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APPLICATION OF COMPUTATIONAL FLUID DYNAMICS ON THE PREDICTION OF URBAN FIRE SAFETY AND URBAN THERMAL ENVIRONMENT

By

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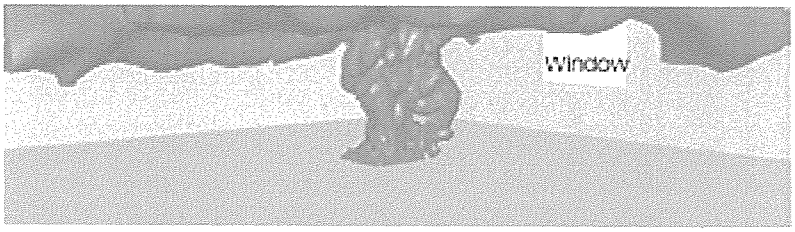
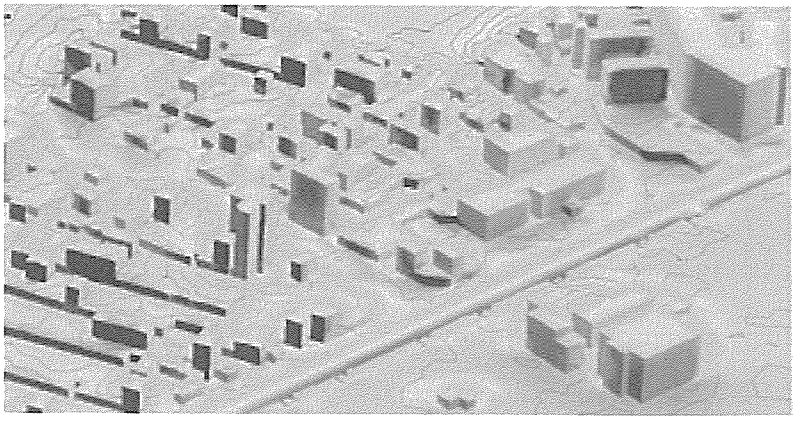
In recent years, urban safety and urban environment are gaining increasing attention for sustainable urban design. Computation Fluid Dynamics (CFD) models have been indispensable and effective tools for studying urban fire safety and urban thermal environment. Here, it is shown how a CFD model is applied to predict urban fire and its spread in a modeled urban area by coupling the model with combustion, radiation and firebrand scattering mechanism models. Urban thermal environment is then predicted by a developed numerical simulation program with adaptability to complex urban areas.

Urban problems, such as, urban safety, urban heat island and urban air pollution is becoming more and more serious due to the progresses of mega cities. The revolutionary progress in Computational Fluid Dynamics (CFD) modeling makes it possible to model urban boundary layer problems. The figures in the right show some CFD numerical simulation examples. In this article, it is shown how a CFD model can be effectively applied in studying urban fire safety and urban thermal environment. The model can predict urban fire and its spread (scattering of firebrands) by integrating relevant processes of turbulent combustion, radiation and firebrand scattering in a simulated urban area. To analyze urban thermal environment, a numerical simulation methodology with adaptability to complex urban areas is developed. The methodology takes into account the convection,



Simulation of fire in a room using CFD model



Urban thermal environment analysis using CFD coupling with radiation model

radiation and conduction processes in the area under investigation.

APPLICATION ON URBAN FIRE SAFETY

The factors that can cause urban fire spread are contact fire, radiation, convection and firebrands. From investigation of past urban fires, fire spread often occurred by fire-brands, especially in case of fires that cause extensive damage. However, there are few findings on the properties and mechanisms of firebrands because there are many uncertain factors, such as meteorological conditions, combustion conditions in the building that is on fire, types of building materials, and so on. In this article, for effective prediction of urban fire and firebrand scattering, the CFD model is suitably coupled with turbulent combustion model, radiation model and firebrand scattering model.

Model description

Both the density and the temperature in the fire plume fluctuate widely. Therefore, the assumption of an incompressible fluid (Boussinesq approx.) does not hold, and the plume must be considered as a compressible fluid. Thus, the Favre-averaged process is introduced here for all the transport equations. A modified k-ε model for compressible reciprocating engine flow is used. A fire model is required to close the governing equations. One of the common methods is to replace the fire region by a volumetric heat source (or sometimes heat flux). However, a combustion model that accounts for the chemical reactions between fuel and oxygen must be included to describe the actual fire more closely. Therefore, combustion in the gaseous phase is modeled using the eddy dissipation combustion model here, which is widely used in fire modeling. The chemical reaction rate is proportional to the turbulence eddy decay rate and minimum concentration of the fuel or oxygen.

Radiation plays an important role in the combustion process. It is solved here in parallel with the governing equations. The discrete transfer method is used to provide the radiation source term for the energy equation of the gas phase and the radiation flux to the solid surface.

In reality, it is not feasible to model all the physical processes of firebrand scattering at one time due to its complexity. Here the processes are modeled as follows. The behavior of firebrands in the airflow can be considered to obey an air-solid two-phase flow. Therefore, the scattering of firebrands can be presented by the Lagrangian transport equation.

Firebrands have various complex shapes (spherical, cylindrical and board shape, etc.), and it is very difficult to evaluate the drag force for all shapes. Here, firebrands are assumed to be spherical and the diameter used in the Lagrange equation is represented by the Stokes diameter of the firebrands. Firebrands are collected from a fire wind tunnel experiment and their Stokes diameters are determined from their densities and the terminal velocities.

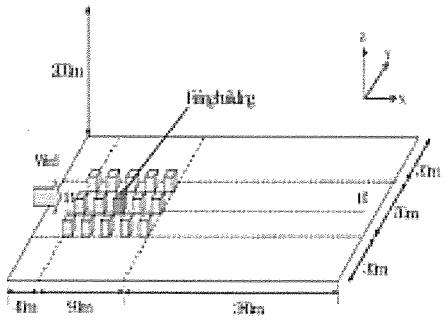
Real urban scale fire simulation

An urban fire simulation in a modeled urban area has been conducted. Figure below shows the calculation area which is X×Y×Z = 510 m × 110 m × 200 m. The size of each building is set to be 10 m × 10 m × 10 m, and the building interval is also set to be 10m. There are fifteen buildings (5×3) and the building on fire is shown. The flow rate of the combustible gas is controlled from the burning face to get a heat release of 1.6 MW/m^2. The inflow wind velocity is assumed as 5.0m/s and 10.0m/s at 10 m height. based on the investigation of Wakayama Shirahama Spa Fire which occurred in 1998. The wind profile is given according to 1/4 profile for urban area. The Stokes diameters of the firebrands are set to be 0.2, 0.3, 0.4, 0.5, 0.6, and 0.7 cm, which are generated at the same generation ratio from firing building. The simulation cases are shown in table below.

Examples of vertical wind distribution and temperature distribution in the center section (section B-B') are shown. The thermal plume is strongest for the all burning cases, the one of roof fire is stronger than that of sidewall fire. The influence on the sky is little for sidewall fire, though strong rising flow is seen between the buildings. When the inflow wind velocity is higher, the thermal plume is suppressed and greatly inclines to the leeward side, which increases the risk of the fire spread to the neighboring buildings.

The examples of the firebrands scattering results are shown in the figure (see next page). The results show that firebrands can influence a wide area in each case, all kinds of firebrands scatter over 100 m due to the rising flow. The firebrands with diameter of 0.2 cm can scatter 400 m or more. Comparing with Case 3 (inflow wind velocity 5 m/s), the scattering distances increase for Case 6 (inflow wind at 10 m/s). This is because, though the rising flow in Case 6 is a little weaker, the firebrands are raised to the sky by rising flow and then follow the wind in the sky which is stronger in Case 6.

Analysis Domain



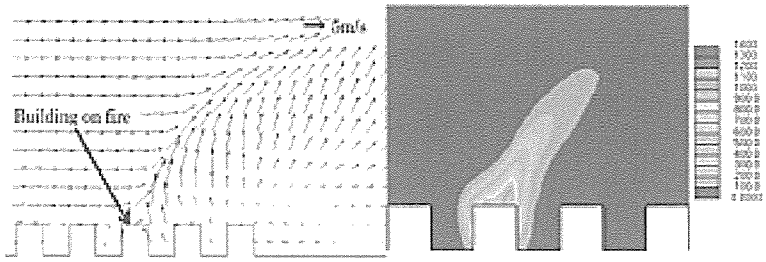
Simulation cases

	Inflow velocity (Height 10m)(m/s)	Burning wall on fire
CASE1	5m/s	Roof
CASE2		Leeward side
CASE3		All sides
CASE4	10m/s	Roof
CASE5		Leeward side
CASE6		All sides

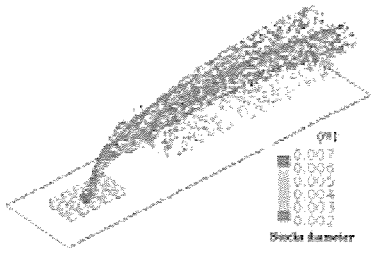
APPLICATION ON URBAN THERMAL ENVIRONMENT

Urban thermal environment simulation method

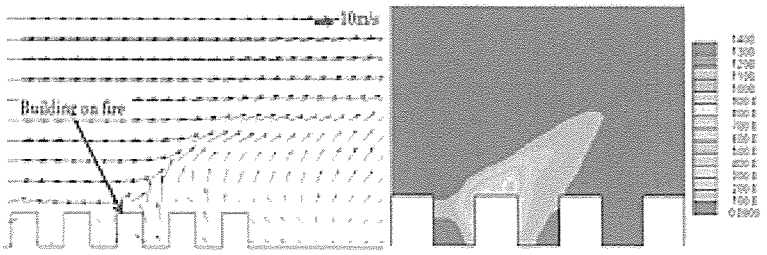
The urban thermal environment numerical simulation is based on a



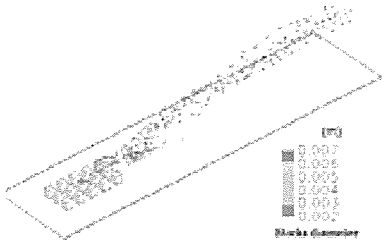
Case 3 (Burning face: all sides)
Vertical wind & temperature distribution
(Section B-B', Inflow wind velocity: 5 m/s)



Case 3
Firebrand trajectories



Case 6 (Burning face: all sides)
Vertical wind & temperature distribution
(Section B-B', Inflow wind velocity: 10 m/s)

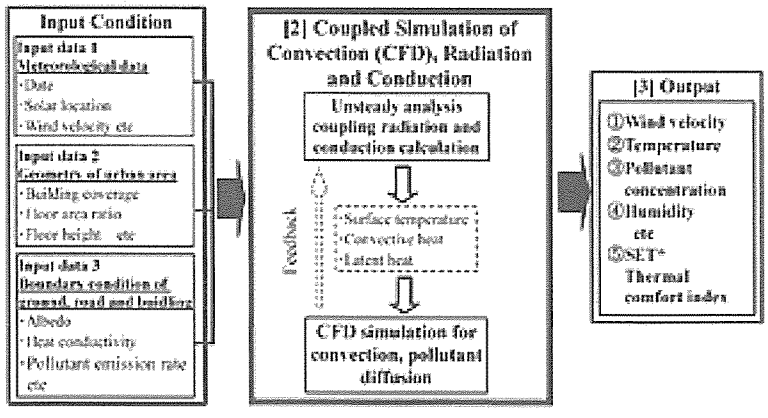


Case 6
Firebrand trajectories

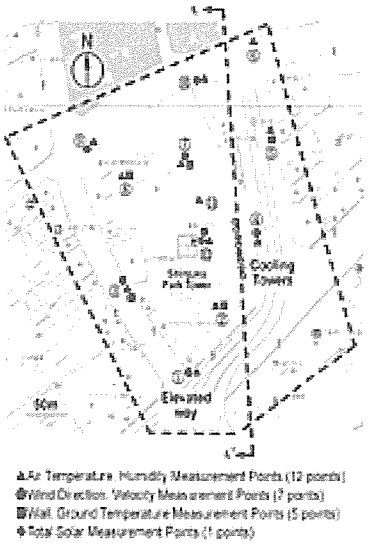
method coupled with three-dimensional CFD analysis, three-dimensional radiation analysis, and one-dimensional heat conduction analysis. Figure below shows the flowchart for this numerical simulation. First, boundary conditions are set up from various input conditions. Second, a three-dimensional radiation calculation is performed. Then, temperature distribution inside the ground or wall is calculated by solving an unsteady one-dimensional heat conduction equation. Three-dimensional coupled convection and water vapor transportation calculations are performed continuously by adding new boundary conditions for the surface temperature distribution of the ground and wall, and air-conditioning heat load obtained from the radiation and conduction calculation. The coupled simulation of convection, radiation and conduction is then completed by repeating these operations in series. This numerical simulation adapts for an unstructured computational grid suitable for a complex urban area.

Real urban area simulation

The simulation object is shown in the frame enclosed by broken lines in the figure below, where the Shinjuku (Tokyo, Japan) DHC (District Heating and Cooling Systems) center (next to Shinjuku Park Tower, a 52-storey building) is located. Field measurements of out-door thermal environment were taken here on



Flowchart of the numerical simulation



Measurement and study area

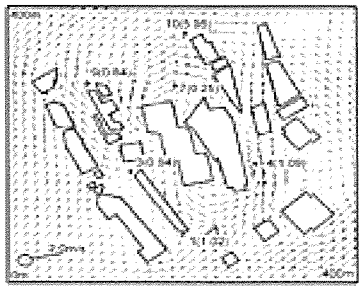
August 20-22, 2003 to investigate the influence of the heat release from the DHC center on the surrounding thermal environment. Target date and time for the analysis is August 22 on 13:00. Figure below shows the simulation results for the horizontal distribution of wind velocity and measurement results at a height of 1.5 m. As an overall tendency, the simulation results show good agreement with the measurements. The velocity of the wind decreases close to the building, and a vortex is formed on the north side of the Shinjuku Park Tower (around measurement point 7). The vertical distribution in section A-A' (refer to figure 'Measurement and study area') is shown. It shows that a strong rising flow is formed by the influence of upward exhaust from the cooling tower. It implies that the heat and vapor released from the DHC system are blown upwards into the sky.

The horizontal distributions of temperature and absolute humidity at a height of 1.5 m are shown. It can be seen that the temperatures are higher around measurement points close to buildings and places where the wind velocity is weak. We can see that the measured results and the simulation results are in good agreement. The vertical distribution at section A-A' is shown. It can be seen that temperature stratification occurs around the buildings and the ground due to heat flux from the buildings and the ground in vertical direction. It is also thought that there is little influence on the thermal environment at the pedestrian level because the heat and vapor are expelled from the cooling tower high up into the sky. This agrees with the measured result that there is little difference between the temperature and humidity on the windward and leeward sides of the area.

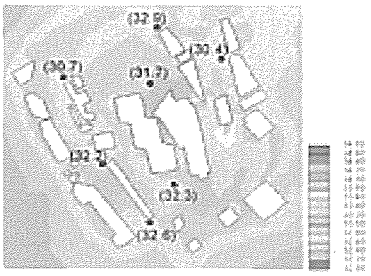
CONCLUSION

In this research, in order to investigate the urban fire safety and urban thermal environment, CFD modeling has been applied. To predict urban fire and scattering of firebrands in a modeled urban area, the CFD model was coupled to turbulent combustion model, radiation model and firebrand scattering model. The results show that when the inflow wind velocity was comparatively slow, the size of the thermal plume became significant, and when the inflow wind velocity was high, the thermal plume was suppressed and greatly inclined to the leeward side, which increased the risk of fire spread to neighboring buildings. The firebrand could scatter over a wide area of more than 400m. In order to simulate the thermal environment, we developed a numerical simulation program which could be adapted to complex urban areas and coupled with convection, radiation and conduction processes. Applicability of the program was tested in a real urban area. Comparison of the measured and simulated results for temperature, humidity and wind velocity confirmed the effectiveness of the tool for assessing complex urban thermal environment.

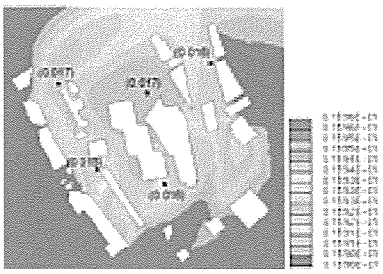
ICUS Associate professor



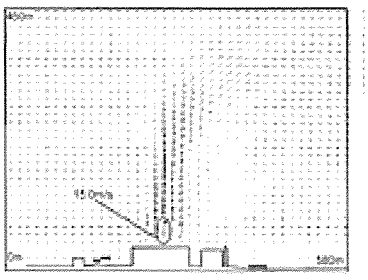
Horizontal wind distribution (m/s) (at 1.5 m height) ( ) : measured wind velocity



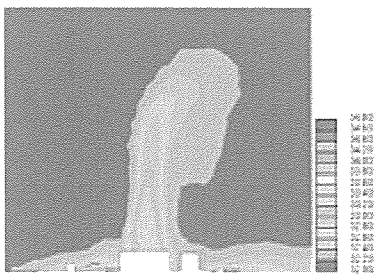
Horizontal temperature distribution (°C)(at 1.5 m height) ( ) : measured temperature



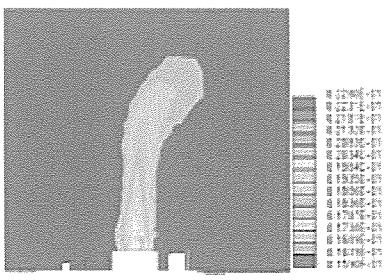
Horizontal absolute humidity distribution (kg / kg of dry air) (at 1.5 m Height) ( ) : measured absolute humidity



Vertical wind distribution in A-A'section (m/s)



Vertical temperature distribution in A-A'section (°C)



Vertical absolute humidity distribution in A-A'section (kg/kg of dry air)

Research Committee 62 (RC62) held meeting

Research Committee 62 (RC-62), "Technologies for Evaluation of Aging Infrastructure Performance Degradation" held its forth meeting on December 2, 2008. In order to evaluate present and future performance of infrastructure, knowledge from two or more specialized fields, such as material science, structural engineering, geotechnical engineering, and so forth is necessary. Although these studies have been performed separately in each field, an appropriate methodology for combining these results has not yet been developed. ICUS has established RC-62 in order to consider this problem, and regular meetings have been held with the member companies from various specialized fields in civil engineering in order to build relationships and allow for joint action.

Two working groups (WG) were lunched under this committee and the target of each WG is structure (WG-1) and ground (WG-2), respectively. Moreover, WG-1 is composed of 3 sub-WGs, namely, evaluation of structural performance (SWG-1), sensing technologies (SWG-2) and integration of ground and structure (SWG-3). In this meeting, action plans of each WG and SWG were introduced and discussed. State-of-the-art report of each field will be published for the next year's activity. After the WG reports, an invited speaker, Prof. F. Katsuki, delivered the lecture "Structural Health Monitoring for Concrete Structures". Prof. Katsuki is a Professor of Shibaura Institute of Technology and an authority of sensing technologies for evaluating the performance of existing concrete structures. He presented the research outcomes of the subcommittee on structural health monitoring for concrete structures under the JSCE (Japan Society of Civil Engineering) Concrete Committee. After his lecture, a small gathering was held in which participants exchanged ideas and questions were answered.

(By Y. Kato)

15th ICUS Open Lecture was held

The 15th ICUS Open Lecture was held on October 6, 2008, which welcomed approximately 120 participants. Lectures were focused on ports and airports in Japan and the world with the title of "Strategy for ports and airports as bases of traffic and physical distribution". We have been facing a difficult situation for port and airport improvement due to many aspects of requirement under budgetary limitations. Among them, it is particularly important to take into account international trade as well as environmental preservation and disaster mitigation. During this Open Lecture, we discussed the policies on how to ensure the functions and international standpoints during port and airport improvement, how to promote the efficiency of physical distribution at ports as a part of global warming countermeasure, and how to maintain the functions and performance of port and coastal infrastructures.

Prof. Kimiro Meguro, ICUS Director, addressed the opening of the Lecture. Brief presenter profiles of three distinguished presenters and respective titles of presentation were as follows:

Dr. Takashi Nanba, Director of Planning Division, Ports and Harbours Bureau, Ministry of Land, Infrastructure, Transport and Tourism (MLIT); "Reduction of environmental burdens by improving efficiency of a physical distribution system through ports".

Prof. Hiroshi Yokota, ICUS Visiting Professor and Executive Researcher at the Port and Airport Research Institute; "Infrastructure management in port and coastal areas"

Mr. Kazushige Umeyama, Deputy Director General, Kanto Regional Development Bureau, MLIT; "Extension project in the Tokyo International Airport (Haneda Airport)"

The closing remarks were delivered by Prof. Yokota. After the Lecture a convivial party was held and attended by approximately 100 participants. They actively carried out further discussion and exchange of views there.

(By H. Yokota)

Dr. T. Nanba

Prof. H. Yokota

Mr. K. Umeyama

Disaster Drill held at the University of Tokyo Hospital

Disaster drill was held at the University of Tokyo Hospital from 13:30 on September 9, 2008. ICUS is leading a joint working group (WG) on disaster management manual system for the University of Tokyo Hospital considering its role as the disaster base hospital with the University of Tokyo Hospital and the Division Environment, Health and Safety. The scenario of the drill was discussed and prepared in the WG.

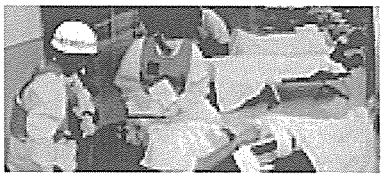
In the drill, occurrence of a Tokyo Metropolitan Earthquake with magnitude of 7 was assumed. The Drill consisted of 2 parts. The first part was the training for checking the safety of patients, staffs and facilities in each ward of the hospital just after the earthquake and reporting the results to the disaster command center. The training of extinguishing fire and evacuation of severely-injured patients were also done. Based on the reports from each ward and sections, the disaster command center decided that the hospital have the capability to accommodate disaster victims transported from outside.

In order for the disaster command center to understand the capability of the hospital quickly after the disaster, the reports from each ward of the hospital to disaster command center should be done smoothly. And, the results, such as the number of injured people, should also be summarized

Triage drill

quickly. This year, viewer system for disaster command center to check the total situation of the hospital was developed and used in the drill. Staffs in 30 wards of the hospital inputted their damage situation in spreadsheets and brought the files to the disaster command center. Each data was inputted in the database and damage situation of each ward was plotted and shown on the viewer system. Real-time data of the total damage in the hospital was shown on the system. Some of the wards failed to input the checking sheets. But most of the 30 wards succeeded in reporting to command center.

The second part of the drill was the training of triage and treatment for outside disaster victims. Triage is the medical activity for sorting patients according to the severity of their injuries in order to provide maximum medical treatment under the restriction of medical resources. The mimic disaster victims were sorted to be Red; Severely-injured to be treated urgently, Yellow; Moderately-injured, Green; Slightly-injured after the first and second triage. Training of first-aid treatment was also done.



Yellow: moderately injured patient

Last year, e-learning system for doctors and nurses on emergency responses in disaster base hospital was developed by Dr. M. Ohara and other WG members in order to increase their emergency response capacity. This year, the contents of the learning system was expanded and used as a preparation for the disaster drill. Advanced learning contents especially for the nurses of emergency and critical care medicine was developed. It consists of five parts explaining procedures such as how to prepare for accommodating injured people, how to do the first and second triage for injured people.

Our joint WG is working according to the three years' research plan from 2007 to 2009. In 2009, WG aims to develop a new disaster manual for hospitals based on the lessons learnt from the drill.

(By M. Ohara)

RC58 Activities

The Research Committee 58(RC-58),"Business Continuity Management (BCM) System Suitable for Japanese Society", held its third and fourth regular meetings on September 29 and November 10, 2008.

This year, RC-58 were divided into three working groups (WGs) in order to discuss the following topics: 1) WG-1a researched the ideal way of BCP (Business Continuity Plan) and BCM for the private sector companies in Japan, 2) WG-1b did the same but the target was for public sectors. 3) WG-2 researched on the ideal evaluation methodology for BCP and BCM.

At the third regular meeting, each working group gave a presentation of the interim report. At the fourth meeting, they reported their research progresses.

Besides these activities, invited speakers delivered some lectures. So far, municipality, bank, local companies and individual disaster prevention organizations have given lectures.

Based upon these activities, RC-58 members will publish a report of the current year 2008.

RC58 regular meeting snapshot

(By Y.Hiruma, Meguro lab.)

USMCA 2008 was held in Beijing, China

Experts from 13 countries delivered 77 presentations at the USMCA 2008, Beijing

Center for Public Safety Research (CPSR), Tsinghua University, Beijing, China and ICUS organized the Seventh International Symposium on New Technologies for Urban Safety of Mega Cities in Asia, USMCA 2008, in Beijing on 21-22 October, 2008. The symposium aimed to provide a forum for decision makers, practitioners and researchers to share their expertise in diverse areas for better urban safety management.

Prof. Weicheng Fan inaugurated the symposium

The two-day symposium program was arranged in four keynote sessions and ten technical sessions. Ten keynote speeches and seven plenary lectures were delivered by invited distinguished academicians and researchers from premier academic and public institutions in Asia and around the world. The symposium was inaugurated by Prof. Weicheng Fan, Director of CPSR, Tsinghua University and chairman of USMCA 2008 organizing committee. Prof. Hu Dongcheng (Vice President, Tsinghua University, China), Prof Jaehne Richard (University of Illinois, USA) and Prof. Kimiro Meguro (Director of ICUS) gave the opening speeches.

In the keynote speeches, Prof. Fan introduced the frontier research on public safety in China. Studies on Myanmar Cyclone and Sichuan Earthquake were presented by Prof. Shibayama (Yokohama National University, Japan) and Prof. M. Ishikawa (The University of Tokyo, Japan) respectively. Prof. M. Tamura (Yokohama National University, Japan) gave a speech on the industrial safety engineering. Prof. Y. Yasuoka (National Institute of Environmental Studies, Japan) presented the new technology of remote sensing application. Researches on disaster management and maintenance of structures were reported by Prof. Jaehne (University of Illinois, USA), Prof. T. Sakata (Tokai University, Japan) and Prof. T. Uomoto (Shibaura Institute of Technology, Japan). Strategy for efficient use of earthquake early warning system was introduced by Prof. Meguro.

Sixty papers were presented in technical sessions covering a wide range of issues in the areas of urban safety including: Emergency Management for Urban Disasters, Advanced Technologies for Monitoring, Assessment & Management of Urban Safety, Risk Assessment, Prediction and Early-warning of Urban Disasters, Safety Assessment of Existing Infrastructure, Environmental Impact Assessment due to Rapid Urbanization, Evacuation Management for Urban Safety, and Rehabilitation and Retrofitting of Urban Structures against Disasters.

Excellent Young Researcher Award was prepared to encourage activities of young researchers in the field of urban safety engineering. The winners of this award were: Mr. Navaratnarajah Sathiparan (The University of Tokyo, Japan), Ms. Gai Chengcheng (Tsinghua University, China), Ms. Xue Wen (Zhejiang University, China), Dr. Akiyuki Kawasaki (The University of Tokyo, Japan), Ms. Kawagoe Yuko (Waseda University, Japan).

Young researcher awardees with Prof. Meguro and Prof. Zhang

The Asia-Pacific Association for Public Safety Science and Technology was launched in this symposium to promote the interchange of the safety science and technology in the region. The chairman of the first session is Prof. Fan, the vice-chairman is Prof. Meguro.

The next symposium will be held at National Institute for Disaster Prevention in Seoul, Korea. Further information will be posted in ICUS web site soon.

(By H. Huang)

Field visit to the Haneda Airport Extension construction site

On October 28, a field visit to the construction site of D-Runway, Haneda Airport (Tokyo International Airport), was organized by Prof. Yokota and Dr. Kato. This airport, which currently has three runways, serves mostly domestic and a few international flights for the Tokyo Metropolitan area. As of 2007, the annual number of passengers was 66.8 millions, the 4th busiest in the world after Atlanta Hartsfield-Jackson, Chicago O'Hare, and London Heathrow. When the extension is completed by the fall 2010, the annual airport traffic capacity will reach 407 thousands, almost 40% more than the current 296 thousands. The facility has been designed for 100 years service life and it is specified that no major maintenance works are required in the first 30 years, although inspection is necessary. The construction, which is currently the largest on-going project in Japan, demanded an investment of US$6billion and almost 2,000 companies are involved.

The development, which mainly consists on the construction of a 2,500m-long runway and a taxi way, has several technical challenges. For instance, the layout and configuration were decided so that ship traffic in Tokyo Bay was not obstructed. The runway is a combination of reclamation works and precast slabs over pile-jacket foundation. Because part of the new runway will be located in the mouth of the Tama River, special detailing of the pile foundation was necessary to avoid affecting the river ecosystem.

Prefabricated 30m high jacket unit

The construction of the piled portion of the runway consists of three stages. First, preceding piles are driven in the seabed. Then, jacket units, as shown in the photos, are installed on top of the driven piles and they are connected with grout. Each jacket unit covers an area of 45 m x 63 m and has six piles. Finally, precast slabs are put on top of the jacket units and connected with cast-in place concrete. In the end, the slab will be one of the widest slabs in the world constructed without joints. Almost 1,200 preceding piles, 198 jacket units, 10,700 pre-stressed precast concrete slabs, and 7,000 UFC (ultra high strength fiber reinforced concrete) slabs will cover the 520,000 m^2 of the pier. To meet the design condition of no major maintenance in the first 30 years of service, a cover of titan plates for slabs and a cover of stainless steel for the splash and tidal zones of the piles and cathodic protection were specified.

Installed jacket units

The Haneda Airport extension project is one of the latest examples of how engineering overcomes the challenges of creating sustainable infrastructure for improving human life with limited impact on the environment.

(By P. Mayorca)

ICUS joined the 14th World Conference on Earthquake Engineering

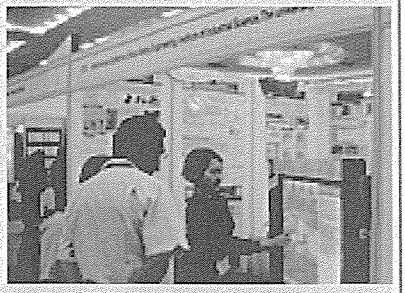
Exhibition at the conference

The 14th World Conference on Earthquake Engineering was held at the Beijing Jiuhua International Conference and Exhibition Center in China from October 12 to 17.

This conference is held every four years and many researchers in the field of Earthquake Engineering gather from all over the world. More than 2,000 researchers and engineers registered and over 3,000 people attended the conference.

ICUS joined the conference as one of the 71 exhibitors. During five days, ICUS introduced its research activities by panels and monitors in its booth. Especially, PP-band retrofitting technologies for masonry structures and its promotion system were explained and videos of shaking table experiments were shown at the booth. Visual system for Urban Earthquake Risk Assessment using 3-D Micro GIS Analysis was also demonstrated at the booth. The system can show vulnerability risk ranks of each district of the Tokyo Metropolitan area in an interactive way with the 3-D urban view. Many participants visited ICUS booth and received printed materials introducing the latest research results.

(By M. Ohara)



ICUS booth at exhibition

RNUS Activities

ICUS Director joined Expert Group Meeting at UN-ESCAP, Thailand

On 19 November 2008, Prof. Meguro, Director of ICUS, gave the presentation on "Advanced technologies for total disaster management" during the Expert Group Meeting (EGM) on WSIS+5 and Emerging Issues in Asia and Pacific organized by the Information and Communications Technology and Disaster Risk Reduction Division of the United Nations Economic and Social Comission for Asia and the Pacific (UNESCAP) at the United Nations Conference Center, Bangkok, Thailand. The presentation given by Prof. Meguro was a part of the EGM to exchange knowledge and experiences among the participating experts at technical, institutional and policy level. This EGM was organized under the theme of WSIS+5 regional review, key and emerging trends in Asia and the Pacific including ICT(Information and Communication Technology) capacity building, ICT and disaster risk management, food security and ICT.

Workshop on Transportation Researches for Urban Safety

RNUS organized "Workshop on Transportation Researches for Urban Safety" at Rama Garden Hotel on December 11, 2008 under the sponsorship of ICUS. It was a one-day workshop with a total of 11 presentations. The objectives of this seminar were to share and exchange knowledge, information and opinions among transportation researchers and practitioners in order to understand critical transportation problems in Asian cities, and to find better solutions for the current problems in transportation engineering.

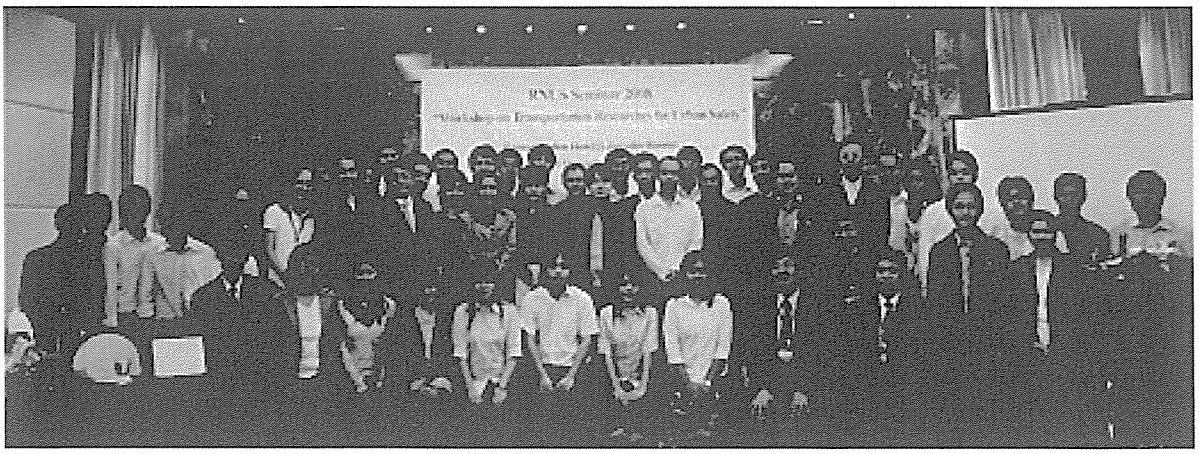
The seminar started with an opening speech by Dr. S. Tanaka, Regional Network Office for Urban Safety (RNUS). It was followed by list of presentations from Prof. F. Nakamura (Yokohama National University), Prof. Y. Kumagai (Kochi Tech of University), Dr. T. Yoshii (Kyoto University), Prof. M. Kuwahara (University of Tokyo), Dr. P. Raothana-chonkun (Burapha University), Dr. P. Taneerananon (Prince of Songkla University, Thailand), Prof. T. Nakatsuji (Hokkaido University), Dr. H. Hamaoka (Akita University), Dr. R. Horiguchi (i-Transport Lab.), Dr. S. Narupiti (Chulalongkorn University) and Dr. A. Sumalee (Hong Kong Polytechnic University). A total of 57 participants in the seminar were from governmental sections, consulting companies and universities in Thailand.

Participants at IIS Thailand Chapter Alumni party

IIS Thailand Chapter Alumni Party 2009

IIS (Institute of Industrial Science) Thailand chapter alumni party 2009 was held at RAMA garden hotel on 12 December 2008. Ten participants joined the party including Prof. M. Kuwahara and Dr. S. Tanaka who were rep-resentatives from IIS. During the party, there was discussion on the future of alumni activities.

(By K. Worakanchana, RNUS)



More than 50 participants joined the RNUS Workshop on December 11, 2008

BNUS Activities

BNUS Conducts Earthquake Intensity Surveys

BNUS conducted earthquake intensity survey for two earthquakes. The first survey was conducted for a small earthquake along Bangladesh-India border, on 5 July 2008 at 22:55 PM Bangladesh local time. The earthquake had a magnitude of M4.1(source: ASC-India website) and was centered at 6.4 kms WNW of Rajshahi, Bangladesh. At least 30 buildings developed cracks and a 6-storey building tilted in the division (photo below). BNUS team visited the areas around the earthquake

Tilting of 6-story building in Rajshahi (5-Jul-2008 quake)

source, Rajshahi City, Chapainawabganj, Godagari, Saroda, Baghmara, Keshore, Natore and Tanore from July 16 to 19 and 27, 2008 and conducted surveys for intensity through a pre-formatted questionnaire to a total of 200 inhabitants of the area. From the collected data, intensities of different locations were estimated. The survey results indicate that the people living in Rajshahi and adjacent areas could feel the shaking, with shaking of light furniture, doors and windows, gentle oscillation of hanging objects were also noticed in some cases. The intensity of the quake estimated from the survey was MMI scale V at Rajshahi, Chapainawabgonj, Baghmara, Keshore and Tanore, IV at Godagari, Saroda and III at Natore.

The second survey was conducted for a light earthquake (Mb4.9, ASC-India website) in northern Bangladesh, on 27 July 2008 at 00:51 Bangladesh local time. The epicenter was at ENE of Mymen-singh and it was felt in many parts of Bangladesh causing several injuries and considerable panic. Using a pre-formatted questionnaire, since July 29 to August 04, 2008, BNUS team surveyed 100 inhabitants of Mymensingh town and nearby areas, namely, Agricultural University Premises, Haluaghat, Jaymangal, Nalitabari, Nakla, Dhobaura, Sherpur, Durgapur and Netrakona. From the collected data, intensities of different locations were estimated. The survey results indicate that, the tremor lasting between 5-10 seconds, was strong enough to awaken the most of the sleeping people, shake light furniture, gently oscillate hanging objects and make showpieces fall down from shelves. Some students in Mymensingh Agricultural University were injured due to the panic from the earthquake with cracks due to this earthquake observed in almost all student residential halls. The intensities of the quake estimated from the survey were VI- VII at Mymensingh, VI+ at Haluaghat and Dhobora , VII- at at Sherpur, V at Durgapur and IV at Netrakona.

Organizing Training Program for Masons on Constructing Earthquake Resistant Buildings

Generally in Bangladesh masons do not have any knowledge about earthquake resistant buildings. On 16th October 2008, BNUS started a three-day training program for masons to provide them with such knowledge by training them about arrangement and formation of various necessary structural requirements for construction of earthquake resistant buildings along with quality control and maintenance. For example, they were given knowledge about forming collar in partition walls to give it stiffness and integrate it with the beam column to resist lateral force during earth-quake, and about placing vertical rods in the partition walls. An introduction to earthquake defi-nition, how it occurs, and earthquake history of Bangladesh were also given. The theoretical training course concluded with a written examination. After the training the masons also built a small structure consisting of 10 feet x 10 feet small rooms providing earthquake resistant reinforcement with base footing. To strengthen a existing weak building to be earthquake resistant, the training also provided ideas about retrofitting, such as, method of bolting, jacketing, beam column casing, split and bandage.

Practical training to masons participants

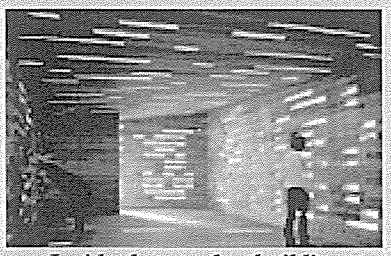
BNUS Participated in the National Workshop on Hospitals Safe from Disasters

A National Workshop on Hospitals Safe from Disasters was organized on 29th October 2008, the International Day for Disaster Reduction-2008, by Disaster Management Bureau of Bangladesh. Mr. A. K. M. Abdul Awal Majumdar, Additional Secretary, Ministry of Food and Disaster Management was the Chief Guest of the program. The workshop was chaired by Mr. K. R. Siddiqui, Director General, Department of Relief and Rehabilitation. Lectures were presented by experts in the technical session on the issues regarding the safety of hospitals from disasters. Dr. M. A. Ansary, Professor, Dept. of Civil Engineering, BUET and Director, BNUS moderated the technical session as the session chair. BNUS displayed panels on the earthquake safety issues, non destructive testing of buildings etc. and distributed awareness posters and booklets in the program.

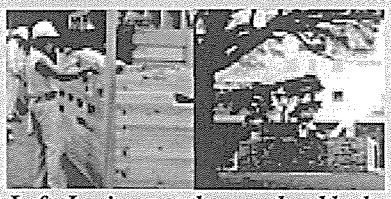
(By M.A. Ansary, BNUS)

A New Building Constructed Using Wood-blocks

A new wooden small building was built in front of the Institute of Industrial Science (IIS) building in Komaba Research Campus of the University of Tokyo. The building has been built with Japanese Cedar grown in Kishu, Wakayama Prefecture. This new building construction system is masonry with wooden blocks. With this construction system, a house in a small site can be built using small and light wooden blocks which can be conveniently carried by a single person. Small wooden blocks can be made from resulting timber after thinning out a forest. As the timbers thinned out are thin or curved, it has been thought that they are not useful for timber buildings. But with this construction system these thinned timber can be innovatively used to construct new wooden buildings and houses.



Inside the wooden building



Left: Laying out the wooden-blocks Right: The wooden building with IIS building in the backdrop

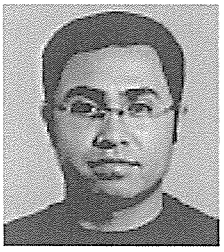
For this construction system, Mr. Kohki Hiranuma, an architect leading the firm Hs WorkShop-ASIA, was awarded the 'Ministry of Land, Infrastructure, Transport and Tourism, Chief of Housing Bureau Prize' in year 2005 competition of "New Building Construction System for housing using thinned out Timber". The wooden building in Komaba Research Campus was built after verification of structural safety by the static loading test conducted by Dr. M. Koshihara, ICUS Associate Professor and technical support team from Housing and Wood Technology Center (HOWTEC), Japan. All wooden blocks used in the wooden building were generously sponsored by Wakayama Prefecture. The building is open to general public from 8:00am to 8:00pm through Monday to Saturday. Everyone is welcome to experience this unique wooden space by using it for taking a rest, relaxing, holding a meeting or a party.

(By M. Koshihara)

ICUS Welcomes Dr. Pranab J. Baruah

We would like to warmly welcome Dr. Pranab J. Baruah to ICUS from November 1, 2008. Since his joining as a researcher at the University of Tokyo in April 2002, he has been working in various research projects related to global ecosystem (carbon budget) modeling and satellite remote sensing applications.

Prior to joining ICUS, he was a researcher at Integrated Research System for Sustainability Science



(IR3S) where he contributed to various international collaboration programs, and studied on food safety & security as well as business case perspective of climate change mitigation measures.

Dr. Baruah received his PhD degree from Tsukuba University, Japan for his research on aquatic remote sensing at the National Institute of Environmental Studies (NIES), Japan. He holds a M.Engg. from Asian Institute of Technology, Thailand and B.Engg. (Civil) from Assam Engineering College, India.

(By K. Meguro)

ICUS Activities

ICUS members participated and presented at the USMCA 2008, Oct 21-22, 2008 in Beijing, China.

Prof. K. Meguro, Assoc. Prof. M. Ohara, Assoc. Prof. H. Huang, Dr. P. Mayorca, Dr. Worakanchana participated in the 14th World Conferences on Earthquake Enginee-ring, Oct 12-17, 2008, Beijing, China.

From Nov 18-22, 2008, Prof. K. Meguro attended UN-ESCAP program in Thailand to give special and keynote lectures.

Dr. S. Tanaka participated in the ITS World Congress, Nov 16-24, New York, USA. During Oct 14-19, Oct 24-29 and Dec 8-19 , 2008, he carried out his research and teaching duties at RNUS, Thailand.

Dr. K. Worakanchana stayed in AIT for his research work and teaching duties between Oct-24 to Dec-14 and Dec-26 onward.

Awards

Dr. Paola Mayorca was awarded "Outstanding Paper Award" at the 14th World Conference on Earthquake Engineering, Beijing, 2008, for her design of PP-band retrofitted adobe/ masonary structures.

Editor's Note

A once in a 100 years economic depression has come to haunt almost the entire world starting with the bankruptcy of Lehman Brothers in September, 2008. Even giants like Toyota and Sony are feeling the pinch with losses, and large-scale restructuring is being executed. The very fact that the financial infrastructure has a big influence on the world is recognized again. However, the current unprecedented events in world economy shows us some important facts and teaches us an important lesson: that a system is generally not so criticized while it is effectively operated. It is also true that, critical opinions about its operation always exist though these opinions are often small in number. An important thing therefore is to always listen to various opinions because we cannot forecast the future with absolute certainty. Now, there is a grave concern that due and urgent attention to environ-mental problems is decreasing with this economic downturn. If we let this fear become real, we will fail again, this time in our environmental front and in an irreversible all-out way.

We in ICUS are continuously concerned with the problems in urban environment that will support more than half of humanity in coming decades. Focusing on Urban Safety, all subjects relevant to it constitutes ICUS activity. Here, we always try to offer the best or better solution to the society based on recognition of the current problems and forecast of future problems through scientific means. As it is possible that our forecast result may have an unexpected outcome similar to the present devastating happenings in the financial world, it is extremely important for us to always review the result of an examination. We believe that, modesty, recognition of such limitations and a listening ear to criticisms are key to influential, effective and sustainable solutions to the ills of the society.

(By Y. Kato)

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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