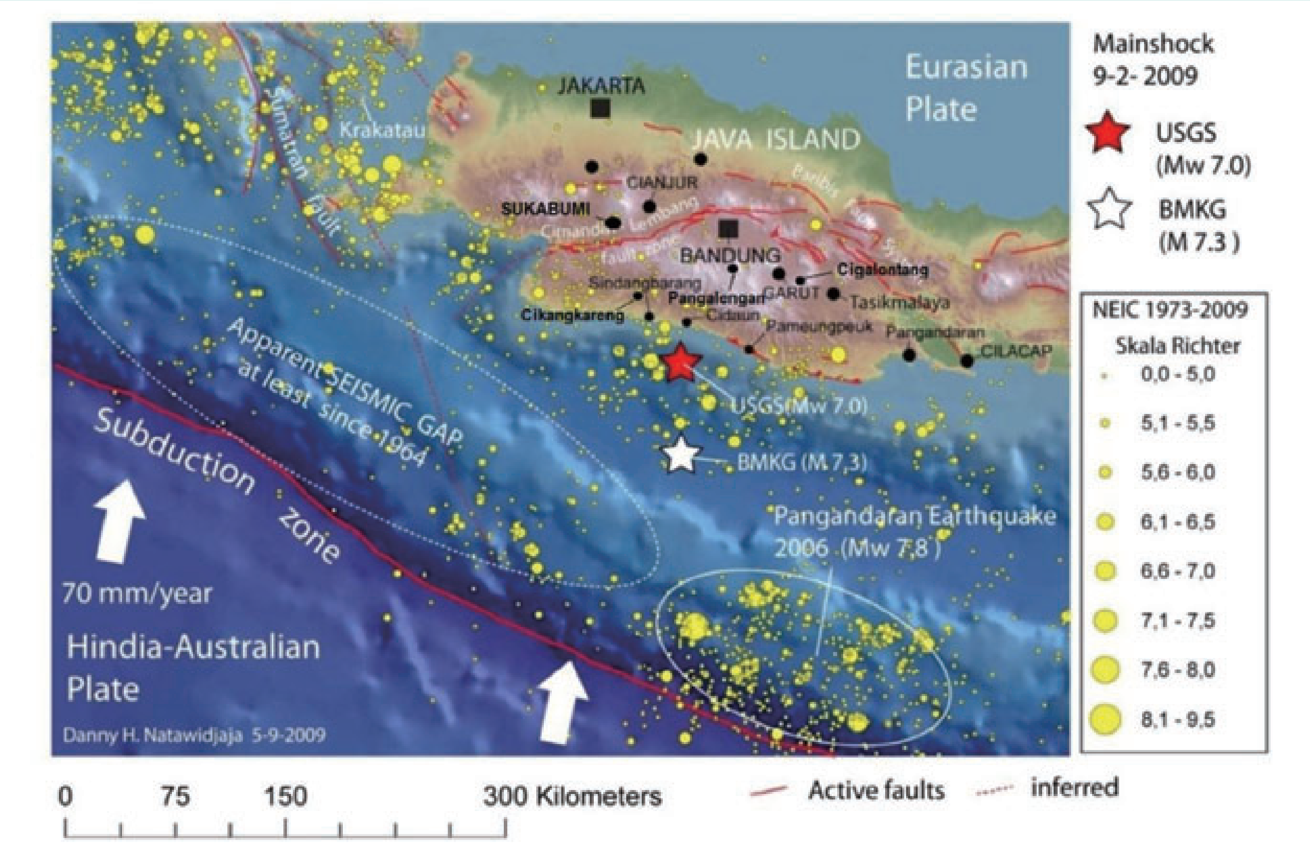
(By M. Ohara)

Landslide hitting a nursing home in Boufu City
(© Pasco Co., Kokusai Kogyo Co. Ltd.; Distribution: Pasco Co.)

REPORT ON THE WEST JAVA EARTHQUAKE ON SEPTEMBER 2, 2009

By

Teddy Boen[1] & Danny Hilman Natawidjaja[2]



General seismotectonic map of west Java region. The island sits above the Hindia-Australian plate that is being subducted beneath Java starting from the WNW side trending through deep ocean with a northerly motion of about 70 mm/year relative to the Eurasian plate. Yellow dots are shallow earthquakes (less than 100 km depth) from 1973 to 2009 from National Earthquake Information Center of US Geological Survey (NEIC-USGS) catalog. The red and white stars are main shocks determined by USGS and Badan Meteorologi Klimatologi Dan Geofisika (Indonesian Metereological and Geophysical Agency, BMKG) for the recent large event. Red lines on Java land are preliminary active fault lines mapped from Shuttle Radar Topography Mission (SRTM).

In the afternoon of September 2, 2009 a large earthquake (M7.0) occured about 50 kilometers off the south coast of west Java, Indonesia. According to the NEIC-USGS report, the earthquake source is located at about 7.7 S and 107.32 E at a depth of about 50 kilometer. As a comparison, the BMKG reported the earthquake epicenter further away trenchward with a source depth of about 30 kilometers. The fault mechanisms, given by the USGS Centroid Moment Tensor (CMT) solution, shows that the earthquake fault is a reverse fault striking NNE and dipping steeply about 45 degree. This clearly indicates that the earthquake is an intra-slab event, not on the Java megathrust, which stikes WNW and dips shallow towards the north. The megathrust section in the south of west Java and the Sunda Strait has no history of major earthquakes in the past 100 years, suggesting it is a seismic gap, which may have been acumulating a large amount of strain to produce a giant megathrust event. However, there is not much GPS data to determine or map coupling properties or degree of locking of the subduction interface, so then, one can estimates what portion of the relative plate motion that has been stored as earthquake ammos. Hence, the threats of earthquake shakes and tsunami from the Java megathrust remains unclear.

The news regarding the damage of the September 2, 2009 earthquake in the media was a bit confusing. All media related the magnitude of the earthquake with destruction. The earthquake had a large magnitude (Mw7.0, USGS). However, the distance of the epicenter from several cities/villages where some damage occurred, was more than one hundred kilometer. Also, the epicenter depth was not shallow and was about 50km (according to USGS). Usually, the shaking of an earthquake with Mw7.0 could be felt within a radius of 400 km and might cause damage within a radius of approximately 80 km.



Many houses collapsed in various forms from the earthquake. Pictures show collapsed houses from Pameungpeuk (left), Margamukti Village-Pangalengan (center) and Cigalontang –Tasikmalaya (right).

In fact, such an event should not cause significant damage beyond a 100 km radius. Unfortunately, this earthquake, so far has caused 76 casualties.

The damaged areas are scattered and the damage itself in each area is sporadic. Most of the damaged and /or collapsed buildings are non engineered construction, built with poor quality materials combined with poor workmanship, resulting in very poor quality houses with no resilience to earthquakes. Also, most of the damaged buildings were dilapidated due to lack of maintenance causing deterioration of the materials strength. Non-engineered buildings consist mostly of houses and several one story school buildings.

The nearest damaged areas from the epicenter are Sindangbarang which is approximately 50 km from the epicenter, and Pameungpeuk and Cikelet which are approximately 60 km from the epicenter. In those places the damage was quite substantial, but sporadic.

Approximately 50% of the houses were damaged, ranging from slight to collapse. Rest 50% of the buildings are still intact. The second closest area to the epicenter is Cikangkareng Village (Cibinong, Cianjur), approximately 80 km from the epicenter. The earthquake caused landslides, burying 12 houses, where 30 people died; the biggest human casualties in a single place from the September 2, 2009 earthquake. The earthquake also caused damage in areas far from the epicenter, namely in Pangalengan approximately 125 km from the epicenter, in Tasikmalaya approximately 140 km from the epicenter and in Sukabumi approximately 155 km from the epicenter.

The extent of the destruction by that earthquake deserved careful investigation. Investigation was needed on the cause of the ground motion and the geologic condition to know why that earthquake with an epicenter at a depth of 50 km did cause damage to non-engineered buildings that are relatively rigid in places more than a hundred kilometers away, apart from the fact that the damaged and/or collapsed buildings are poorly built.

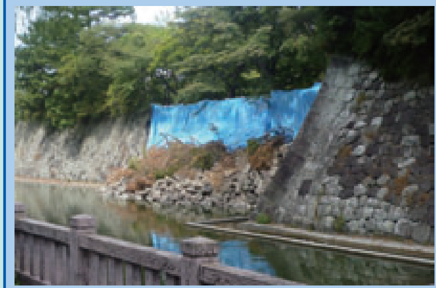
In big cities, particularly Jakarta, tall buildings were swaying and caused tremendous panic among the occupants and everybody started rushing to get out of the buildings while the buildings were still swaying. In the course of the escape, some were injured. Subsequently everybody gathered in the streets, causing a chaotic situation and traffic jam. Several of those tall buildings suffered minor non structural damage only.

Actually, the damage or collapse of non engineered construction is a repetition of all past occurrences and is a demonstration that not much has been done with regard to non-engineered buildings. All the damage to those non-engineered construction and the casualties could be prevented if the authority has a plan to prepare, prevent or mitigate the effects of earthquakes.

[1]World Seismic Safety Initiative
[2]Indonesian Institute of Sciences


Left: Lanslide at Cikangkareng Village from the earthquake; Right: Panic and chaos in front of Indonesia Stock Exchange after the earthquake (courtesy: kompas.com)

Report on Suruga Bay Earthquake, Japan

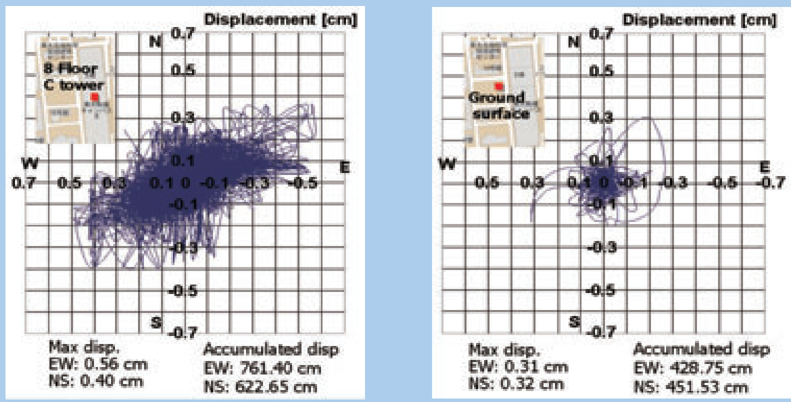


Collapsed stone wall due to the earthquake

An earthquake with magnitude of 6.5 and centered 23 km below the seabed in Suruga bay in Shizuoka Prefecture occurred on August 11, 2009. After its occurrence, the possibility of the expected Tokai earthquake was examined immediately. However, the results showed that, this earthquake was not the expected Tokai earthquake as the magnitude was smaller than the expected value and it was not a plate boundary type earthquake.

The seismic energy in this earthquake was about 1/180th of that of the expected Tokai earthquake (expected to be of M8 class) and the range of dominant period was smaller than 0.5 seconds or less. Also, damage due to this earthquake was far smaller compared to the damage (the number of casualties, damage to social infrastructures and economic loss) estimated to be caused by the expected Tokai earthquake. In past earthquake disasters, the component of seismic ground motion with about 1 second or more caused large damages to the structures.

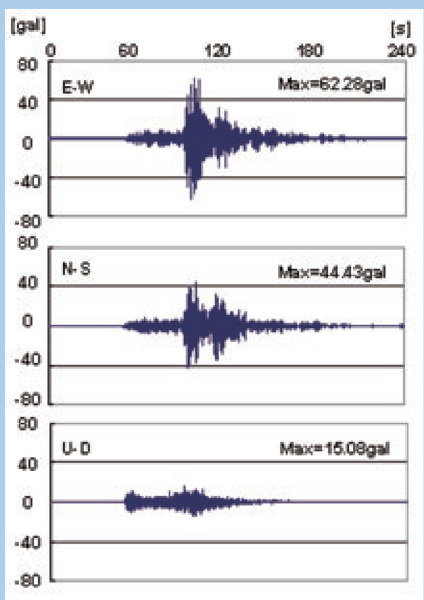
Shortly after the earthquake, I visited the site to have a meeting with Mr. Hikoyama, the crisis-management bureau of Shizuoka Prefecture, to enquire about housing damages, governmental action to the damages and the economic loss in industries. Few causalities and extensive damages to housing were caused in Shizuoka Prefecture. The main reason why the structural damage was not so heavy was due to the short-period seismic wave. The damage to the housing roof was predominant. The stone wall of Sunpu castle, situated just in front of a government building, was collapsed by the seismic shaking. The acceleration meter installed by ICUS, observed the seismic response at IIS, University of Tokyo, which is located around 120 km from the earthquake epicenter.



Displacement at 8th floor in C-block and ground surface at IIS

Accelerometer installed at the 8th floor of C-block of IIS building recorded the maximum structural response of 62.28 gal in the east-west (EW) direction due to the earthquake.

The horizontal acceleration record observed at the 8th floor of C-block of IIS building was converted into displacement, and track of displacement was plotted. The maximum displacement was 0.56 cm in the 8th floor of C block on the east side, and the accumulated displacements were 761.40 cm and 622.65 cm in the north and south direction respectively. Therefore, large displacement was caused in the direction of EW. Similarly, the track of displacement at the ground level was obtained. Accumulated displacement in the EW and NS directions were recorded as 428.75 cm and 451.53 cm respectively. The response of the building was dominant in the EW direction.



Seismic wave on 8th floor in C-block of IIS building

The response spectra of the main shaking were calculated and the relationship between the ground motion and structural response are determined. The dominant period in the directions of NS and EW of IIS building were 0.50s and 0.57s respectively due to both the big input motion and lower structural stiffness in the EW direction. The dominant period in the direction of NS and EW of ground response spectrum ratio (ground surface 0m and the 18m depth) were 0.27s for both directions. This can lead to the difference of the predominant period between ground response as input motion to the IIS building.

The damage caused by the expected Tokai Earthquake (M8) is estimated to be about 5,900 human deaths, about 19,000 serious injuries and about 190,000 collapsed buildings. This earthquake on August 11, 2009 should be used as an opportunity to promote and check countermeasures to the future expected Tokai earthquake, which has a 87% probability to occur within coming 30 years.

(By M. Numada)

Robust Optimum Design for Smoke Control System using CFD and Genetic Algorithms

Due to progressive urbanization, there has been a rapid increase in complex buildings over recent years. There is an increasing risk that even a small mistake in operation of disaster management systems may lead to a huge disaster in the event of fire or terrorism activity involving biochemical weapons, because of the complexity of the nonlinear airflow paths in the complex buildings. In order to prevent or minimize such disaster, disaster management systems should be appropriately designed with consideration of their reliability and robustness. In this research, robust optimum design method for smoke control systems in buildings is developed using an approach which couples Computational Fluid Dynamics (CFD) with Genetic Algorithms (GA).

Optimization system and GA method

The optimization system coupling CFD and GA for smoke control design, which is based on a feedback system is shown in the figure below. The system constitutes three parts:
A) Setting of the optimal problem;
B) CFD analysis of fire dynamics;
C) Evaluation of the smoke-control system and optimal process control.

The feedback loop shown in the figure below will continue until the optimum solution satisfies the design objective.

GA is used to select the optimum solution candidates, and to control the optimum inquiry process. GA is a method that enables optimization problems to be solved by imitating the organic evolutionary process. The individual with the highest fitness value among the investigated individuals becomes the optimum individual.

General optimization and robust optimization

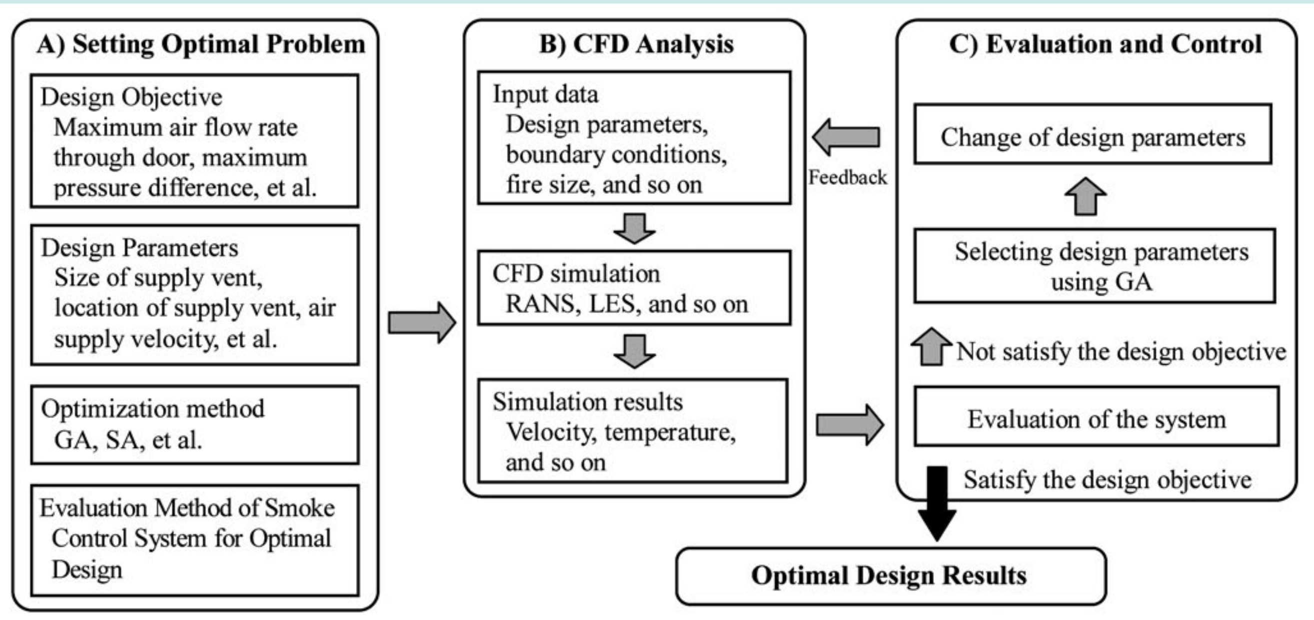
General optimization usually seeks out the optimal combination of design parameters under a fixed environmental condition. However, in practice, environmental conditions usually change or fluctuate. We do not know if this optimum design will function smoothly under these changes. Such uncertainty is very dangerous in a system or product. The objective of robust design is to ensure a robust system under varying environmental conditions and to consider the variability in the system's components. Therefore, robustness means system stability within the effects of environmental fluctuations. Robust design covers not only the optimum for the objective function, but also minimize variation in responses arising from any fluctuations.

Design object

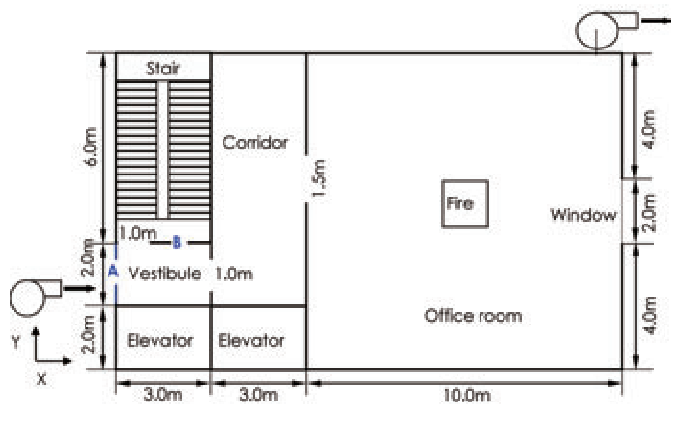
The design object is shown in the top-left figure next page. This is a simplified office building with 10 stories. The smoke control system consists of a smoke extractor in the office and a pressurization process through the vestibule. The vestibule is pressurized with outdoor air using a supply fan to prevent smoke from entering the vestibule and the stairwell.

Design process

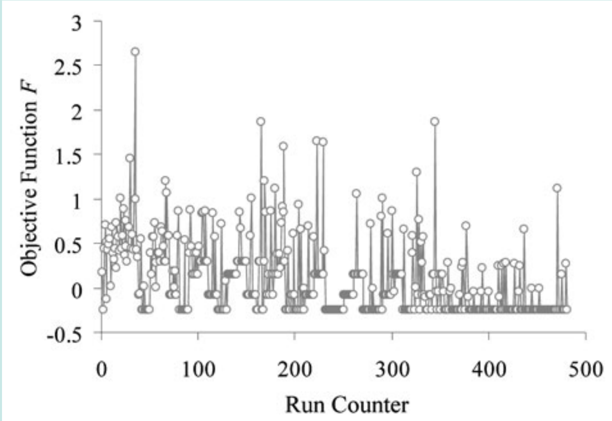
Two design cases, i.e., general optimum design and robust design were conducted. For the general design, maximizing the average airflow rate through the doorway between the vestibule and the corridor during the evacuation time is selected as the design objective. Robust design involves maximizing the above average airflow rate and at the same time minimizing the variation of the airflow rate arising from some uncertainty. Here, the uncertain fire location is set as the uncertainty. Patterns (location, size) of smoke extraction vents and air



Optimal design system coupling CFD and GA for smoke control design



The design object



Curve of GA inquiry in robust design

supply vents are set as design parameter. Optimum combination of these parameters will be designed.

Results

In case of the general design, for the extraction vent in the room, it agrees with the common perception that the extraction vents are best set in the ceiling rather than the sidewalls. In the vestibule, vents in the ceiling and facing wall are a good choice. The curve of the GA inquiry for the robust design is shown in the top-right figure. The horizontal axis shows the Run Counter for the optimum selection process, and the vertical axis shows the objective function (A combination function of airflow rate and the variation). This shows that the objective function converges to its optimal value after 300 runs, The maximum airflow through the doorway of the vestibule is 2.334 m^3/s. This is a little lower than the optimum design. From the result of the best pattern, it is indicated that square vents provide a robust design. Through robust analysis, it is shown that the airflow rate is lower in the robust design, however, the unevenness is smaller. This means that under the same environmental fluctuations, the change in the optimum design is larger, demonstrating that the general optimum design is sensitive. If there is a large fluctuation, this has a greater possibility of failing to operate satisfactorily.

(By H. Huang,
Center for Public Safety Research,
Tsinghua University, China)

Survey on a New Tsunami Disaster Mitigation System

Interview with potential user of TDMS

From September 18 to 24, 2009, Professor K. Meguro, Dr. M. Takashima from Fuji Tokoha University and two graduate students of Meguro lab. visited Phuket and Phang Nga in Thailand. The major purposes of the visit were to investigate recovery situation of the affected sites due to the 2004 Sumatra Earthquake induced Tsunami and to survey potential needs and users' opinions for a new tsunami disaster mitigation system (TDMS) proposed by Prof. Meguro and his research group.

The system proposed by Prof. Meguro combining a reliable but simple warning system and proper evacuation facilities, does not have the practical difficulties of other systems currently proposed elsewhere. The warning system consists of a multi-purpose marine observation buoy network that can be operated by local organizations such as hotels and beach associations. This is a community-based mutual support system and tsunami leading time can be guaranteed by the other network member buoys. Important characteristics of this system are its simplicity, economical efficiency and daily-usability. Information on temperature, current velocity, wave height, moisture, etc. obtained by the buoys can benefit business activities of the users. These information would also help in environmental monitoring and awareness generation, thereby further benefitting the region and the businesses. These factors in turn will motivate the users to play a major role in maintaining the system themselves. Our estimates show that, just by collecting only 1 USD per night above the room rate of the participating hotels, maintenance cost for the system could be adequately raised.

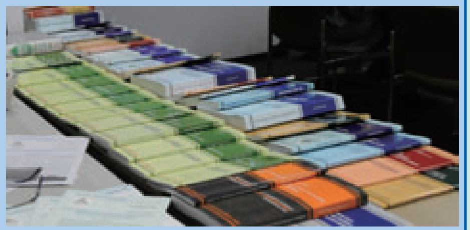
As for evacuation facilities, Prof. Meguro has proposed to use the religious places of worship along the coastal line in the region whose location is carefully selected based on tsunami inundation simulation. This scheme has two main advantages. Because worship centers are frequently used by people, their location is well known for efficient evacuation when a notice is issued. Additionally, as the people feel strong commitment to these facilities, they take active participation in their building and maintenance.

Unlike countermeasures such as landuse control, with the proposed TDMS, people can manage their own businesses and reduce future tsunami disaster without changing their life style. From our interview survey, we could obtain very supportive opinions from users and understand potential needs of multi-purpose marine observation buoy network system.

(By K. Meguro)

Evaluation of ICUS Activities by External Experts


Snapshot of the External Evaluation Committee Meeting


ICUS reports exhibited at the venue

On March 2011, ICUS completes its tenth year of establishment. In order to continue its activities effectively with a vision for a safe urban environment, ICUS carried out an external evaluation of its extensive activities since its establishment till now from a balanced perspective, both of its academic and social contributions. The external reviewers, consisted of six eminent experts inducted from relevant fields from Japan and overseas countries, were namely (1) Dr. Hisashi Tarumi, President, Railway Technical Research Institute, (2) Dr. Kenji Sakata, Professor Emeritus, Okayama University and Chairman of the Japan Concrete Institute, (3) Dr. Haresh C. Shah, Professor Emeritus, Stanford University and founder of Risk Management Solutions (RMS), (4) Dr. Satoru Nishikawa, Director, Water Resources Policy, Ministry of Land, Infrastructure and Transport (MLIT), Japan, and ex-UN Secretariat for International Strategy for Disaster Reduction (UN-ISDR), (5) Dr. Fan Weicheng, Professor, Tsinghua University, Director of the Public Safety Research Center (CPSR), and Member of the China Academy of Engineering, and (6) Dr. Haruhisa Shimoda, Director of Space Information Center, Tokai University and President of Commission VIII (Remote Sensing Applications and Policies), International Society for Photogrammetry and Remote Sensing (ISPRS).

The evaluation committee meeting was hosted at ICUS on 4th and 5th August for evaluation of its activities. The reviewers were presented with reports beforehand describing the overview of the ICUS activities since its establishment to 2008, PowerPoint slides (about 100 sheets each covering approximately 15 selected research topics of each division) describing its activities and track record of its three divisions were sent to them.

At the meeting, ICUS faculties, led by Prof. K. Meguro, Director, ICUS gave explanations on its activities. Detailed explanations were given on key research topics by its three divisions. Also, explanations on the future plans of a post-ICUS center were given. After two days of extensive and rigorous interactive evaluation, reviews were received in writing about a week later.

The reviewers noted that extensive research findings have been made in various topics related to urban safety. Contribution of ICUS was found to be unique and noteworthy despite its limited resources, with 425 peer-reviewed journal papers, 53 books, 486 international conference papers, 832 domestic conference papers, 26 reconnaissance reports and other 396 publications. Also, ICUS activities were in television, newspapers and other media 425 times, ICUS faculty gave invitational lectures 390 times and 65 awards have been received till now for research findings by the ICUS faculty including their students. Reviewers admired the center's international activities- MOUs with domestic and overseas organizations, holding of international symposiums, exchange of researchers and publication of international activity reports. They evaluated that, these activities not only contribute to technology transfer and advanced research, but also build up experiences with different technologies to put these into practical application in developing countries. They found ICUS research findings have been used practically in the society and have contributed significantly in enhancing urban safety of cities.

The reviewers suggested that, though visiting professors and researchers are making up for the limited human resources in ICUS as far as possible, more utilization of graduate students and foreign students in its activities is necessary as implementation of such diversified and energetic activities with inadequate manpower is difficult.

Also, the reviewers suggested that, strengthening of cooperation with administrative bodies and aggressive participation in administrative activities for ICUS to take a leadership role. Overall, they found that, ICUS has achieved its stated objective and "has achieved extremely good results."

On the proposal for a post-ICUS center, the reviewers suggested that, future plans should include organizational cross-cutting research for handling "advanced and core technologies," and should include social science, economics, and public policy along with natural science and engineering. Also, intra-university cooperation and increasing of staff strength is proposed.

ICUS sincerely thanks the distinguished external reviewers for conducting an impartial and critical review of its activities and will strive to carry on its activities aggressively using their valuable suggestions and recommendations.

(By K. Meguro)

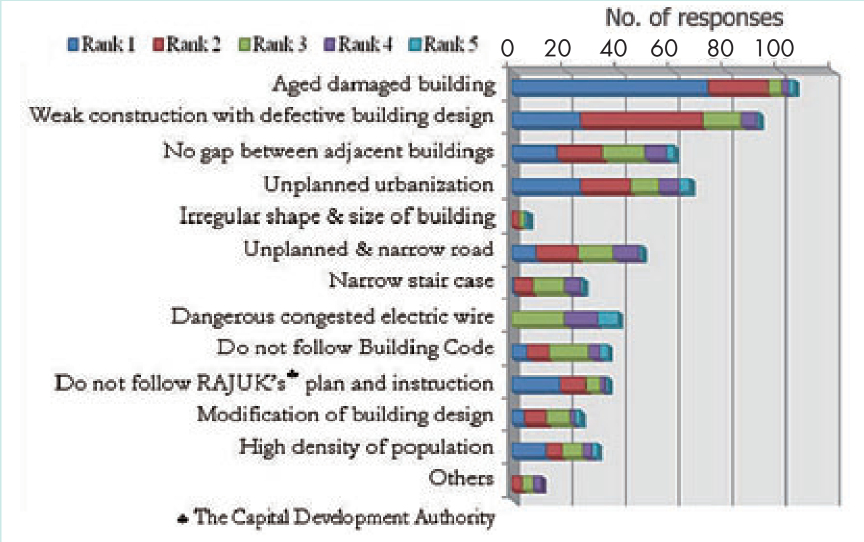
BNUS Activities

BNUS assessed social vulnerability to earthquakes

The major concern in any disaster risk mitigation measures falls on raising awareness level of the local community. BNUS conducted a socio-economic survey of 200 households in ward No. 68 of the older part of Dhaka City. The social vulnerability of individuals due to an earthquake is assessed within the households. The social vulnerability indicators have been selected from the literature and the relevant data needed for the analysis are collected through house to house socio-economic questionnaire survey. Information regarding the level of public awareness about earthquake risk of the community was found through this survey. The sample size of survey is carefully chosen at random basis at 95% confidence level to give a clear view of the whole community. Vulnerability of the community is assessed considering the existing socio-economic condition of the locality.

From the study, it was found that almost 96% literate respondents have earthquake awareness. Also, the literacy rate is more in the age group of 15-29 and 30-44 years and they are more aware about earthquakes than the people of other age groups. The age group 15-29 years is more aware about earthquake because most of them are students. The 30-44 age group is basically engaged in different professions. Professional groups keep themselves informed with day to day information received through professional activities and so they have more experience than others. They also interact with various groups of people which help them to gather information and knowledge. Age group of 0-14 years consists mainly of school going kids and because very few of this group are aware of earthquakes, the number aware members is roughly equal to number of unaware members in this group.

The household heads are important as they make key decisions in a family. In Bangladesh, mostly the male is the head of any family. It is clear from the survey that, most of the household heads are businessmen in the study area and most of them are aware of earthquakes.

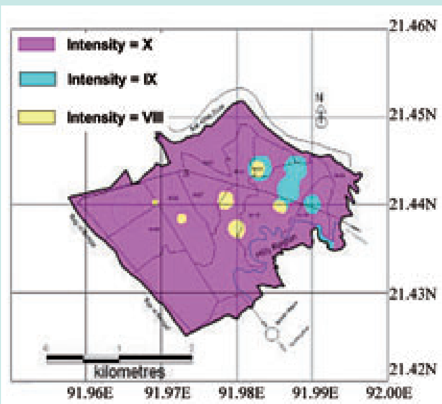


Reasons behind earthquake vulnerability to community

From the study it was found that, overall most of the respondents (74% respondents) in the study area are aware about earthquake. Also, in the study area, most of the respondents (about 75%) think their community to be exposed to earthquake vulnerability. The respondents considered a range of factors for their earthquake vulnerability as shown in the figure above.

BNUS conducted seismic microzonation of Cox's Bazar Municipal Area

Cox's Bazar is in the Southeastern part of Bangladesh, and is a coastal tourist resort. Due to rapid urbanization in past decades, often in an unregulated manner and without seismic design consideration of buildings, seismic microzonation is needed for formulating effective earthquake mitigation measures. Also, common occurrences of landslide and related casualties in the hilly parts of city have increased the necessity of it. BNUS conducted a seismic microzonation study using geographic information system, where reflection of ground shaking and the site attributes of soil amplification, liquefaction and landslide are the salient features. The probable earthquake hazard, expected ground motion and liquefaction potential were assessed using probabilistic approach. The study found that, the rock level Peak Ground Acceleration (PGA) of the area is 0.18g for a 7.5 magnitude earthquake having a return period of 200 years. The surface PGA could be as high as 0.41g for an average 2.3 times amplification factor. Due to ground shaking amplified by 2, 2.5 and 3 times, respectively 47%, 42% and 11% of the municipal area could be affected. About 87% of the study area is highly susceptible to liquefaction. Approximately 8% of the municipality consists of hilly region and 97% of it is found to be very unsafe from the viewpoint of natural slope stability.



Distribution of seismic hazard in Cox's Bazar Area

(By M. A. Ansary, BNUS)

RNUS held the 2nd Joint Student Seminar on Civil Infrastructures

Student seminar participants

A moment from the Seminar

RNUS jointly organized the 2nd Joint Student Seminar on Civil Infrastructure on July 6th, 2009 at AIT Conference Center together with Korean and Thai partners. This seminar is aimed at encouraging students to have an international experience such as making presentations, exchanging opinions and developing good relationship with foreign partners.

We had 34 participants, consisting of faculties and students from Korea University, Chonnam University, Seoul National University, Suranaree University of Technology, Asian Institute of Technology, Khulna University of Engineering & Technology and The University of Tokyo. There were 4 faculty lectures and 18 student presentations in this seminar. The topics were varied from all areas of civil engineering and all students did their best in their own presentation as well as in the discussion. At the end of the seminar, excellent presentation awards were given to 3 students who were selected by votes from all the participants.

On the next day, a field visit was held to see public transportation facilities in Bangkok City. Bangkok is famous for its traffic congestion and there are several ongoing projects to improve the public transportation system. The participants visited 2 construction sites of current public transportation projects, that is, City Air Terminal of Suvarnabhumi Airport Rail Link (SARL) and Bus Rapid Transit (BRT) station. To visit the sites, they experienced various transportation systems on the way, such as MRT (subway), BTS (skytrain), taxi, bus, tuktuk and boat, which were also very impressive for them.

The student participants played a major role by discussing their research topics and communicating with students from other countries. The seminar was successful and fruitful similar to the one last year. We believe this seminar gave not only knowledge and information but also a lot of other stimuli to the students. ICUS hopes to continue to hold this kind of interchange activities also in coming years.

(By S. Tanaka)

ICUS Activities

• Prof. H. Sawada visited Bangkok, Thailand from July 5 to 8, to co-ordinate and participate in the Joint International Student Seminar on Civil Infrastructure. He visited São Paulo and Manaus in Brazil from August 5 to 16 to investigate on changes in carbon budget in Brazilian Amazon. From September 5 to 11, he visited Helsinki and Joensu in Finland to participate in and make a presentation at the Finnish-Japanese Seminar.

• Assoc. Prof. M. Koshihara visited Shizuoka Prefecture on September 26 to do a follow-up survey on Suruga Bay Earthquake.

• Assoc. Prof. R. Kuwano visited Alexandria, Egypt from September 30 to October 9 to attend and make a presentation at the 17th International Conference on Soil Mechanics and Geotechnical Engineering.

• Assoc. Prof. H. Huang visited Beijing, China from July 11 to 20 to conduct research and discuss collaboration between ICUS and Tsinghua University, Beijing, China.

• Dr. S. Tanaka visited Bangkok, Thailand from July 5 to 12 to organize, make a presentation and chair a session at the Joint International Student Seminar on Civil Infrastructure at AIT, Bangkok.

• Dr. M. Numada visited Bangkok, Thailand from July 5 to 9 to make a presentation & chair a session at the Joint International Student Seminar on Civil Infrastructure at AIT.

Awards

Graduate student Mr. K. Sakurai of Meguro Lab. received Excellent Young Researcher Award at USMCA2009, Incheon, Korea.

Three graduate students of Kuwano lab. won best paper and presentation awards by Japanese Society of Civil Engineers (JSCE). They were, Mr. N. Hosoo (at JSCE Annual Meeting in Fukuoka), Mr. A.L. Beltran-Galvis and Mr. B.P.D. Cokorado (both at JSCE International Summer Symposium on Sep. 11 in Tokyo).

Editor's Note

While we edited an article on the West Java Earthquake, news on another big earthquake in Indonesia on September 30 surprised us. It occurred in Padang, West Sumatra Province in Indonesia and its magnitude was 7.6. According to UN Office for the Coordination of Humanitarian Affairs (UNOCHA), about 115,000 houses were severely damaged due to this earthquake. We sincerely extend our condolences to the victims and affected people due to this tragic earthquake and hope prompt restoration in the suffered area.

The main article of this volume was written by Dr. Christina Magill in Macquarie University, Sydney, Australia. She spent two months in our research center in 2007. Her visit was as a part of a joint research project with Tokyo Marine & Nichido risk consulting Co. Ltd. on analysis of volcanic risk in Tokyo. During her stay, she conducted site visits and collected data for modeling reported in this newsletter. ICUS members were very happy to share precious experience with her and hope for continuous collaboration.

During October 15-16, the 8th International Symposium on New Technologies for Urban Safety of Mega Cities in Asia was successfully held in Incheon, Korea. National Institute for Disaster Prevention (NIDP), Disaster Prevention Association (KDPA) and Korean Society of Hazard Mitigation (KOSHAM) in Korea jointly organized it with ICUS. ICUS expresses gratitude from the bottom of our heart to the presenters, participants and all the people who were involved in this symposium. Next symposium will be held in Japan on October 2010.

(M. Ohara)

If you would like to contribute an article to ICUS newsletter or have any comments or suggestions, please contact the editorial committee at icus@iis.u-tokyo.ac.jp. Any article within the scope of urban safety engineering and management will be considered for publication after internal peer review by the editorial committee. To know the scope of ICUS activities, please visit ICUS homepage at http://icus.iis.u-tokyo.ac.jp/

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