ICUS NEWSLETTER

International Center for Urban Safety Engineering

International Center for Urban Safety Engineering

Institute of Industrial Science
The University of Tokyo

VOLUME 7 NUMBER 2
JULY-SEPTEMBER 2007

Distress in the Tarmac

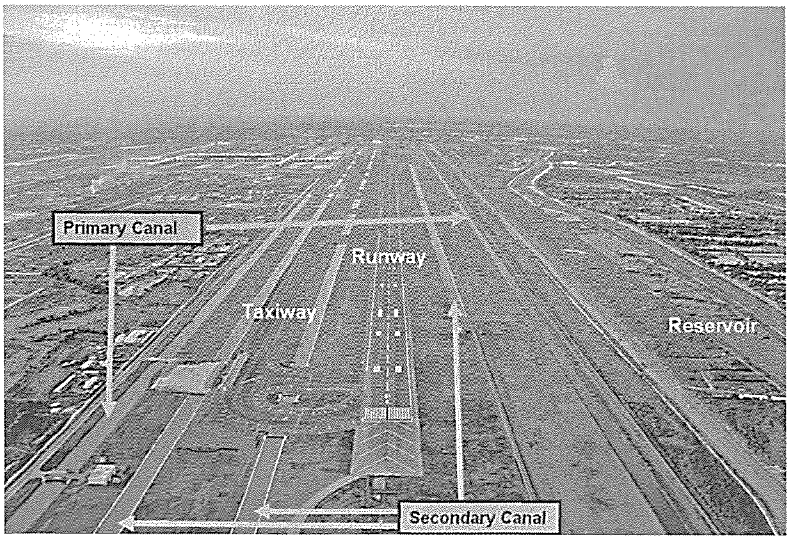
By

*Worsak Kanok-Nukulchai**

Last October, when the first sign of rutting was spotted in five of the six taxilanes and in one taxiway at the newly opened Suvarnabhumi International Airport, the Engineering Institute of Thailand (EIT) assigned a team of experts to join the preliminary investigation. The investigation revealed that the damage was caused by the premature failure of asphalt base course due to the separation of asphalt binder from aggregate surface in the presence of moisture, commonly known as "stripping". It was quite evident from the milled damage area that water seeped from the sand blanket underneath the cement-treated base (CTB) through expansion joints. The author summarized the technical facts about this tarmac distress after this matter was blown out of proportion by the politically-oriented media hype early this year.

PAVEMENT STRUCTURE

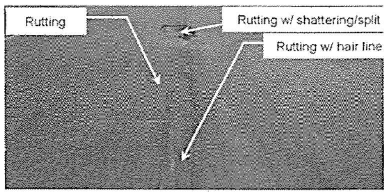
Suvarnabhumi airport covers an area of 20,000 rai (3,200 hectares). In its first phase, the airfield serves its hourly 112 flights with two runways, six taxiways and six taxilanes. The tarmac consists of three layers of asphalt concrete, namely the base course (23 cm thick), the binder course (6 cm thick), and the wearing course (4 cm thick). Underneath are four layers of the cement-treated base (CTB), 18 cm. thick each, sitting on top of the sand blanket (approximately 80 cm thick) left over from the ground improvement process.



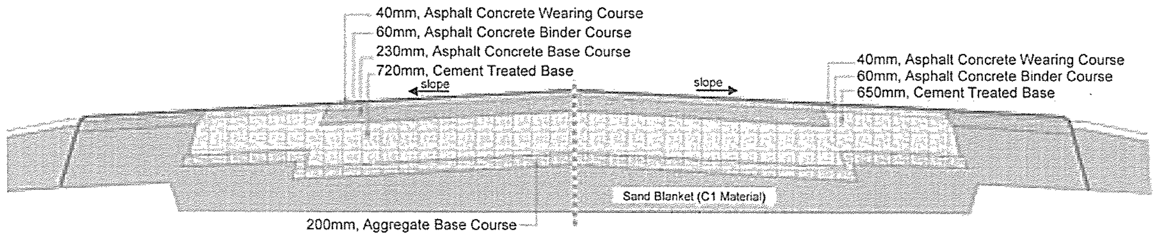
Overview of east runway, taxiways and the drainage system, Suvarnabhumi Airport, Thailand

OBSERVATION OF DISTRESS

On 27 October 2006, around 3 weeks after the official opening of the airport, the first signs of distress were spotted at several locations in the taxiways and taxilanes, in the form of rutting, rutting with shattering and split, and rutting with hairline cracks. Since then, a similar pattern of failure has developed heavily in five of the six taxilanes and along the east parallel taxiway. Although both runways are still in good structural condition, plastic deformation of the asphalt wearing course was observed near the takeoff position. This location is normally under maximum load when the plane takes off with full load of fuel. The high shearing stress that causes plastic deformation



Typical observation of distress



Structure of Taxiway Pavement laid on top of Bangkok preloaded consolidated soil

was imposed by braking, accelerating or turning traffic. Plastic deformation is greatest at high temperature especially for the AC 60/70 binder grade used in this case. The occurrence of the plastic deformation at this location appears to be common phenomenon and only requires a routine maintenance to repair the distress.

TEST OF THE CORE SAMPLE

Initial investigation was made by coring the asphalt concrete pavement at a diameter 100 mm throughout its 33 cm thickness from the damaged areas. The following observations can be made:

- All core samples from damaged area show evidence of asphalt stripping at the base course, a typical effect of soaking water, while core samples from undamaged areas show good condition.
- The water had infiltrated into and confined in the asphalt concrete base course for a long period. Thus, the base course has been immersed in and impaired by the water.
- As a result of asphalt stripping, asphalt binder was separated from aggregate surface, leading to premature loss of strength and stability of the base course.
- The load of the aircraft had then impaired the failed asphalt concrete pavement, causing rutting on the surface.

CTB VISUAL INSPECTION

Based on the core samples, laboratory tests have indicated the correct job mix and aggregate gradation of the asphalt concrete material. This was also confirmed by a separate test at the Highway Department.

To expose the cement-tested base (CTB) for visual inspection, an area of asphalt concrete pavement was milled at the damaged area of the taxilane. It was evident that there was no sign of damage or subsidence in the CTB. However, traces of water seepage were clearly observed along the rim of the expansion joints in the CTB. This evidence of seepage further hinted that a large quantity of water might still be trapped in the sand blanket.

TEST PIT

On January 31, a test pit was dug on Taxiway T11, where damage was found to be extensive. After the excavation went through CTB and exposed the top surface of the sand blanket, water seeped through the sand immediately until the water level reached about 20 cm above the sand blanket (or roughly at +0.0 MSL). The water stayed at that level even when attempt were made to clear the water.

Interestingly, to prove that water in the sand blanket is fully confined with no connection outside, a deep excavation was made nearby, but outside the pavement area. After the excavation, the dug hole was completely dry. No sign of water from the sand blanket had receded into this empty hole.

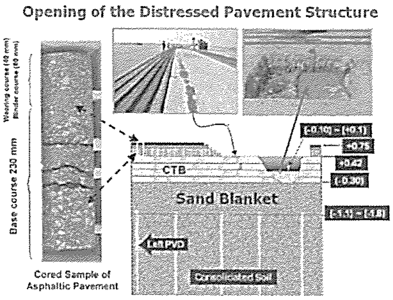
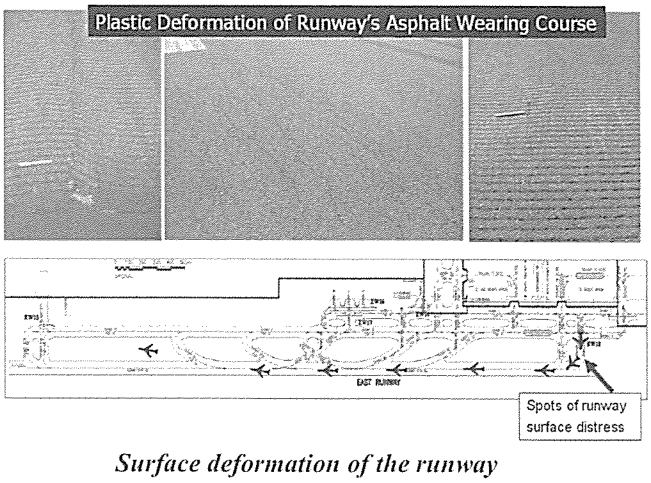
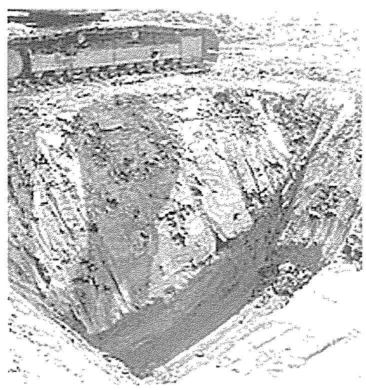


Illustration of milled pavement in the taxilane T11, a core sample of asphalt concrete, trace of the water seepage at CTB joint and the test pit.



Surface deformation of the runway



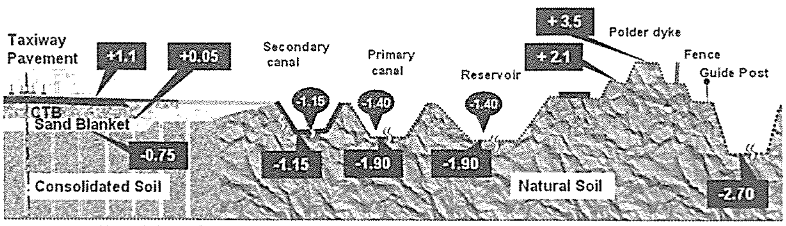
Excavation to test the connectivity of the trapped water.

Meanwhile, Highway Department experts have tested the samples of sand and CTB from this test pit and reported that all materials tested have met the standards.

HOW WAS THE WATER TRAPPED?

Based on the official report of the investigation committee appointed by Airports of Thailand Public Company (AOT), the following reasons had been given as possible causes for the trapped water:

1. Runoff of rainfall water was collected and retained within the airport compound in the pockets of sand used to fill fishponds, swamps and waterways prior to the airport construction. Water from this source might find its way into the sand blanket.
2. Surface water spilled from the drainage canals, during the flooding period, over the top soil around the unpaved neighborhood into the sand blanket.
3. Surface water once trapped underground was not able to escape due to the lack of a subsurface drainage system. This was aggravated by the blockage of culverts and other underground structures.
4. Based on soil boring records, thin sand layers may exist originally within the soft clay layer at a level about 10 metres deep. Some of these sand layers may cross path with the leftover PVD, thus allowing running shallow ground water to seep upward into the sand blanket.



Profile of the flood protection and the drainage system

On the last point, some geotechnical experts argued against this possibility. At the end of the PVD preloading, the extra surcharge consisting of crushed rocks was removed. Thus, it is no longer possible for water to move up to the surface through the PVDs against the hydraulic gradient and against gravity at the end of consolidation process.

In addition, there is hydraulic back-pressure from the trapped water in the sand blanket making it impossible for such hydraulic upward flow to occur.

FLOOD PROTECTION AND THE DRAINAGE SYSTEM

As the airport site is located in the floodway of Bangkok's eastern suburbs, it requires both effective flood protection and drainage systems. The aim is to prevent flooding from flash floods, as well as to drain away rainwater in the catchments of the airport compound. The design of the polder system includes the perimeter polder dike, internal drainage system, two pumping stations and a perimeter road.

Basically, the internal drainage system for runoff water consists of:

1. The unlined primary canals and reservoirs both with the bed at -1.90 m MSL. Based on the design criteria, water level in the primary canals and reservoirs must be maintained not higher than -1.40 m MSL.
2. The secondary canals with concrete linings. The canal bed of the secondary canal is -1.15 m MSL. It is designed to be dry except during the raining.

The primary and secondary canals are interconnected by ditches to ensure that the runoff water from the pavement area will flow under gravity towards the two pumping stations located at the south corners of the site. In the operating manual, water in the primary canals and reservoirs must always be controlled at the pumping stations to ensure that the water level is maintained at -1.40 m MSL or lower.

With the design assumption that no rain water runoff can leak into the sand blanket, no subsurface drainage system exists to systematically drain trapped water from the sand blanket. This might be a weakness in the design criteria of the airfield pavement.

Parties involved in the construction and design of Suvarnabhumi Airport, Thailand

Pavement Zone	Designer	Construction Supervision Consultant	Contractor
East and West Runways, Taxiways, Apron	ADG: DMJM International, Scott Wilson Kirpatrick, Norconsult International, Span, Seatec	APC: Scott Wilson Kirpatrick (TH), Seatec, Norconsult International, MAA, Span	IOT: Italian-Thai, Obayashi, Takenaka
East and West Support Zones, Remote Parking Aprons	WESA: Span, Scott Wilson Kirpatrick (TH), Norconsult International	SMS: Scott Wilson Kirpatrick (TH), MAA, Span	KPV

Ground Improvement Zone	Designer	Construction Supervision Consultant	Contractor
West Runway, Taxiways, Apron	ADG: DMJM International, Scott Wilson Kirpatrick, Norconsult International, Span, Seatec	TMSUM: TEC, MAA, Siam General Engineering, Upham International, Meinhardt (TH)	Italian-Thai
East Runway		TNM: TEC, Nippon Koei, MAA	VKJV: Vijitphan, Krung Thon
West Support Zone	WESA: Span, Scott Wilson Kirpatrick (TH), Norconsult International	NBIA	CH. Karchang
East Support Zones, Remote Parking Aprons			KPV

WHAT'S NEXT?

In its press release issued on 15 February 2007, the Engineering Institute of Thailand (EIT) strongly recommended that, similar to a first-aid treatment, trapped water should be drained out urgently to minimize the potential spread of cracks on taxi lanes, taxiways, and even on runway. It is important that water in the primary canals and reservoirs must always be controlled at the pumping stations to ensure that the water level is strictly maintained at -1.40 m MSL or lower based on the operation manual.

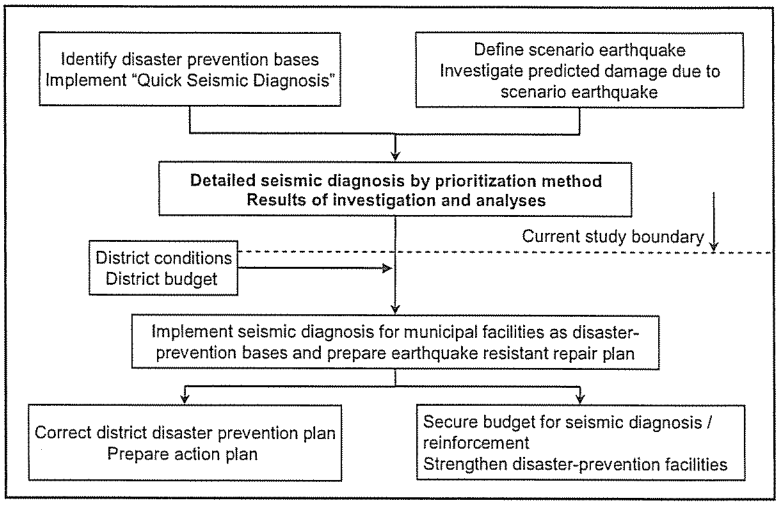
** Ph.D., Professor*
Dean, School of Engineering & Technology
Asian Institute of Technology
and
Vice President of the Engineering Institute of Thailand

A method to prioritize the seismic retrofitting of disaster-prevention bases

INTRODUCTION

Many earthquakes are expected to occur in Japan in near future, and relevant authorities have planned and executed various measures to minimize damage. Prior measures aimed at reducing damage are considered to be more effective in mitigating the impact of earthquake disasters than post-disaster measures. In particular, it has been reported that the most effective method is to strengthen buildings and structures to make them earthquake resistant. However, it is not easy for municipalities with limited budgets to strengthen their many facilities. As a result, action has been delayed even for disaster-prevention base facilities. A study is presently being carried out to establish a methodology to prioritize actions on facilities for district disaster-prevention bases in a municipality considered likely to suffer most damages caused by the Tokai, Tonankai and Nankai earthquakes. This article briefly introduces this prioritization methodology.

It is worth mentioning that this study is being carried out as a joint project among three sectors: industry (Kajima Co.), academia (The University of Tokyo) and government (Ministry of Internal Affairs and Communications).



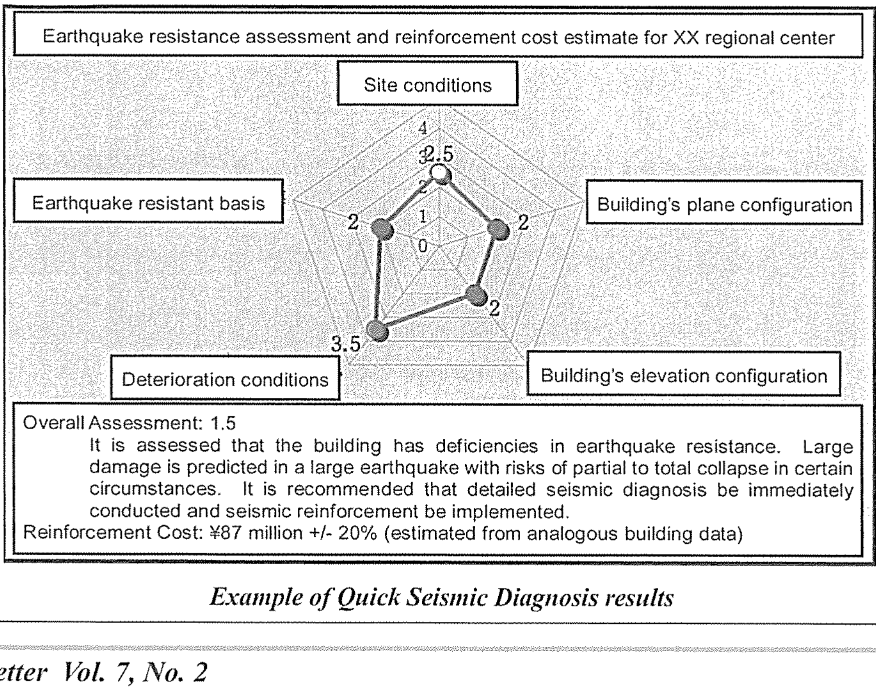
Investigation flow

INVESTIGATION METHOD

The investigation flow is shown in the figure above. At first, the method for prioritizing facilities for district disaster-prevention bases is developed. Next, the municipality should take the responsibility of preparing a disaster prevention plan and budgeting the seismic strengthening of its facilities based on the prioritization study results.

IMPLEMENTATION OF QUICK SEISMIC DIAGNOSIS

In order to budget for earthquake-resistant strengthening of facilities in district disaster-prevention bases, it is necessary to estimate the cost in line with the reinforcement plan based on a detailed seismic diagnosis. However, a large budget is already necessary for detailed seismic diagnosis (several million yen / facility). As a result, it has been decided to employ a "questionnaire-type Quick Seismic Diagnosis" that



Example of Quick Seismic Diagnosis results

Distribution of seismic intensity and locations of disaster-prevention base facilities

has been developed from the results of many detailed seismic diagnoses.

Then, 165 facilities for district disaster-prevention bases have been assessed. In addition to the individual assessments of elements such as site, building, deterioration, etc., overall assessment can be made based on 10 grades.

INVESTIGATION OF PREDICTED DAMAGE DUE TO SCENARIO EARTHQUAKES

The subject municipality worked on the development of a hazard map of scenario earthquakes (the Tokai, Tonankai and Nankai Earthquakes). This took place the preceding year. This map, an example of which is shown in the next page, displayed hazard level by seismic intensity, tsunami, landslide disaster, etc. using GIS. The current study utilized the above GIS data to identify hazard information at each disaster-prevention facility's location.

INVESTIGATION OF PRIORITY IN SEISMIC-RESISTANT STRENGTHENING POLICY

The 165 facilities that have various roles as disaster-prevention bases are varied: fire stations, city hall, branch city offices, health centers, shelters, stockpile storehouse, etc. Of these, 61, which will be utilized for key functions of paramount importance when a disaster occurs, i.e. "control and execute measures", "dispatch and gather information", "help and rescue" and "temporary recovery," have been identified and their priorities investigated. Specific procedures are as follows:

1. *Extract digital data of seismic intensity, tsunami, landslide disaster and liquefaction at the locations of these 61 disaster-prevention base facilities using GIS data.*
2. *Exclude from the investigation items facilities that have high risks of tsunami or landslide disaster. Add supplementary notes on liquefaction for reference only.*
3. *Derive correction factor which converts the seismic intensity at each location to the external force.*
4. *Obtain seismic hazard Z by dividing correction factor by the assessment score of "Quick Seismic Diagnosis" X.*
5. *Give priority in order from large seismic hazard Z obtained above to smaller (the larger the number, the higher the priority).*

CONCLUDING REMARKS

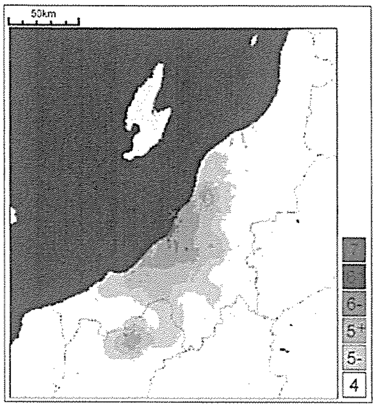
In this investigation, priority has been determined considering the hazard and the earthquake resistance of the facility. The priority assessment is based on whether structural health can be maintained when a disaster occurs. However, the health of a disaster-prevention base assessment should be based not only on the structure's health but also on various factors such as accessibility, sustainability of lifeline function, surrounding population, wooden building ratio, etc. These are items to be investigated in the future. However, a method for utilizing the hazard map and prioritizing disaster-prevention bases for earthquake-resistant strengthening can be obtained from the results of this study. Uploading the study results to the website of FDMA (Fire and Disaster Management Agency) is under planning in order to contribute to realizing earthquake-resistant strengthening of disaster-prevention bases in municipalities.

(By R. Amano, Former ICUS Visiting Professor)

Earthquake hits Niigata Prefecture

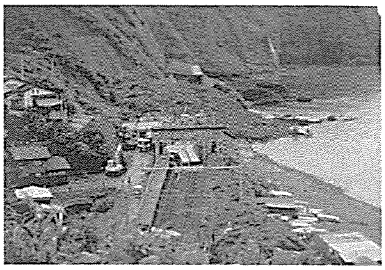
The Niigata Chuetsu-Oki (Niigata Chuetsu Offshore of Niigata Prefecture) Earthquake (magnitude: 6.8; focal depth: 17km), Japan, occurred at 10:13 on July 16, 2007. The earthquake shook Niigata and neighboring prefectures and was felt as far away as Tokyo. Kashiwazaki City, Iizuna and Kariwa villages registered the highest seismic intensity equal to 6+ on the Japan Metereological Agency (JMA) Scale. Due to this earthquake, strong ground motions up to 1019 Gals were recorded. Fourteen people were killed, 1,259 houses totally collapsed, and more than 40,000 houses were affected, mostly older wooden structures.

Meguro laboratory (ICUS) dispatched a reconnaissance team to the affected sites to investigate damages from July 21 to 22. Our group investigated Kashiwazaki City, where damage was the largest, the Japan Railway (JR) Oumigawa Station surroundings, Kariwa village and the Kashiwazaki-Kariwa nuclear plants. Weak houses collapsed, lifelines were



JMA seismic intensity distribution

disrupted, and many landslides and liquefied sites were observed. At JR Oumigawa Station, the route was closed due to a huge slope failure. Little damage was reported at the Kashiwazaki-Kariwa nuclear power station, which is located part on a hard site and part on sand fill. Although at the latter, liquefaction, landslides, and ground subsidence were observed, structures, which were supported on pile



Landslide at JR Oumigawa Station

Old wooden structures collapsed at Kashiwazaki city

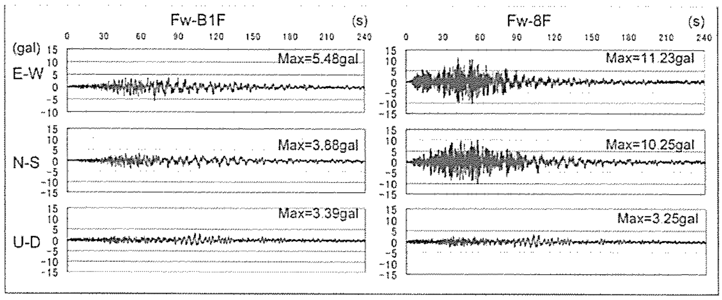
foundations, were not severely affected. In spite of a fire that broke out at an electrical transformer and a radioactive gas leakage, the overall performance of the facility was considered good.

(By Hiruma, Meguro Lab)

Niigata Chuetsu-Oki Earthquake strong ground motion recorded at IIS

ICUS installed a system for monitoring the dynamic behavior of IIS buildings this year. It consists of 18 accelerometers and a computer server for collecting data using the intranet. IIS buildings were divided into four: the west and east wings of Buildings B-C-D, the west and east wings of Buildings E-F. There are joints between Building D and E, and between east and west wings. Accelerometers were installed at the basement, 2nd, 4th, 6th, 8th floors of the west and east wings of Building B, C/D, E/F, and F. The sampling rate is set to 100 Hz and the observation resolution is 0.2 Gal.

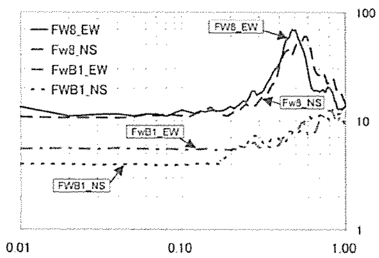
Our monitoring system observed the dynamic response of IIS buildings due to the Niigata Chuetsu-Oki Earthquake. The figure on the top right corner shows the accelerographs recorded at the basement



Comparison of accelerographs recorded at the basement and 8th floor

and 8th floor of Building F. The maximum accelerations in east-west (E-W) direction were 5.4 Gals and 11.2 Gals at the basement and 8th floor, respectively. JMA seismic intensity calculated by structural response was equal to 2.3 and 2.8 at the basement and 8th floor, respectively. Stronger vibration was observed on the higher stories of the buildings.

The spectrum of E-W and N-S accelerations measured at the 8th floor of the west wing of Building F were calculated. From them it was estimated that the natural periods of the building were 0.48s in E-W direction and 0.58s in N-S direction. From the data recorded at



Acceleration response spectra

the point between Building C and D (i.e. C/D), natural periods were estimated as 0.43s in E-W direction and 0.52s in N-S direction. This data confirmed that the dynamic characteristics of Building B-C-D and Building E-F are slightly different.

(By M. Y. Ohara)

Accelerometer

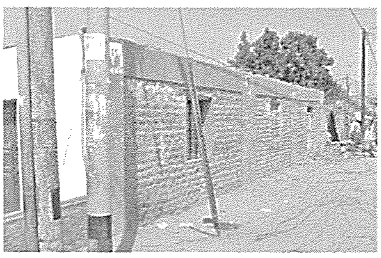
The Mw. 8.0 Pisco Earthquake hits Peru

On August 15, 2007 a Mw. 8.0 earthquake hit the central coast of Peru at 6:40PM (local time). As of September 30, 519 fatalities and almost 1,300 injured people were reported by the National Institute of Civil Defense (INDECI). The most affected cities were Pisco, Chincha, and Ica where intensities as high as MM VII and strong ground motions lasting almost three minutes were reported. The table below summarizes the earthquake effects.

Collapsed houses	75,861 units
Affected houses	92,828 units
Collapsed schools	643 classrooms
Affected schools	635 classrooms
Collapsed health facilities	14 units
Affected health facilities	112 units
Collapsed bridges	2 units
Affected bridges	4 units

HOUSING DAMAGE

According to the latest housing census, more than 50% of the houses were made of adobe without any type of reinforcement in the affected region; among them 70% were more than 25 years old. Consequently, they performed badly exhibiting cracks at wall intersections, partial wall collapse and complete collapse as shown in the photos below. Few houses, were reinforced by either external coatings (existing structures) or inner cane reinforcement (new constructions). These performed well and showed no damage.



Adobe houses in the areas affected by the earthquake (top: non-reinforced, bottom: retrofitted)

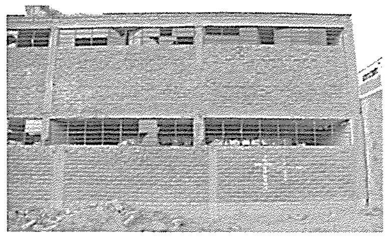
The second most popular housing material in the earthquake affected areas is confined masonry. These structures are mostly made of clay bricks and reinforced concrete confinements. If built following good design and construction practices, they are seismic resistant. However, many bad practices were evidenced by this earthquake. The most common were the use of bricks with horizontal alveolus for load bearing walls (locally called pandereta and prohibited by the code in this region), lack of confinement of parapets and façade walls, insufficient wall density, badly distributed stiffness (in plan and elevation), and a poor understanding of the confined masonry construction procedure. Another deficiency found was the lack of steel reinforcement in the confining beam or the lack of confining beams altogether.

PUBLIC FACILITIES

Most of this earthquake fatalities occurred in public buildings and approximately 30% of them at the San Clemente Church in Pisco. These structures are very old and thus do not comply with the current building codes. There is no legislation that requires retrofitting them to meet the latest code revisions.

The infrastructure quality of schools and hospitals was very diverse. Those built following the design codes performed very well whereas those which did not failed. At the San Juan de Dios hospital in Pisco, the buildings which had just been finished before the earthquake did not suffer any damage whereas the remaining units dating from the 30's were left useless.

148 people attending a mess died at the San Clemente Church in Pisco



Top: School at Los Molinos, Ica. Note that columns in the 1st and 2nd floor are either not aligned or interrupted. Bottom: Hospital at Pisco, where 80% of the houses were affected, suffered no damage.

Privately owned public facilities such as hotels did also suffered extensive damage.

CODE ENFORCEMENT AND LAND USE

Although building codes for adobe, masonry, reinforced concrete and a seismic design code are enacted in Peru, in practice most of the houses do not with them. As in many other developing countries, self construction is widespread in Peru. In order to improve the quality of the building stock, programs to train masons may be one of the key points to overcome this situation.

Inadequate land use is also an issue. Vulnerable areas in many cities have been already identified by programs such as the Sustainable City Program carried out by INDECI. Hazardous locations at the affected areas coincide very well with the most damaged locations. However, putting this findings into practice still takes too long time.

The author was a member of the team dispatched by the Japan Society of Civil Engineers and the Japan Association of Earthquake Engineering, which was led by Dr. Jorgen Johansson, to evaluate earthquake damages. The full report of the survey findings is available at http://shake.iis.u-tokyo.ac.jp/Peru2007/JSCE_JAEE_Report/Index.htm

(By P. Mayorca)

2007 Flood in Bangladesh

The floods of 2007 started at the end of June. Due to heavy rainfall over the north and northeast part of the county, Rangpur, Kurigram, Gaibandha and Netrakona Districts were inundated. According to Flood Forecasting Warning Centre (FFWC) of Bangladesh Water Development Board (BWDB), as of the morning of the August 20, rivers were flowing above their respective danger levels at 8 stations in the districts of Manikganj, Dhaka, Rajbari and Kishorganj. Between the morning of the August 19 and 20, water levels fell at 33 stations and rose at 25 stations and were unchanged at 3 with a total of 61 stations reporting.

In a normal year, the open water extent of Sirajganj was 40% whereas in August 2007, it was found to be 61%. In 1998, it was estimated as 81%.

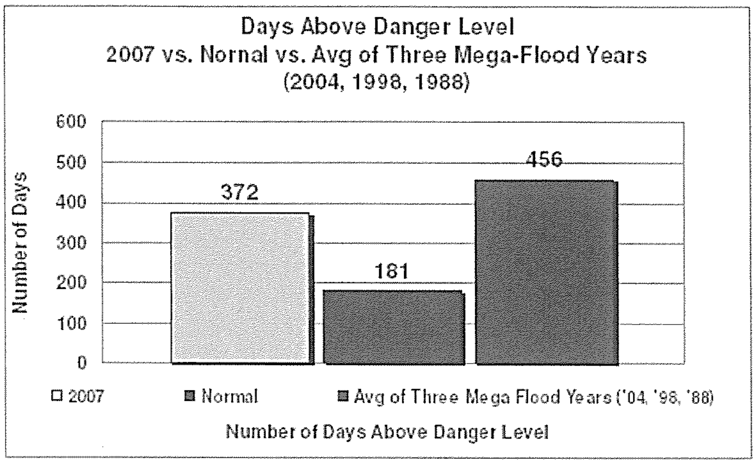
About 80% of Sunamganj area was under open water extent in August 2007 and it was 70% in a normal year. Flood will be reduced in most of the areas and water level will be below the danger level except some part of the central region of the country.

The damage assessment according to the FFWC is presented in the table below.

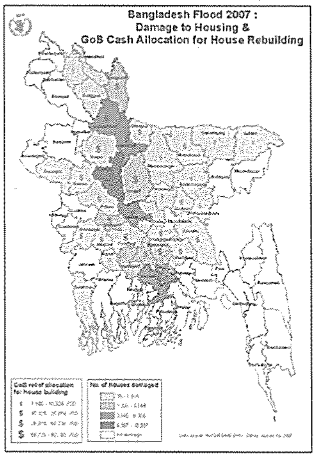
Total no of affected districts:	39 (out of 64)
No. of affected upazilas:	241
No. of population affected:	10 Million
People death in the districts:	700
Population in shelter:	294,146
Total approximate loss:	USD 400 Million

At an August 19 meeting for development partners in Dhaka, the Government encouraged donors to provide assistance for flood response and monetary support.

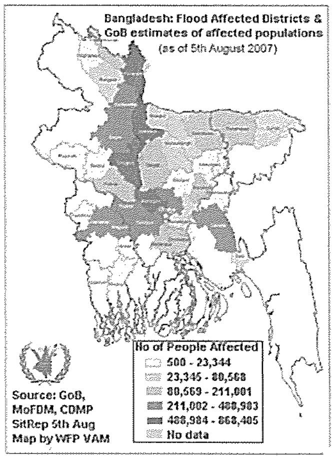
(By M. Ansary)



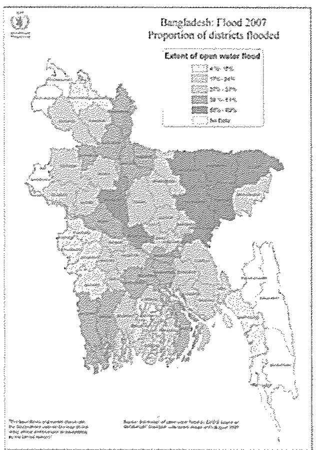
How does the 2007 flooding compare to previous years? (From: UN WFP Bangladesh Report. 2007 Floods vs. Floods of Previous Years: Historical Perspective Analysis, 29.08.2007)



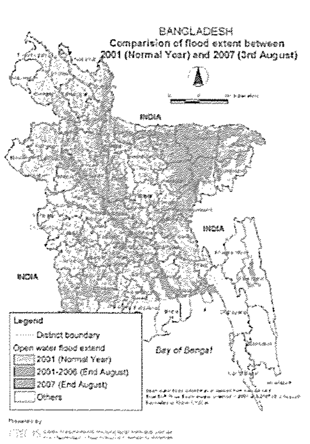
Number of houses damaged (From: UN WFP Bangladesh Bulletin, Hazard EARLY WARNING & Humanitarian Response, Issue 34/2007)



Population affected (From: UN WFP Bangladesh Bulletin, Hazard EARLY WARNING & Humanitarian Response, Issue 30/2007)



Proportion of districts flooded (From: UN WFP Bangladesh Bulletin, Hazard EARLY WARNING & Humanitarian Response, Issue 32/2007)



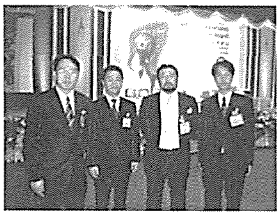
Comparison of flood between a normal year and 2007 (From: CEGIS Report. Flood Situation, Aug. 2007, 11.08.2007)

RNUS Activities

ICUS and RNUS participated in Thailand Science and Technology Fair 2007

From August 8 to 19, 2007, ICUS and RNUS participated in the Thailand Science and Technology Fair 2007. Prof. K. Meguro, Dr. W. Takeuchi, Dr. R. Sahamitmongkol, Dr. K. Worakanchana and Ms. A Suwannasuk as representatives of the University of Tokyo (UT) presented ICUS latest in-house technology for urban safety engineering. The highlight of the booth consisted of the new proposal for earthquake disaster reduction using a touch screen workstation system and the non-destructive testing of concrete flaws using an infrared camera.

During the exhibition, the UT booth was warmly welcomed by crowds of Thai people. The number of total participants during the whole period of the exhibition was expected to exceed 1 million. In this special occasion, it was our great honor that HRH Princess Maha Chakri Sirindhorn visited our booth and heard the presentation from Prof. Meguro and Dr. Kawin on August 10 in the official opening ceremony day.



Dr. Raktipong, Dr. Takeuchi, Prof. Meguro and Dr. Kawin (from left to right) during the Opening Ceremony

Participants visited the booth of the University of Tokyo.

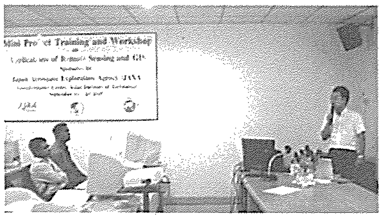
RNUS and GIC donated a forest fire monitoring system with remote sensing to GISTDA in Thailand

On September 12, 2007, Dr. Takeuchi and Dr. Vivarad Phonekeo from Geo-Informatics Center (GIC) at AIT visited Dr. Chaowalit Silapathong from Geo-Informatics and Space Technology Development Agency (GISTDA) of Thailand to install and donate a MODIS-based hotspot information detection and distribution system. This system is developed by Prof. Yoshifumi Yasuoka and Dr. Takeuchi research group and is designed to monitor hotspot information such as forest fires, volcanic activities and field burning twice a day from space with remote sensing techniques. Satellite data used in this study is a suit of MODIS data received at IIS in Tokyo and AIT in Bangkok currently working as a Southeast and East Asia Satellite Observation Network (SEASON). SEASON is designed to monitor both environment and disaster phenomena such as forest fire, flooding, heat island issues, vegetation health, sea surface temperature, atmospheric pollution and so on, over Asian region with continental scale in a near-real time fashion (http://webmodis.iis.u-tokyo.ac.jp/). This is conducted on behalf of a memorandum of understanding (MOU) signed among IIS, AIT and GISTDA and is financially supported by the Japan Science and Technology Agency (JST) under the research project "Solution Oriented Research for Science and Technology (SORST)" initiated by Prof. Yoshifumi Yasuoka from Oct. 2005 to Mar. 2007. This is expected to be a first step to strengthen a relationship among IIS, AIT and GISTDA to bridge science and technology. Further efforts are conducted to explore more collaborations on knowledge and technology transfer aspects.

RNUS participates in Mini-project and Workshop on Application of Remote Sensing and GIS

On September 17 and 19, 2007, Dr. W. Takeuchi was invited to give a presentation on "Remote Sensing of Fires, Principles and its Operational Use." He also participated in the group discussion during the Mini-project and Workshop on Application of Remote Sensing and GIS held by Geoinformatics Center (GIC) in AIT. Participants in this mini-project are from many Asian countries including Bangladesh, Bhutan, Cambodia, Indonesia, Laos, Myanmar, Philippines, Sri Lanka and Vietnam. RNUS also had a chance to establish good relations with many participants for future information exchanging.

(By K. Worakanchana)



Dr. Takeuchi's presentation

RC-58 held its second meeting

The Research Committee 58 (RC-58) held its second meeting on August 2nd. RC-58 was launched under the topic "Business Continuity Management (BCM) Systems Suitable for Japanese Society." Businesses are faced with many threats to the continuance of their trade and planning to avert those threats or to reduce their effects has been getting increasing attention. Japan is confronted with particular situations such as the high likelihood of natural disasters, high population density, and also its own cultural background. BCMs need to be designed considering these conditions.

The first activity of the committee is to review the existing BCM related literature produced in Japan and abroad. For this purpose, three working groups (WGs) have been created: WG1: comparison of foreign documentation; WG2: comparison of domestic documentation related to governmental agencies; and WG3: comparison of domestic documentation related to private businesses. Interim and final reports will be prepared and a report, available to the committee members, will be published with the findings of the three WGs.

(By P. Mayorca)

Disaster Drill held at the University of Tokyo Hospital

ICUS is leading a joint working group (WG) on disaster management manual system for the University of Tokyo Hospital considering its role as disaster base hospital in cooperation with the hospital and the Division for Environment, Health and Safety. A disaster drill was held at the hospital from 13:30 on September 4, 2007. The total number of the participants, doctors, nurses, and administrative staffs, amounted to more than 400. About 100 students of the Faculty of Medicine were given special make-up and joined as mimic patients as a part of the lecture of emergency medicine. In the drill, the occurrence of the Tokyo Metropolitan Earthquake with magnitude 7 was assumed. The probability of this earthquake stricking in the coming 30 years is evaluated to be 70% by the Headquarters for Earthquake Research Promotion, Japanese Government.

The drill consisted of two parts. The first half 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 for extinguishing fire and evacuation of severely-injured patients were also done on the 12th floor. Mimic patients were transported on stretchers specially designed for emergency transportation in the staircase from the 12th to the 6th floor. After that, they were evacuated with the firehouse ladder truck to the ground. The training of safety checking of buildings and lifelines was also carried out by the administrative staff. Based on the reports from each ward and section, the disaster command center decided that the hospital had capability for accommodating disaster victims transported from outside.

Transportation by ambulances

Transporting patients in staircase

Rescue by ladder truck

The latter half of the drill was the training of triage and treatment for external 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 classified into four categories: Black: dead or severely injured and not expected to survive; Red: severely injured to be treated urgently; Yellow: moderately injured, and Green: Slightly injured after the first and second triage. Training of first-aid treatment was also done. In this year, a monitoring camera system was installed in the hospital so that staff members in the disaster command center could assess the whole hospital situation.

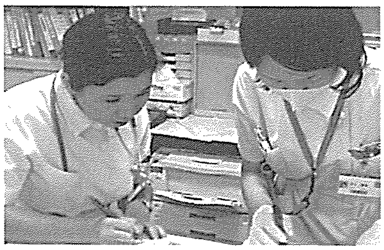
As a part of the preparation for the drill, E-leaning system for doctors and nurses on emergency responses in disaster base hospital was developed by Dr. M. Yoshimura Ohara and other members of the WG in order to increase their emergency response capacity. The learning program consists of three parts: first is the leaning of priorities of emergency medical response through decision-making simulation; second is the leaning of triage method; and third is the leaning of practical technique of triage and treatment through decision-making simulation. Users can learn by accessing the system through the intranet in the hospital. 242 doctors and 879 nurses finished learning before the drill.

Disaster command center

Training of second triage of mimic patient

The drill preparation was achieved by our joint WG. ICUS members and students of Meguro Laboratory recorded all the actions with video cameras and will prepare a documentary DVD in the near future. Our joint WG will continue the research for increasing emergency capacity of the hospital using the lessons of the drill.

(By M. Y. Ohara)



Summarizing results of safety check in ward command center

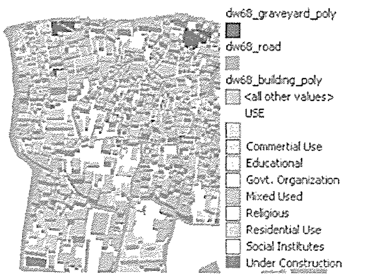
Training of treatment of mimic patient

BNUS Activities

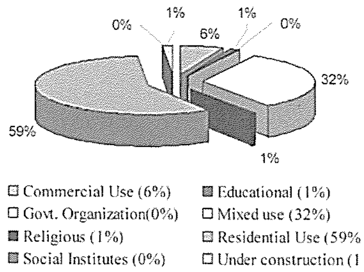
The development of a GIS based earthquake evacuation plan for old Dhaka is ongoing. BNUS is analyzing the compiled data to have an effective plan for the target area. Initially, the land use distribution pattern of the study area is evaluated. It is found that the residential and mixed type land use is predominant there. It is interesting to notice that the 3 storied buildings are more in number followed by 2 storied buildings in the study area.

Research is also going on to assess the existing un-reinforced masonry (URM) structures against lateral force such as earthquake. For that purpose, a pilot laboratory test has been performed. In this case, diagonal tension and off axis compressive loads were applied. It was observed that in case of diagonal tension only end crushing occurred. Off axis compressive load was applied at various inclinations. In case of diagonal tension only shear stresses are produced whereas in other sample distributed stresses are both normal and shear.

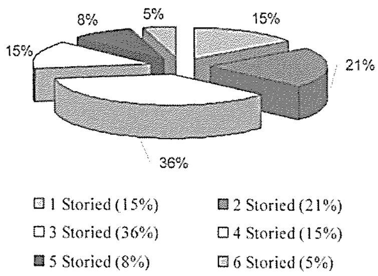
(By M. Ansary)



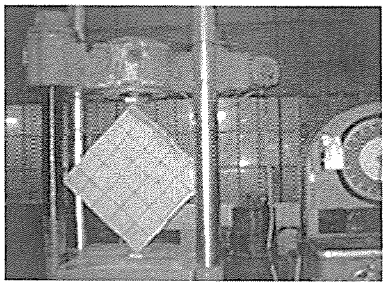
3D-model with land use



Land use patter of the study area



Building distribution on story basis



Test arrangement

ICUS Activities

- *Prof. Meguro traveled to Bangkok, Thailand from Aug. 8 to 11 to attend the Bangkok International Trade and Exhibition Center which was held from Aug. 8 to 19.*
- *Prof. Meguro visited Taipei, Taiwan from Sept. 1 to 3 to join the Taiwan–Japan Workshop on the Earthquake Early Warning System.*
- *Dr. Tanaka stayed at RNUS and TRE, Bangkok, Thailand from Sept. 3 to 7.*
- *Dr. Mayorca traveled to Peru from Sept. 4 to 28 to survey damages due to the 2007 Pisco Earthquake as a member of the team sent by the Japan Society of Civil Engineers and the Japan Association of Earthquake Engineering.*
- *Dr. Worakanchana stayed at AIT for his research work and teaching duties at RNUS from June 8 to Oct. 26.*
- *ICUS dispatched a team to survey the damages from the Niigata Chuetsu Oki Earthquake led by Prof. Meguro from July 21 to 22.*
- *RC-58 research committee met on Aug. 2nd.*
- *ICUS and RNUS represented the University of Tokyo in the Thailand Science and Technology Fair 2007, which was held from Aug. 8 to 19 in Bangkok.*
- *ICUS participated in the University of Tokyo Hospital disaster drill on Sept. 4.*
- *ICUS co-organized the "Earthquake Early Warning System Symposium" held on Sept. 22. Approximately 100 people joined the event.*

Awards

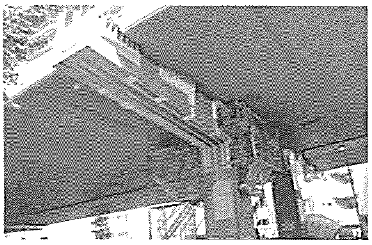
- *Dr. Ohara and Mr. Sathiparan, who is a Meguro laboratory PhD candidate, received the "Best Research Award" for their papers "A Consideration on Land-Use Control Plan along Active Faults in a Depopulating Society" and "Parametric Study on Diagonal Shear Behavior of Masonry Wall Retrofitted by PP-band Mesh," respectively, at the 26th meeting of the Japan Society of Natural Disaster Science held at Hokkaido University on September 25-26.*
- *Mr. Michael Henry from Kato Laboratory obtained the Furuichi Award on September 28 for his excellent Master Degree Thesis entitled "Influence of Re-curing Condition on Damage and Recovery of Mortar Exposed to Fire."*

Editor's Note

From this July to September, big earthquakes struck Niigata, Japan, Peru, and Indonesia, floods hit Bangladesh and a bridge collapsed in Minnesota, US. These disasters dealt a huge blow to the countries both socially and economically. In Japan, main infrastructure was established about forty years ago and it has been deteriorating more and more with time. Once we suffer a big earthquake especially in Tokyo Metropolitan area, the national function may be shattered by the destroyed infrastructure. While public investment budget is shrinking, the significance and necessity of effective maintenance of these infrastructures has been strongly pointed out by many academic experts.

A new cabinet was inaugurated on Sep. 26, 2007 in Japan. New Prime Minister, Mr. Fukuda pledged in his first policy speech to enforce a political shift to the policy development with emphasis on our national safety and security, especially the realization of the nation where no disaster generates any casualties. I hope this policy shift will become true.

(By S. Miyazaki)



Frequent bridge maintenance is strongly required on main routes in Tokyo Metropolitan Area

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

PRINTED MATTER

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
E-mail: icus@iis.u-tokyo.ac.jp
http://icus.iis.u-tokyo.ac.jp/

ICUS
INSTITUTE OF INDUSTRIAL SCIENCE THE UNIVERSITY OF TOKYO
International Center for Urban Safety Engineering