

Stakeholder Consultation Workshop on

*The Effects of Distant Large Earthquakes
on Infrastructure in Bangkok*

Legal, Engineering & Risk Reduction Perspectives

22nd - 23rd July 2011
The Rama Gardens Hotel,
Bangkok, Thailand

MINUTES OF THE MEETING

By

International Ocean Institute (IOI)





NTC The National Telecommunications Commission



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Minutes

Friday 22nd July 2011

The meeting was officially opened at 09.00 hours on the 22nd July. The opening and welcoming addresses were given by the high level co-organizers – Mr. Thaneerat Siriphachana (Deputy Permanent Secretary, Ministry of Information and Communication Technology (MICT)); Mr. Jumpol Sumpaopol (Director-General, Public Works Department, the Bangkok Metropolitan Administration (BMA)), and H.E. Dr. Smith Dharmasaroja (Chairman of Foundation of National Disaster Warning Council (FNDWC), Chairman of the Advisor Board of the IOI – Thailand Operational Center and Former Vice Minister to the Office of the Prime Minister); the message from Dr Awni Behnam (President of the International Ocean Institute and Former Assistant Secretary General of the United Nations Commissioner General to the World Expo 2010) was relayed by Dr. Cherdsak Virapat, Executive Director of the International Ocean Institute HQ (IOI); Mr. K Harald Drager (President of The International Emergency Management Society (TIEMS)) introduced the TIEMS initiative.

Overview of Earthquake Impacts on Bangkok

Co-Chairs:

- **H.E. Dr. Smith Dharmasaroja, Chairman of Foundation of National Disaster Warning Council (FNDWC)**
- **Associate Professor Dr. Virote Boonyapinyo, Former Dean of the Faculty of Engineering, Thammasart University**

H.E. Dr. Smith Dharmasaroja introduced this part of the meeting by asking experts to quantify or prove the risk of earthquakes and the consequent safety of the citizens of the metropolitan area of Bangkok. He gave a brief overview of historical seismic events and the development of Bangkok.

Dr Walter D. Mooney - intervened with information about the Christchurch earthquake

Mr Garry De la Pomerai - intervened with information on prediction methodology which is becoming more reliable and proven. The challenge is how to use the information and to educate the message receivers (ie the government, policy makers and person responsible to pass on the news to the public)

Dr. Kit Miyamoto – prediction is currently not secure however warning system could be helpful along with a combination of risk management. Solutions could include not only prediction but also ways in which buildings are not only “safe” but capable of being restored to economic use soon.

10.00 – 11.30 hrs **The Seismic Risk in Bangkok from Distant Large Earthquakes, the New National Standard for Seismic Resistant Design and Seismic Retrofit of Existing Buildings**

- **Associate Professor Dr. Pennung Warnitchai, Asian Institute of Technology & Expert Team**

Dr. Pennung Warnitchai presented historical evidence of earthquakes in Thailand - (Great Pagoda of Chiang Mai, 400y ago). Inland Thailand is not on a direct source of earthquakes but is close to the Andaman, China and Myanmar sources. The tragedy in Haiti was caused by a combination of bad building practices and the occurrence of a shallow large earthquake event close to a dense population centre. Seismic damage experienced therefore depends not only on magnitude but also on location of the quake and the duration. In Thailand the potential for disaster is there and preparations need to be made; there are some 10 low activity faults which combined can cause a mag7 fault every 200/300 yrs. Effective measures include:

- Earthquake prediction
- Earthquake early warning
- Post-earthquake emergency response *
- Earthquake-resistant design of new buildings ***
- Seismic retrofitting of existing buildings*

In low-to-moderate risk zones, the difficulty to convince is higher – the low-moderate seismic risk legend

refers NOT to magnitude of Earthquakes but to the relative frequency.

1st ministerial decision has been revised by ministerial declaration in 2007 to cover the risk for distant large earthquakes to Bangkok. Bangkok is susceptible to low cyclic vibration long distance earthquakes as low frequency waves can travel further and be amp by soft soils (greatest amplifications, found around Bangkok) and these do the greatest damage to highest buildings (as in Mexico). The biggest threat is from a low magnitude slipfault earthquake.

National Standard DPT 1302 (-50): Seismic Resistant Design of Buildings and Structures + Bangkok design spectrum map based on work collated on building resonance measurements. Updated seismic design code in 2009. Retrofitting methods also available including bracing and increase in ductility of concrete.

11.30 – 12.00 hrs Seismic Safety of Lifelines in Bangkok

- **Assistant Professor Dr. Anat Ruangrassamee, Department of Civil Engineering, Chulalongkorn University**

Lifeline structures dealt with in the presentation are principally bridges, pipelines, nuclear facilities studies (not telecoms, water or electric supplies): normally found at ground/low level as opposed to high-rise buildings. Retrofitting is recommended especially for short span bridges with narrow diameter support columns. For gas pipelines including in the Gulf of Thailand (include tsunami risk); risk is low. For nuclear facilities and cooling pools and reservoir, retrofit measures should be assessed. In lifeline structures one small failure may incapacitate the whole system so redundancy in the system is an aspect of risk management.

Questions and Discussion:

Question addressed to Dr. Pennung Warnitchai *“Is Bangkok similar to the Christchurch situation where no previous activity was recorded also in view of the possible tectonic formation of the Bangkok basin?”*

Dr. Pennung Warnitchai – the most effective measure is to build new stock under seismic standards as well as to identify existing vulnerable buildings and retrofit them. Current risk is low but possible so that remedial measures can be put in place as risk management measures (go for “low hanging fruit”) however probabilities are just that. The private sector needs to be the driver of change and implement measures once the risk issue is communicated well (business may be halted for long after the earthquake). Current building standards may be downloaded from public works website.

Mr K. Harald Drager – the private sector understands money so that damage and risk estimates in monetary terms are essential.

Dr. Pennung Warnitchai - acknowledged Mr Drager’s comment and indicated that some work is ongoing on this but not enough funds and researchers currently available; also tall buildings may be difficult to quantify in this way.

Mr Stan Goosby – loss estimations are critical. HAZUS and other PDC models can be utilised – US based model needs modification for local conditions.

Mr Garry De La Pomerai – assessment of existent building stock for red-flagging should be carried out as a first step to take into account immediate environment. Enforcement is not as effective as fostering compliance and education.

Dr. Pennung Warnitchai: the current situation is that there is neither adequate enforcement of seismic building codes nor suitable inducements to comply or retrofit to standard (*“no stick exists so far and no attractive carrots”*).

Earthquake Building Code, Engineering and Risk Reduction

Co-Chairs:

- **Professor Dr. Panitan Lukkunaprasit, Center of Excellence in Earthquake Engineering and Vibration, Department of Civil Engineering, Chulalongkorn University**
- **Associate Professor Dr. Virote Boonyapinyo, Former Dean of the Faculty of Engineering, Thammasart University**

13.00 – 13.30 hrs Earthquake Building Code, Engineering and Risk Reduction: Mexico's experiences

- **Dr. Walter D. Mooney, Senior Research Seismologist, USGS, Past-President, American Geophysical Union Seismology Section**

A film of the Padang earthquake in 2009 was shown to illustrate the point that if mitigation measures are not implemented correctly, than risk remains high.

1985 Mexico case study: this was a multi event, low frequency energy quake, 60 km below surface on the west coast of Mexico, some 400 km away from Mexico City but soft sediment caused strong amplification of seismic waves. In Mexico "*building fling*" was the result of amplification of the vibrations at the top storeys of the buildings with destruction of the upper storeys being more prominent.

Similarity of Mexico event to Bangkok: strong subduction zone earthquake in vicinity; many tall buildings; sedimentary basin, recent recordings of earthquakes, strong ground motions recently recorded. Therefore, the lessons learned from the 1985 earthquake in Mexico are highly relevant to the city of Bangkok.

13.30 – 14.00 hrs Earthquake Building Code, Engineering and Risk Reduction: Japan's experiences

- **Prof. James Mori, Disaster Prevention Research Institute of Kyoto University**

Japan has an extensive experience with earthquakes and therefore with the assessment of seismic risk and mitigation with many important revisions to building code resulting from significant earthquake events.

- 1978 Miyagi-ken 7.4M earthquake was the first earthquake to test new building code including retrofitting solutions.
- 1994 Northridge/1995 Kobe earthquake changed risk and economic perceptions in both countries. In the 1990's not much was known about near distance ground motions for large earthquakes but this info is now better known due to newly obtained seismic measurements.

There are two levels of probabilistic standards frequently used – the life safety standards for a maximum earthquake or damage limitation for a once in a lifetime earthquake (30-50 years)

The event in Kobe also highlighted the need for more immediate information for response requirements (early warning), for strong motion data, for probabilistic hazard maps.

The Tohoku earthquake, M9, 400km long, 11.03.2011 was "unexpected" in that it had a higher magnitude than expected and generated a much bigger tsunami 15/20 – 30m high waves; people were educated and training implemented well but there are still lessons to be learnt.

The easiest way to protect lives is to have good building codes and practice; much damage and casualties sustained were principally because of the tsunami. An early warning system with automated warning rang out on TV and Radio and cell phones with earliest warning of 5 sec before the S wave. In Japan this type of hi-tech solution to early warning works for a hi-tech society – this may not be the case universally.

Conclusion:

- A long historical record of data is required to evaluate seismic hazards (>1000yrs)

- Largest rare events do the most damage
- Education is difficult, people need to react quickly (educate for a 1000yr event?)

**14.00 – 14.30 hrs Earthquake Risk Reduction Solutions for Public and Private Sectors:
Experience from U.S.A., Japan and Turkey**

- **Dr. H. Kit Miyamoto, S.E., President & CEO, Miyamoto International**

3 main options exist for managing seismic risk – buildings and economical/business damage

- Do nothing
- Manage some of the risk through insurance coverage for damage and business interruption (BI) (not adequate)
- Assess the risk and reduce it to an acceptable level

Sometimes it is not necessary to retrofit everything but to prioritise remedies after triage (a PERFECT job is not necessary) – in some countries this even improves business bottom lines by reducing insurance premium.

Turkey – Istanbul case study – the foremost buildings were selected for seismic strengthening and 3-part plan implemented:

- a. Public awareness and education campaigns
- b. Retrofit and strengthen Priority Public Buildings and cultural heritage
- c. Update and adjust building code based on local standard practice control and covered by many layers of quality

Sometimes the building code is successful in saving lives but will give rise to “single earthquake buildings” which are unusable after an earthquake in which they fail to return to neutral point, so that whole societies and ways of life may be lost.

Public sector actions required

- Develop standard of practice involving engineering societies and international funding
- Conduct global risk audit
- Prioritize building retrofitting

Private sector actions required

- Develop risk management strategic plans
- Conduct risk audit and priorities selection
- Increase client insurance and investment awareness
- Use high performance earthquake engineering practice

**14.30 – 15.00 hrs The SOLUZION System: Social Scientific Requirements of Early Warnings and
Prediction Science, How to communicate and prepare a community to
receive early warning and predictions & Challenges of Codes, Compliance
and the Need to Develop Standards for Retrofitting**

- **Mr. Garry de La Pomerai, Partner, Verus Vicis SOLUZION Consortio
LLpj, Chair of the UNISDR/UNESCO Global Task Force for Building
Codes**

Two areas of discussion are pertinent:

- The specifics of an active real time warning system
- The social science of implementing Early Warning System into communities

Early warning studies (REIC Japan) show that a 2 seconds warning can reduce casualties by 25% with a 5 sec warning potentially reducing casualties by 80%.

If epicenters are outside the country (as for Bangkok) negotiations will need to be made with surrounding

countries to collect data for the Early Warning System.

The social science and challenges of implementing a strategy for Early Warning System

Types of warning

- Real time Early Warning System - event started but yet to arrive at your location – need to know scale and time to countdown, measures to be taken
- Early Warning– event imminent – events in progress should not come as a surprise
- Early Warning Forecast – a future event is expected, event is a threat and can be mitigated or response managed
- Reliable prediction – still a research goal and may involve prediction of an event which may/not occur

Early Warning Systems cannot be put into place without preparing the community – this preparation will depend on the target community, level of society and culture.

15.30 – 17.00 hrs

Brain Storming Session on Retrofitting Legislation for Earthquake Building Resistance & Strategic Action Plans

Facilitators:

- **Mr. Pran Siamwalla, Industry Specialist, Risk Policy & Planning Department, Bank of Ayudhya**
- **Dr. Cherdsak Virapat, Executive Director, IOI**
- **Ms. Antonella Vassallo, Programme Officer, IOI**

Mr. Pran Siamwalla - introduced the Brain Storming session and outlined the actions and decision required. Following the Burma quake, Bangkok residents were worried and there was no clear official response to this type of event. Today's meeting should provide some answers on mitigation and learning from other countries' experiences.

"HOW CAN WE IMPROVE OUR BUILDING CODE?"New buildings vs old buildings; retrofit vs new implementation of updated code; encourage private sectors by incentivizing action (BMA). Banking sector relies heavily on compliance with the law in order to finance loans etc.,

Dr Cherdsak Virapat – the target for discussion are the Bangkok buildings – how can one deal with retrofit legislation and new buildings? How can the master plan be created to integrate baseline data input from stakeholders? Solutions, case studies from experts indicate possible ways forward including probability studies and risk mapping. Input from the floor is expected to highlight current experience and to point out ways of modifying legislation to make Bangkok safer in case of earthquake risk.

Dr Walter D. Mooney – Dr. Kit Miyamoto's presentation highlighted some priorities for action which could be the first way forward (triage) so is any effort currently underway to assess vulnerability or set priority?

Dr. Pennung Warnitchai – no one is assessing seismic vulnerability in Bangkok – just a little private effort is being carried out so no public interest has been registered in this assessment as yet.

Mr. Pran Siamwalla – referred to the possibility of surveys by BMA for assessment of seismic vulnerability.

Dr. Pennung Warnitchai – some information requires in-depth assessment and analysis and requires modelling – it is currently not being done.

Dr. Kit Miyamoto – microzonation models which may already have been carried out gives a good idea of current risk.

Dr. Pennung Warnitchai – general surveys have been carried out for Chiang Mai and Chiang Rai. They are

in progress for Bangkok but with tall buildings in Bangkok, more in-depth studies are required.

Dr. Kit Miyamoto – the mixture of building stock in Bangkok is varied but with concrete tall buildings already some modelling can be done with data using building age and materials to give a picture of response to particular events. Emphasis should be on schools, hospitals, administrative buildings, police support etc (public sector), the private sector needs to look individually at its portfolio.

Dr. Pennung Warnitchai – The Ministerial Regulation of 2009 contains only simplified calculations for tall buildings, it was updated 2 years later but these updates for tall buildings are not binding at law. More training and information of building engineers is required to bring them up to date with latest developments and inspections on seismic safety are not mandatory. Education of professional engineers is ongoing but there is not enough uptake of training.

Mr. Pran Siamwalla – Thammasat University is already training students with a specialized programme.

Assoc Prof Dr Virote Boonyapinyo – many universities include seismic design at postgraduate level as an elective course.

Comment from the floor – seismic design is perceived as a specialist topic and is not mainstreamed into under graduate courses of engineering design.

Dr. Pennung Warnitchai – the Department of Public Works and Town Planning is responsible for national standards, BMA administers these in Bangkok and follows national Ministerial guidelines. It is not in the procedure yet to implement or enforce. Based on the Applied Technology Council 40 (ATC 40), the current law also allows for the adoption of other standards by senior professional engineers.

Mr Garry De la Pomerai - regardless of the standards set or applied, this system only works if procedures are well regulated. Capacity building at all levels including building, control and independent inspections. The local advantage is that Bangkok is starting from scratch so that new legislation will work for new builds but may not be adequate or sufficient for retrofit.

Mr K. Harald Drager – many separate parts of a risk assessment for Bangkok are available and all it needs is to be integrated seamlessly – this can be done through an expert team assembled by the bank and authorities and could include the full spectrum of solutions (similar to Dr. Kit Miyamoto 's Turkey case study).

Dr. Kit Miyamoto – building code can be perceived as dealing with simplification of the actual movements of buildings so that local knowledge and local expertise along with international input is required initially. So learning under expert guidance is essential.

Dr Cherdasak Virapat – should we wait for damage to occur and modify legislation (Prof Mori's presentation) or should Thailand adopt an advanced code (Japan) and modify it to local conditions? Is this the right direction?

Professor James Mori – it is very difficult for Thailand to do that in one step so it should be a phased programme starting from simpler steps – improve codes, educate engineers and look at it as a long term process, obtain public support starting with specific issues and regulations covering things such as crucial structures like schools and hospitals.

Mr K. Harald Drager – sound hazard analysis is required followed by triage and action; expertise (foreign and local) should be transferred to locals along with a clear idea of gap analysis and goals to be achieved.

Mr Stan Goosby – the simulation of potential impacts can be carried out to identify critical facilities and to assist in planning, training and mitigation measures; professional formation should be incentivised.

Mr. Pran Siamwalla – can this be a global plan or must it be site specific?

Mr Stan Goosby – the global picture must be obtained first before working on site specific cases.

Prof Nicholas Kathijotes – inspection and approval of earthquake design plans for new buildings must be rigidly applied by the appropriate agency/ministry (through a panel of experts). It should be ensured that design plans for new buildings be carried out by qualified civil engineers skilled in earthquake design. Development of mechanisms then for checking the design plans as well as their practical application are vital in securing earthquake resistance in new buildings.

Mr Garry De la Pomerai – asked who will be the experts assessing this? – e.g. the United Nations International Strategy for Disaster Reduction (UNISDR) have 2 initiatives to make schools and hospitals safe and experts from this body can also be used to assist with the development of resilience in cities, the collation of knowledge and case studies and choice of best practice applicable. Regarding assessment – this can start internally and at all levels to red flag problems from the ground up before even implementing risk map studies.

Prof Panitan Lukkunaprasit – the BMA should take the initiative to retrofit schools and hospitals in Bangkok as examples for others, using assistance from experts as needed. BMA could also be active in the Resilient Cities network. Thailand is one of the leaders in Asia in terms of seismic awareness compared to some of its neighbours thanks also to the efforts of local agencies and experts. Regarding the building code, this needs to be revised as more information is known, the present standard needs refinement in some aspects and must be updated to reflect the correct levels of seismic phenomena expected.

- Bangkok has a huge stock of buildings not built with adequate seismic resistance set for new buildings
- BMA should take the initiative to retrofit critical infrastructure (e.g. elevated expressways without proper seismic restraint to prevent loss of support in case of strong earthquakes) and public buildings
- retrofitted schools can serve as shelters in times of disaster, retrofitted hospitals could provide medical services
- the private sector could suffer big damage should Bangkok's infrastructure and important public buildings be damaged by large tremors. So, some sort of fund should be setup by large corporations (and banks) in Thailand as part of CSR to supplement that available from the public sector to setup an earthquake early warning system so that BTS or underground trains can be stopped to prevent derailment, gas supply in oil refinery can be shut off to prevent fire, etc.

Mr. Pran Siamwalla – Director General of Public Works Department of BMA is open to receiving recommendations and we must be synchronized to their needs with a consensus view on the way forward. What is now required is the way to crystallize this approach.

Dr. Wantanee Surapaitoolkorn – the probability of this event is quite high based on available data collected over the last two year; many of the requirements in terms of experts, baseline data and technology are already available so that the final step would be to link them up together based on experience gained from other case studies.

Mr. Pran Siamwalla – why re-invent the wheel when there is so much experience already available? Suggestion that we contact UNISDR to bring them on as partner; one would also need to assess whether hazard mapping is required first or to create a pool of sample buildings for assessment?

Mr K. Harald Drager – having no facts at hand leaves all open to conflict and argumentation; a risk assessment leaves no room for misinterpretation. Seismic risks are but one of the hazards to which

Bangkok is vulnerable, a risk assessment of Bangkok should include also other known hazards to the city, for example flooding.

Dr. Pennung Warnitchai – using available hazards model to obtain a global view is not easy since many US models need to be adjusted for local conditions; so approximate estimations are being carried out for impacts to tall buildings using information to hand. I agree with the proposal to carry out a pilot study; private entities should take the lead in ensuring safety of their property in extreme events and use their work as an example to the public to accelerate the process.

Dr. Kit Miyamoto – I agree that the private sector needs to lead the way. The private sector needs to start the process.

Mr. Pran Siamwalla – the Bank is open to that, it is willing to be guinea pig but in the big picture, we need to have applicable standards to cover all Bangkok structures. We cannot avoid involving BMA.

Dr. Pennung Warnitchai – private companies can also set the standard which others many follow. Private entities have more commitment while with government entities political will can be changed.

Dr Cherdasak Virapat – initiative from private sector can be linked with activity of BMA.

Meeting concluded at 6.45 pm

Saturday 23rd July 2011

Risk Management, Decision Support System, Earthquake Mitigation, Preparedness and Response Plans & Operations

Co-Chairs:

- **Mr. K. Harald Drager, *President of The International Emergency Management Society (TIEMS) on TIEMS***
- **Assistant Prof. Dr. Tavida Kamolvej, *Thammasat University***

09.00 – 09.30 hrs Risk Management due to Effects of Distant Large Earthquakes on Infrastructure in Thailand

- **Assistant Prof. Dr. Wantanee Surapaitoolkorn, *SASIN Graduate Institute of Business Administration, Chulalongkorn University***

With measurement of risk, money may be generated.

Risk management involves the assessment of the exposure to uncertainty or the chance of loss;

Risk Management implies the management of Risk well in uncertain times.

The basic assumption is that a risk assessed is eventually going to happen, you must not be risk averse.

Casualty costs and consequence –there are great difficulties in calculating this but it should be included.

09.30 –10.30 hrs Decision Support System and Concept of Operation for Earthquakes

- **Mr. Stanley Goosby, *Chief Scientist, Pacific Disaster Center (PDC)***

The number of disasters worldwide is increasing by nearly a multiple of 2, and with this should be included opportunity losses.

- The Integrated approach - Uses information from a multitude of observational systems, collates data and analyses it, communicates data in a visual and clear way to enhance decision making.
- Practicing Disaster Management – be proactive and also be aware that any advance warning makes a

difference

- Cloud Computing – delivers a high degree of reliability and deliverability of data when there is a high request for information by many users at once (twitter, facebook and social media servers are used to disseminate info to the public).
- CONOPS - Concept of Operations
- NASA Langley – infrasound below 10HZ as early warning indicators of earthquake motion and tectonic stress.

Mr Garry De la Pomerai – extremely hazardous land should not be kept as empty land as this will be still overtaken by squatters etc but alternative uses should be found for this land that excludes habitation.

Mr Stan Goosby – sometimes the community feedback is such that, being aware of the risks, they accept them and refuse to move. In this case one needs to learn from the community and accept its decision.

11.00 – 11.30 hrs Cognitive Capacity and Mitigation Preparedness: Public and Public Agency Response

• **Assistant Prof. Dr. Tavid Kamolvej, *Thammasat University***

- Can a population be forced to evacuate in an emergency against its will? Answer: NO
- Messages need to be clear and transmitted in a clear way (e.g. water will go from ankle height to knee height in the next 3 hrs)
- Culture – safety culture in Thailand is very poor.
- Emergency – can be handled by the locals locally; Disaster – defined as that point when local systems cannot cope.
- Message to be delivered as an early warning depends on cultural openness or otherwise.
- Effective disaster response depends on the socio-technical components: organizational flexibility + technical infrastructure + cultural openness.
- The problem of disaster risk reduction needs to be solved in an interdisciplinary and holistic way in a timely manner.

Mr Garry De la Pomerai – recommended inspecting the safety culture and records of Bangladesh which has reduced fatalities to all kinds of disasters over the last 50 years. Suggests that there be an efficient handover of information between departments as data is collected.

Mr K. Harald Drager – to change safety culture one has to start with children in primary and secondary school. They can handle technology and new concepts very well when taught.

13.00 – 13.30 hrs Involvement of Private Sectors and Business Entrepreneurs to Advocate People in Bangkok on Earthquake and Other Disasters

• **Assistant Prof. Dr. Kritinee Nuttavuthisit, *SASIN Graduate Institute of Business Administration, Chulalongkorn University***

- After the Indian Ocean tsunami in 2004, private sector involvement ranged from immediate short term support to long term financial support in recovering businesses and education. Social support and sustainable development guidance was also provided.
- “acts of God” – these also may be mitigated or some impacts prevented.
- Media communication – appeal – message – channel of communication.
- Appeal – fear of the crises
- Tactics to stimulate thought and awareness should be followed by educational material (leaflets and brochures etc).

How to create and promote a PPP (Private Public Partnership)

1. Talk money – identify significant economic losses (key message)
2. Reach private partner by sharing information
3. Form a coalition
4. Communicate regularly to update and inform

Advocacy strategy

- The local community remains the cornerstone of effective risk reduction and the education of local communities is required to promote awareness and build a critical mass of knowledge.
- First identify the leaders of the community and representatives of the local stakeholders so as to confer local ownership of the plan
- Then bring local NGOs on board (they have best experience of local situation with few resources) and match them with Private Enterprise who may have resources but not the time to implement long term projects. A good way to start is by having joint education, training and research projects and then following up with longer term projects as confidence and trust grow.
- The Government shapes policy and funding strategies, they can endorse and enforce legislation and take action to build institutional capacity and infrastructure. This done by identifying key officials and decision makers who genuinely care.

International organisations can mobilize international support, provide access to networks and alliances and info and knowledge, as well as lobbying effort, access to funding and consultation.

Dr Cherdsak Virapat – asked regarding the relationship between knowledge and understanding post disaster?

Prof. Dr. Krittinee Nuttavuthisit – the two are very related but based on personal experience/research, some communities have great implicit understanding of an event but not knowledge. It is difficult to transmit implicit understanding between generations and persons – knowledge is more easily transmitted. Experience is an implicit understanding which needs to be transformed into transmissible knowledge. Knowledge needs to be transformed from theoretical knowledge into actionable knowledge which should generate further actions. Indigenous knowledge (rooted in the past) vs local knowledge (current, constantly adapted). Knowledge changes according to different situations, the need is to get communities to produce the knowledge as well as to act on it. Contributions of NGOs are very strong in this area because of their links with the community. Clustering of communities (around schools as a hub for e.g.) is also productive.

13.30 – 14.00 hrs Public Warning State of the Art (safe lives in case of natural disasters/threats)

- **Mr. Norbert Hunger, General Manager, SirCom GmbH**

- It is important not to use the acoustic warning system for drills or tests as public will get used to them and not take them so seriously.
- The provision of Early Warning System & alarms could be enforced as part of the licensing and approvals process of hotels and industries in vulnerable areas with expenses to be borne by the Private sector.
- The provision of Early Warning System and safety information in an easily accessible way (not by reading brochures) is also a selling point for the tourism industry in vulnerable areas.
- Having different languages and messages is only an add-on and is not as important as an auditory signal which is more immediate – message must be of less than 5 words and continuously repeated.

Extra

Film by Dr. Walter D. Mooney - Concept of Earthquake Early Warning (USGS).

American Red Cross website and other sites have specialized information about earthquake protection. Warnings sent by SMS.

Mr Garry De la Pomerai – completion is essential to keep the momentum so it must be the competition of a range of ideas as well as supporting the ideas proposed by Miyamoto.

Prof Panitan Lukkunaprasit – it is important that the private and public sectors are both involved in a PPP, Private sectors also operate through Corporate Social Responsibility Schemes (CSRs).

Dr. Krittinee Nuttavuthisit - Motivation can be supplied through the involvement of the public request for information and coverage – carrot and stick approach with the stick being regulation and legislation.

Mr Garry De la Pomerai – one of the biggest incentives is the involvement of schools and educational establishments in an awareness raising programmes also highlighting the protection of children. This can be complemented also by schemes to make these buildings safe.

Dr. Kit Miyamoto – to quantify the costs of losses and the annualisation of mitigation costs will immediately highlight and provide a measure of the risks and benefits of mitigation. It can also be used as a tool of good corporate management. Building code in USA covers seismic strengthening in hospitals – this system failed as it required perfection in complete coverage (too expensive, ambitious) while doing affordable strengthening is actually more practical.

Dr. Pennung Warnitchai – communication between stakeholders is essential, the issue is not easy to explain to the public while media can also transmit conflicting information. The BMA can play a leading role in risk communication.

Dr. Wantanee Surapaitoolkorn – regarding quantifying loss – especially biggest loss – this this system applicable and do-able. For insurance products in CATBONDS, each building can be individually assessed (Swiss RE etc) and this action can and will promote follow up.

Mr. Markus Streibel – fire codes are established based on real risk so based on the real risk of earthquakes in Bangkok, why does the government not establish the severity of this risk and provide appropriate legislation to force implementation?

Dr Cherdsak Virapat – referred to Japan’s continuous update of building code after each crisis; this venue has brought together the appropriate experts and government stakeholders to create a report for the policy makers to act upon and to bring them on board. Once policy direction is in place, than we can move forward to streamline the actions of all local players in the country including Bangkok. The private sector (e.g., Bank of Ayudhya) can also look into the creation of a pilot project and also involve the private sector in individual projects. However the action must be spearheaded by an entity (collation of entities) to present this to the government for implementation.

Mr Stan Goosby – any advocacy group needs to have the support of all stakeholders especially the private sector to assure sustainability of the effort.

Mr. Pran Siamwalla – the private sector can do much; it has established the “Association of National Disaster Prevention Industries-ANDPI” (in which the BMA & Public Works are interested). We require synergy and momentum to achieve results through guidance of financing and similar support by the Banks; an entity is required to spearhead this.

Mr Garry De la Pomerai – supports this mode of action, recommends that rather than evaluating for the “big earthquake” just assume that this will be the case and take action immediately on this so that results can be seen within months.

Dr Cherdsak Virapat – proposed a harmonised board/cooperation between government/public, private and funding agents to provide both links to financial sources as well as expertise and momentum.

Dr Walter D. Mooney – earthquake drills could be implemented in Chiang Mai as a location closest to earthquakes fault lines and then this exercise could be the impetus for similar drills and attention drawing to the problem of earthquakes in Bangkok.

Mr Garry De la Pomerai – these drills started originally in schools and then were adapted and developed for the whole city; starting stepwise is wiser rather than shocking a whole community and it will also have the added benefit of percolating the practice and awareness into the whole community.

Mr. Pran Siamwalla – there is no current preparedness in the business community, but following up on the current news of disasters worldwide, it makes sound business sense to invest in appropriate measures to respond to these challenges. The free market will require the guidance of legislative bodies/policy makers.

Dr. Krittinee Nuttavuthisit – problems in communication should be highlighted and the avoidance of conflicting messages should be sought in order that the outcome is most efficient. From personal experience, communication with the media should be handled carefully. What is the best way to approach this positively?

Dr Cherdsak Virapat – when establishing tsunami warning system, consultations with experts helped in the formulation of operational criteria where the tsunami warnings were adapted taking into account practical lessons learnt (such as disseminating operation procedure through the levels of command and follow-up) all the way to the “last mile”. Media involvement is challenging as their main interest is news rather than dissemination of scientific information.

Mr Pichakorn Pimonsathian – when using public media, the opportunity is to manage the attitude of the audience and build trust from which effective communication may spring; the principle challenge is dealing with rumours and “reading between the lines” rather than relying on facts.

Dr. Kit Miyamoto – risk cannot be hidden from the public – it should be treated as a fact of life and approached with honesty and without sugar coating the message.

Mr Pichakorn Pimonsathian – honesty and transparency without undue alarmism would be the best approach.

Mr. Pran Siamwalla – expressed gratitude at the presence and input of the experts and the floor and promised further action on the discussions held.

16.15 hrs

Closing Remarks & Way Forward

- **Rear Admiral Thaworn Charoendee, Executive Expert for Executive Director, NDWC**
- **H.E. Dr. Smith Dharmasaroja, Chairman of Foundation of National Disaster Warning Council (FNDWC), Chairman of the Advisory Board of the International Ocean Institute Thailand Operational Center, Former Vice Minister to the Office of the Prime Minister**
- **Mr. Pran Siamwalla, Industry Specialist, Risk Policy & Planning Department, Bank of Ayudhya**
- **Dr. Cherdsak Virapat, Executive Director, IOI**

H.E. Dr. Smith Dharmasaroja strongly recommended that the BMA and the administration of Bangkok and the government of Thailand take steps to legislate in favour of and to protect the citizens and resident of Bangkok and Thailand in view of their vulnerability to earthquake risk.

Certificates of appreciation presented to the experts by H.E. Dr. Smith Dharmasaroja.

Way Forward

- The Association of Natural Disaster Prevention Industry (ANDPI) will be established as a non-profit organization to pursue private sector initiative in cooperation with BMA in dealing with natural

disaster prevention and mitigation affecting private sector industries;

- The Bank of Ayudhya Public Company Ltd. will consider a pilot case study on retrofit and possible actions on its Headquarters building;
- The ANDPI and BMA will meet to discuss and plan on retrofit issues. They will consider priority actions on schools and hospitals in Bangkok;
- The Public Relations Team will continue to promote public awareness in all possible ways including interactive website, media awareness and face-to-face public awareness;
- The IOI and IES will proceed for the follow up of the questionnaire survey to assess Thailand's national capacity on the effects of distant large earthquakes on infrastructure in Bangkok and Major Cities in Thailand. A strategic planning workshop will be organized by early next year to present the outcome from the questionnaire analysis and to plan for strategic actions;
- The NDWC will coordinate with DMR, TMD and relevant agencies such as PDC and academic institutions to conduct vulnerability assessment of selected major cities in Thailand;
- The NDWC will coordinate with DDPM and relevant departments to implement earthquake early warning and mitigation system, preparedness and response plans at all levels;
- The ANDPI, NDWC, FNDWC, IOI, relevant interagency governmental departments and academic institutions will establish the TIEMS Thailand Chapter in cooperation with the TIEMS President.

ANNEXES to the Minutes

1. Programme
2. Opening Address by Mr. Thaneerat Siriphachana
3. Opening Address by Mr. Jumpol Sumpaopol
4. Opening Address by Dr Smith Dharmasaroja
5. Message from Dr Awni Behnam
6. Greeting by Mr. K. Harald Drager
7. Closing Address by Rear Admiral Thaworn Charoendee
8. Closing Address by Dr Smith Dharmasaroja
9. List of Experts
10. List of Participants and Contributors

PROGRAMME

Friday 22nd July 2011

08.30 – 09.00 hrs Registration

09.00 – 09.30 hrs **Opening Address**

Mr Thaneerat Siriphachana

Deputy Permanent Secretary, Ministry of Information and Communication Technology (MICT)

Mr. Jumpol Sumpaopol

Director-General, Public Works Department, the Bangkok Metropolitan Administration (BMA)

H.E. Dr. Smith Dharmasaroja

Chairman of Foundation of National Disaster Warning Council (FNDWC), Chairman of the Advisory Board of the IOI – Thailand Operational Center, Former Vice Minister to the Office of the Prime Minister

Message from Dr. Awni Behnam

President of the International Ocean Institute (IOI) & Former Assistant Secretary-General of the United Nations Commissioner General to the World Expo 2010

Mr. K. Harald Drager

President of The International Emergency Management Society (TIEMS) on TIEMS – An International Network of Emergency and Disaster Management Experts-With a Global Vision for a Safer World

09.30 – 10.00 hrs Group Photo and Coffee Break

Overview of Earthquake Impacts on Bangkok

Co-Chairs:

- H.E. Dr. Smith Dharmasaroja, *Chairman of Foundation of National Disaster Warning Council (FNDWC)*
- Associate Professor Dr. Virote Boonyapinyo, *Former Dean of the Faculty of Engineering, Thammasart University*

10.00 – 11.30 hrs The Seismic Risk in Bangkok from Distant Large Earthquakes, the New National Standard for Seismic Resistant Design and Seismic Retrofit of Existing Buildings

- Associate Professor Dr. Pennung Warnitchai, *Asian Institute of Technology & Expert Team*

11.30- – 12.00 hrs Seismic Safety of Lifelines in Bangkok

- Assistant Professor Dr. Anat Ruangrassamee, *Department of Civil Engineering, Chulalongkorn University*

12.00 – 13.00 hrs Lunch

Earthquake Building Code, Engineering and Risk Reduction

Co-Chairs:

- Professor Dr. Panitan Lukkunaprasit, *Center of Excellence in Earthquake Engineering and Vibration, Department of Civil Engineering, Chulalongkorn University*

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- Associate Professor Dr. Virote Boonyapinyo, *Former Dean of the Faculty of Engineering, Thammasat University*

- 13.00 – 13.30 hrs Earthquake Building Code, Engineering and Risk Reduction: Mexico's experiences
- Dr. Walter D. Mooney, *Senior Research Seismologist, USGS, Past-President, American Geophysical Union Seismology Section*
- 13.30 – 14.00 hrs Earthquake Building Code, Engineering and Risk Reduction: Japan's experiences
- Prof. James Mori, *Disaster Prevention Research Institute of Kyoto University*
- 14.00 – 14.30 hrs Earthquake Risk Reduction Solutions for Public and Private Sectors: Experience from U.S.A., Japan and Turkey
- Dr. H. Kit Miyamoto, *S.E., President & CEO, Miyamoto International*
- 14.30 – 15.00 hrs The SOLUZION System: Social Scientific Requirements of Early Warnings and Prediction Science, How to communicate and prepare a community to receive early warning and predictions & Challenges of Codes, Compliance and the Need to Develop Standards for Retrofitting
- Mr. Garry de La Pomerai, Partner, Verus Vicis SOLUZION Consortio LLpj, Chair of the UNISDR/UNESCO Global Task Force for Building Codes
- 15.00 – 15.30 hrs Coffee Break
- 15.30 – 17.00 hrs Brain Storming Session on Retrofitting Legislation for Earthquake Building Resistance & Strategic Action Plans
- Facilitators:
- Mr. Pran Siamwalla, *Industry Specialist, Risk Policy & Planning Department, Bank of Ayudhya*
 - Dr. Cherdsak Virapat, *Executive Director, IOI*
 - Ms. Antonella Vassallo, *Programme Officer, IOI*

Saturday 23rd July 2011

Risk Management, Decision Support System, Earthquake Mitigation, Preparedness and Response Plans & Operations

Co-Chairs:

- Mr. K. Harald Drager, *President of The International Emergency Management Society (TIEMS) on TIEMS*
- Assistant Prof. Dr. Tavidia Kamolvej, *Thammasat University*

- 09.00 – 09.30 hrs Risk Management due to Effects of Distant Large Earthquakes on Infrastructure in Thailand
- Assistant Prof. Dr. Wantanee Surapaitoolkorn, *SASIN Graduate Institute of Business Administration, Chulalongkorn University*
- 09.30 – 10.30 hrs Decision Support System and Concept of Operation for Earthquakes
- Mr. Stanley Goosby, *Chief Scientist, Pacific Disaster Center (PDC)*
- 10.30 – 11.00 hrs Coffee Break
- 11.00 – 11.30 hrs Decision Support System and Concept of Operation for Earthquakes
- Mr. Stanley Goosby, *Chief Scientist, Pacific Disaster Center (PDC)-continued*
- 11.30 – 12.00 hrs Cognitive Capacity and Mitigation Preparedness: Public and Public Agency Response
- Assistant Prof. Dr. Tavidia Kamolvej, *Thammasat University*

12.00 -13.00 hrs	Lunch
13.00 – 13.30 hrs	<p>Involvement of Private Sectors and Business Entrepreneurs to Advocate People in Bangkok on Earthquake and Other Disasters</p> <ul style="list-style-type: none"> • Assistant Prof. Dr. Krittinee Nuttavuthisit, <i>SASIN Graduate Institute of Business Administration, Chulalongkorn University</i>
13.30 – 14.00 hrs	<p>Public Warning State of the Art (safe lives in case of natural disasters/threats)</p> <ul style="list-style-type: none"> • Mr. Norbert Hunger, <i>General Manager, SirCom GmbH</i>
Extra	Film by Dr W Mooney - Concept of Earthquake Early Warning (USGS).
Extra	Film by K Miyamoto – Tuned Mass Damper retrofitting for Los Angeles Observation Deck (iconic structure in LAX)
Extra	Film by K Miyamoto – Hope comes to Haiti
14.00 – 15.00 hrs	<p>Brain Storming Session on Road Map and Strategic Action Plans on Earthquake Engineering and Risk Reduction, Warning Tools & Response for Bangkok</p> <p>Facilitators:</p> <ul style="list-style-type: none"> • Mr. Pran Siamwalla, <i>Industry Specialist, Risk Policy & Planning Department, Bank of Ayudhya</i> • Dr. Cherdsak Virapat, <i>Executive Director, IOI</i> • Ms. Antonella Vassallo, <i>Programme Officer, IOI</i>
16.15 - hrs	<p>Closing Remarks & Way Forward</p> <ul style="list-style-type: none"> • Rear Admiral Thaworn Charoendee, <i>NDWC</i> • H.E. Dr. Smith Dharmasaroja, <i>Chairman of Foundation of National Disaster Warning Council (FNDWC)</i> • Mr. Pran Siamwalla, <i>Industry Specialist, Risk Policy & Planning Department, Bank of Ayudhya</i> • Dr. Cherdsak Virapat, <i>Executive Director, IOI</i> <p>Certificates of appreciation presented to the experts by H.E. Dr. Smith Dharmasaroja.</p>
15.00 – 15.30 hrs	Coffee Break

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Bangkok, Thailand

OPENING ADDRESS BY

MR. THANEERAT SIRIPHACHANA

DEPUTY PERMANENT SECRETARY, MINISTRY OF INFORMATION AND COMMUNICATION TECHNOLOGY

Governor of Bangkok Metropolitan Administration, Keynote Speakers, Distinguished Experts, Representatives from Public and Private sectors, Ladies and Gentlemen,

On the behalf of Ministry of Information and Communication Technology (MICT), it is my great pleasure and honor to extend my warmest welcome to all participants in the Stakeholder Consultation Workshop on Effects of Distant Large Earthquakes on Infrastructure in Bangkok : Legal, Engineering and Risk Reduction Perspectives today.

Ladies and Gentlemen, As a result of effect of natural disaster, for example Earthquake, Flood, Drought, Land Slide, Tsunami, Tornado or Volcanic eruption, caused financial, environmental and human losses. The Royal of Thai Government concerned about disasters which occurred in this region, as a result, how important of our life and property is damaged by the disasters. We put priority on warning and rescuing in our policy in order to tackle the disasters thoroughly.

Ministry of Information and Communication Technology by National Disaster Warning Center has responsibility to inform, warn and also instruct people to be awareness of the risk which occurred from the disasters consciously and preparedly even though the preparedness is provided.

On this occasion, I would like to express our sincere appreciation and grateful thanks to all participants for attending the workshop. The workshop will certainly provide a forum for stakeholders from relevant governmental departments, the private sector and business entrepreneurs, academic institutions, non-governmental organizations as well as scientist and experts to address national system, to identify measures for adaptation and mitigation efforts, and to share information and best practices in order to improve disaster prevention and mitigation measures for Bangkok Metropolitan Region. Now I am pleased to declare open the Stakeholder Consultation workshop on Effects of Distant Large Earthquakes on Infrastructure in Bangkok: Legal, Engineering and Risk Reduction Perspectives. I wish all of you will be fruitful and successful in the workshop. Thank you.

คำกล่าวของผู้อำนวยการสำนักงานการโยธา นายจุมพล สำเภาพล

ในการสัมมนาเชิงปฏิบัติการ ผลกระทบจากแผ่นดินไหวระยะไกลที่อาจจะมีต่อสาธารณูปโภคพื้นฐานและอาคารบ้านเรือน
ในกรุงเทพมหานคร

กราบเรียนท่านปลัดกระทรวงเทคโนโลยีสารสนเทศและการสื่อสาร เรียนท่านประธานมูลนิธิสภาเตือนภัยพิบัติแห่งชาติ ท่านวิทยากรและ
ผู้เชี่ยวชาญ และผู้เข้าร่วมสัมมนาทุกท่าน

กรุงเทพมหานครเป็นเมืองขนาดใหญ่ ที่มีประชากรมากกว่า 6 ล้านคน มีบ้านเรือนมากกว่า 2,043,043 หลัง อาคารสูงขนาดใหญ่ทั้งที่เป็น
อาคารสำนักงาน ที่พักอาศัย ตลอดจนอาคารสาธารณประโยชน์มากกว่า 30,000 หลัง รวมถึงสาธารณูปโภคพื้นฐานจำนวนมาก ที่รองรับ
การใช้งานของประชากรกรุงเทพทั้ง 6 ล้านคน

แผ่นดินไหวในช่วงระยะเวลาที่ผ่านมา อาจจะมีผลกระทบต่ออาคารต่างๆในกรุงเทพมหานครบ้าง แต่ก็ยังไม่ถึงกับสร้างความเสียหายอย่าง
รุนแรงให้กับทรัพย์สินและชีวิตของพลเมือง แต่เนื่องจากในระยะเวลาไม่นานมานี้ โลกเราเกิดแผ่นดินไหว ในอัตราความถี่ที่เพิ่มมากขึ้น
และมีความรุนแรงที่มากขึ้นกว่าในอดีต แผ่นดินไหวหลายครั้งเกิดขึ้นในรัศมีที่ไม่ไกลจากกรุงเทพมหานครของเรามากนัก ประกอบกับ
กรุงเทพมหานครของเราตั้งอยู่บนพื้นที่ดินอ่อน ที่การสะเทือนจากแผ่นดินไหวระยะไกล สามารถส่งผลกระทบต่อฐานรากของอาคาร และ
ทำให้เกิดการแกว่งตัวของอาคารบางแห่งได้ ที่สำคัญเนื่องจากเราไม่เคยได้รับผลกระทบจากแผ่นดินไหวมาก่อน ทำให้สิ่งปลูกสร้างต่างๆที่
สร้างขึ้นก่อนปี 2548 จึงมีโครงสร้างที่อาจไม่สามารถรองรับผลกระทบจากแผ่นดินไหวในปัจจุบันได้ ด้วยความไม่ประมาทและความ
ห่วงใยในสวัสดิภาพ และความปลอดภัยในชีวิตและทรัพย์สินของพลเมืองกรุงเทพมหานคร กรุงเทพมหานครจึงได้ร่วมกับมูลนิธิสภาเตือน
ภัยพิบัติแห่งชาติ และหน่วยงานต่างๆที่เกี่ยวข้องทั้งในและต่างประเทศ จัดการสัมมนาเชิงปฏิบัติการในครั้งนี้ขึ้น โดยหวังผลที่จะได้แนวทาง
ยุทธศาสตร์สำหรับการออกข้อกำหนด กฎหมาย รวมถึงแนวทางปฏิบัติและการบริหารความเสี่ยงจากภัยพิบัติ ที่จะทำให้สิ่งปลูกสร้างใน
กรุงเทพมหานคร สามารถรองรับหรือลดความรุนแรงของผลกระทบจากแผ่นดินไหวระยะไกลได้ รวมถึงการให้ความรู้แก่ภาคเอกชน
เพื่อให้เกิดการมีส่วนร่วมในการสร้างความตระหนักรู้แก่ภาคประชาชน ให้สามารถรับมือกับภัยจากแผ่นดินไหวได้

ผมในนามของกรุงเทพมหานครและในฐานะสมาชิกหนึ่งของพลเมืองกรุงเทพมหานคร ขอขอบคุณหน่วยงานภาครัฐและเอกชน ที่ได้ให้การ
สนับสนุนอย่างยิ่ง ทั้งศูนย์เตือนภัยพิบัติแห่งชาติ กระทรวงเทคโนโลยีสารสนเทศและการสื่อสาร ธนาคารกรุงศรีอยุธยา อารียาพร็อพเพอร์ตี้
และผู้สนับสนุนภาคเอกชนอีกหลายราย ที่ร่วมกันสนับสนุนให้การสัมมนาเชิงปฏิบัติการครั้งนี้เกิดขึ้นได้ ผมหวังว่าผลจากการสัมมนาใน
ครั้งนี้ จะสร้างคุณประโยชน์อย่างมากแก่ประชาชนชาวกรุงเทพมหานครและประชาชนชาวไทยทุกคน ขอขอบคุณครับ

22nd - 23rd July 2011

The Rama Garden Hotel & Resorts,
Bangkok, Thailand

**OPENING ADDRESS BY
MR. JUMPOL SUMPAOPOL
DIRECTOR-GENERAL, PUBLIC WORKS DEPARTMENT
THE BANGKOK METROPOLITAN ADMINISTRATION (BMA)**

Excellencies, Deputy Permanent Secretary, Chairman of the Foundation of National Disaster Warning Center,
Distinguished speakers and Experts, Ladies and Gentlemen

Bangkok is a large city with its population of more than six million people, it has 2,043,043 households, high buildings comprising of offices, condominium and utility buildings resulting in more than 30,000 buildings which include many basic facilities to cater for the large population of local people.

Though earthquakes in the past may have affected some buildings in Bangkok, they did not seriously destruct the lives or property of the population. However, recent earthquakes have increased in frequency and magnitude. Recent seismic hazard studies show that Bangkok is at risk from damaging ground motions induced by distant large earthquakes. The risk is primarily caused by the ability of thick soft surficial deposits in Bangkok to amplify earthquake ground motions about three to five times. It can be noted that the buildings which were built prior to 2005 do not have an adequate foundation to resist the current magnitude of earthquakes.

The Bangkok Metropolitan Administration realizes the need of safety and welfare of the population in Bangkok and hence will co-organize the Workshop with the Foundation of National Disaster Warning Council and relevant local and international organizations. It is expected that the Workshop will identify strategic actions and disaster risk management to mitigate the impacts from distant large earthquakes and to provide knowledge and awareness for the private sector in mitigation, preparedness and response.

On behalf of the Bangkok Metropolitan Administration, I would like to express my sincere thanks to the public and private sectors for their generous support, namely; the National Disaster Warning Center, Ministry of Information and Communication Technology, Bank of Ayudhya Public Company Limited, Areeya Property and sponsors in making the Workshop possible. I hope the Workshop will be a major contribution to the people of Bangkok and Thai people in general. Thank you.

OPENING ADDRESS BY

**H.E. DR. SMITH DHARMASAROJA,
CHAIRMAN OF FOUNDATION OF NATIONAL DISASTER WARNING COUNCIL, CHAIRMAN OF THE ADVISORY
BOARD OF THE INTERNATIONAL OCEAN INSTITUTE THAILAND OPERATIONAL CENTER, FORMER VICE
MINISTER TO THE OFFICE OF THE PRIME MINISTER**

Excellencies, Permanent Secretary of the Ministry of Information and Communication Technology, Governor of Bangkok Metropolitan Administration, Executive Management of the Bank of Ayudhya, President of the International Emergency Management Society, Mr. K. Harald Drager, Executive Director of the International Ocean Institute, distinguished experts, Ladies and Gentlemen,

I have the honor and pleasure to extend to you on behalf of the Foundation of National Disaster Warning Council my warmest welcome for your participation at the Stakeholder Consultation Workshop on Effects of Distant Large Earthquakes on Infrastructure in Bangkok: Legal, Engineering and Risk Reduction Perspectives.

The Foundation was established in November 2009 and registered under the Law of the Ministry of Interior, the Government of Thailand as a non-profit organization to provide public information and guidance on natural disasters early warning and mitigation based on scientific information to improve public awareness and understanding for multi-hazard disaster risk reduction. The Foundation communicates directly with the public via a nation-wide FM radio network and organization of public forum and outreach. The Foundation signed a Memorandum of Understanding with the International Ocean Institute (IOI) Headquarters to carry out capacity building on National and Regional multi-hazards disaster early warning and mitigation systems, shoreline change and erosion & sea level rise due to impacts of climate change; community awareness and resilience, and community and school-based adaptive management.

In the aftermath of the 2004 Indian Ocean Tsunami, the Thai Government immediately established a Committee on National Disaster Early Warning Administration - in which I was a Chairman - to formulate policy and strategy on establishment of Thailand's tsunami early warning and mitigation systems. The National Disaster Warning Center (NDWC) was successfully established on 31st May 2005 to function as a national central command center in nation-wide end-to-end tsunami early warning and mitigation systems.

As one of the Founders of NDWC, I would like to mention about its development during my service. In the early period, the NDWC had technical cooperation with various national, regional and international organizations, namely; the Supreme Command Headquarters (now the Royal Thai Armed Forces Headquarters), Pacific Disaster Center (PDC), Japan Meteorological Agency (JMA), Intergovernmental Oceanographic Commission/United Nations Educational, Scientific and Cultural Organisation (IOC/UNESCO), World Meteorological Organization (WMO), Asian Disaster Preparedness Center (ADPC), Asian Disaster Reduction Centre (ADRC)-Japan, United Nations International Strategy for Disaster Reduction (UN/ISDR), United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP), United States Agency for International Development (USAID), United States Trade and Development Agency (USTDA), United Nations Development Programme (UNDP), United Nations Office for the Coordination of Humanitarian Affairs (UNOCHA), National Oceanic and Atmospheric Administration (NOAA), and International Ocean Institute (IOI). Thailand took a lead role in the establishment and development of effective end-to-end tsunami early warning and mitigation systems during the first four years from 2005 to 2008.

The NDWC is now able to detect earthquake and tsunami activity and to provide early warning messages via various modes of communication to governmental agencies and coastal populations. Without technical cooperation from these organizations, it would have been more difficult for NDWC to move forward during the period. In 2009, at the request of NDWC, PDC developed and submitted a proposal to USTDA for funding to expand its early warning system to include flooding and landslides. The USTDA approved the proposal and offered a grant to NDWC for PDC to expand the system. NDWC was not able to accept the grant, and consequently it was cancelled. Later in 2010, Thailand learnt a very important lesson from the flood damage which resulted in more than 100 casualties of Thai people. Now it is for us to invest on development of decision support system for flood early warning and mitigation system with our own budget.

There are still much work and many challenging issues for NDWC to overcome on planning, coordinating and implementing end-to-end multi-hazard early warning and mitigation systems within its institutional structure and among interagency departments, government function levels and community level in particularly on preparedness and response.

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The recent catastrophic events, in Japan on 11th March 2011 caused by the 9.0 magnitude earthquake, the fifth most powerful tsunami in the Japan's history, are the worst scenes of unimaginable destruction in northeast Japan and are accompanied by a big loss of life. We must promote a better understanding of natural disasters especially at the community level and improve early warning and mitigation systems. It is now the right time to implement all possible preventive approaches to improve mitigation, preparedness and response. I hope that disaster early warning and mitigation will be one of the top priorities for the incoming government.

It is truly beneficial that we are able to organize the stakeholder consultation workshop to discuss earthquake risk mitigation for Bangkok. The impact of an earthquake on life and property of people in Bangkok can be reduced by measures such as earthquake resistant building design and construction standards, proper planning, education and training. In particular, we will need to build awareness on disaster prevention at the community level as well as enforcement on regulatory frameworks, monitoring and assessment.

By sharing experiences with our invited experts at this workshop, you will have a great opportunity to discuss with them during the next two days. I would like to take this opportunity to thank the experts who dedicated valuable time and efforts to share with us their experiences. I look forward to having development cooperation with you on disaster reduction in the near future.

Last but not least, to our sponsors, we very much appreciate our main sponsors; Bank of Ayudhya Public Company Ltd., Ministry of Information and Communication Technology, and Areeya Property Public Company Ltd; our co-sponsors, Thai Yamaha Motor Co. Ltd., Property Perfect Public Company Ltd.; our sponsors, Yanhee International Hospital, DHA Siamwalla Ltd., Raimon Land Public Company Ltd and Thai Airways International. Without their helps, the Workshop would simply not have been possible.

I wish also thank our Local co-organizers, Bank of Ayudhya Public Company Ltd, Bangkok Metropolitan Administration, International Ocean Institute-Thailand Operational Centre, National Disaster Warning Center, and Sasin Graduate Institute of Business Administration, Chulalongkorn University.

I thank our international partners for their contributions, namely; International Emergency Management Society, International Ocean Institute, Institute of Earth Systems, University of Malta, Miyamoto International, Pacific Disaster Center, SirCom GmbH, SOLUZION Consortio LLPi and the United States Geological Survey. Thank you very much.

MESSAGE FROM DR. AWNI BEHNAM

PRESIDENT, INTERNATIONAL OCEAN INSTITUTE (IOI) AND FORMER ASSISTANT SECRETARY GENERAL OF THE UNITED NATIONS COMMISSIONER GENERAL TO THE WORLD EXPO 2010

Excellencies, Ladies and Gentlemen,

I have the honor to extend to you on behalf of the IOI Governing Board, its Steering Committee and Network of Operational Centres, our sincere appreciation for the organisation of this important workshop. We commend the efforts and support of the Chairman Dr. Smith Dharmasaroja, the authorities of Thailand and co organizers for this critical initiative.

The importance of knowing how to prepare and respond to disasters has led to the evolution of disaster management from an almost ad-hoc response to nature's disturbances to a holistic system of preventing and mitigating risks and adaptation. New ways of addressing disasters have taken advantage of the advances in information and communication technology. It has also integrated various disciplines and concerns including stakeholder involvement, governance and policy issues at the local and national level and the threat of climate change, which put a global perspective on an otherwise local concern. One of the most challenging issues facing the oceans today is the urbanization revolution, the implications of which have yet to be fully assessed, especially in terms of the earth's coastlines. Today more than half of the world's population lives within 60 km of the coastline and more than 50 % live in cities. Mega-cities in coastal areas have the highest forecasted population growth in coastal areas for the next decades.

Natural disasters such as earthquakes, tsunamis, floods, landslides, wild fires, hurricanes, and droughts have severe impacts on coastal zones. The tsunami in December 26, 2004 caused over 300,000 deaths and damage-to-property of about 10 billion US\$ to most East Indian Ocean countries and greatly impacted the tourism industry. Some types of natural disasters have increased in their frequency and strength. The hurricane Katrina has shown, that governments are not well prepared to react to natural hazards. Governments have to cope with this situation and start initiating programs to minimize harm to persons and damage to property.

The Government of Australia, India, Indonesia, Sri Lanka, and Thailand, for example, have established their national disaster warning centers to function as a national central command center in nation-wide end-to-end multi-hazard disaster early warning. Other measures are training and public awareness creation to build up coastal community and tourists' awareness and resilience to these disasters. For the private sector, there is a need to consider hotel responsibility and reliability.

It was found that major challenges remain as communication gaps between governments and communities for effective early warning, mitigation and preparedness. Lack of common understanding of preparedness and prevention arrangements is significant which is a priority to an effective disaster management approach at the government function levels and the community level.

Future implementation, replication and scaling up of efforts will be needed as multi-cooperation among countries within the region and among regions. The tasks are too large for any single international or regional agency framework to solely coordinate on early warning, mitigation and preparedness at the national and local levels, since it will have to deal with a large number of populations at risk. Sharing of knowledge and lessons learned, planning and implementation on adaptive management approach will be urgently needed. The International Ocean Institute has a significant role to play in the coordination, strategic planning and implementation at government function levels and community levels.

Immediate attention for countries and governments is to co-manage disaster management with the community in disaster management. Sustainable financial inputs will need to be allocated for local adaptive learning on multi-hazards disaster management. A long-term plan, for example, a 10 year plan should be developed.

Excellencies, Ladies and Gentlemen,

We look forward to the results of your expert deliberations, and your recommendations for actions on legal and engineering views as well as on mitigation, preparedness and response to save lives and to protect the damage on infrastructure in Bangkok due to distant large earthquakes.

I wish you success in your consultations.

22nd - 23rd July 2011

The Rama Garden Hotel & Resorts,
Bangkok, Thailand

GREETING BY MR. K. HARALD DRAGER, PRESIDENT, THE INTERNATIONAL EMERGENCY MANAGEMENT SOCIETY ON TIEMS-AN INTERNATIONAL NETWORK OF EMERGENCY AND DISASTER MANAGEMENT EXPERTS WITH A GLOBAL VISION FOR A SAFER WORLD

Excellencies, Ladies and Gentlemen

I am honoured to be invited to this workshop, and I like to thank especially Dr Cherdsak Virapat and Mr. Pran Siamwalla for their initiative, and on behalf of TIEMS membership I like to express my congratulations and good wishes for a productive and successful workshop. The workshop concept is quite interesting, with the right experts and all stakeholders seemed being invited, and this opens up for a fruitful discussion across areas of responsibility, and thus without the limitation faced when experts are only discussing and thinking "within their box". I will contribute to my best ability and experience, but also listen and learn and take with me the concept and ideas and re-use it for other events and issues at stake.

Bangkok is one of my world favourite cities, with its smiles, colours, smells, food, massage, etc., and it's very beautiful women. I even married one of them. However, concerning safety and public awareness, there is quite a way forward and we have to have that time perspective in mind when we address this issue. We have to start with the young ones introducing a new safety mindset in teaching safety and disaster response from elementary school on and up.

The International Emergency Management Society

TIEMS is a global forum for education, certification and policy in emergency and disaster management. TIEMS is dedicated to developing and bringing the benefits of modern emergency management tools, techniques and good industry practices to society for a safer world. This is accomplished through the exchange of information, methodology innovations, and new technologies to improve society's ability to avoid, mitigate, respond to and recover from, natural and man-made disasters.

TIEMS provides a platform for all stakeholders within the global emergency and disaster management community to meet, network and to learn about new technical and operational methodologies. It also aims to exchange experience on good industry practices. This will influence policy makers worldwide to improve global cooperation and to establish global standards within emergency and disaster management.

TIEMS was founded in Washington DC, USA in 1993 as an International, Independent, and Non Profit NGO and later registered in Belgium in 2006 with now an operational secretariat in Brussels. TIEMS 2011 Annual Conference was held in Bucharest, Romania, and workshops were held in 2010 in Russia, China, Croatia and South Korea. Planned Events in 2011 are in France, India, China, Iraq and Philippines. The slogan in TIEMS is to "think globally and act locally" and therefore TIEMS chapters are established around the world. Approved Chapters are today found in Romania, BeNeLux, China, Korea, India and Middle East and North Africa (MENA). Chapters are under approval in Iraq, Finland, South East Europe, Japan, Turkey and the ASEAN Region. TIEMS supports students through the TIEMS Rohrmann Student Fund and TIEMS honour excellence in emergency and disaster management with awards. A TIEMS Young Scientist Network is under establishment. TIEMS offers Membership, Sponsorship and Partnership. TIEMS is also developing a Global Education, Training and Certification Program in Emergency and Disaster Management and is initiating and participate in research projects addressing the main issues in global emergency and disaster management. TIEMS Annual Conference 2012 will be held in Mumbai, India.

TIEMS Vision and Contribution to Disaster Mitigation is through involvement and partnership with Governments and Insurance Industry, International Expert Institutions and Organizations, TIEMS International Network of Experts and Chapters and by establishing a TIEMS International Education, Training and Certification Program and initiate and participate in Research and Development projects addressing the main global issues in emergency and disaster management.

Cost of Disasters

There were a total of 950 natural disasters in 2010 with totally 295 000 casualties, and the estimated cost for these disasters was 130 billion USD. The most severe disasters were the Earthquake in Haiti (222 570 casualties), Floods in Pakistan and China and Heat wave in Russia.

When addressing the total cost for disasters, it is important to address who pays these costs. In this respect, the total loss versus insurance coverage shows an interesting picture. The 1995 Kobe earthquake incurred \$100 billion of economic losses, but only \$3 billion of insurance losses. The loss in the Chile Earthquake was 30 billion USD, where the Insurance Industry paid 8 billion USD. A World Bank report estimates the Japanese earthquake could cost from \$122 to 235 billion USD, where the insurance industry may pay only 10 bill USD.

It is therefore important to be aware of the fact that in the past the country itself is the one party who needs to find coverage for the majority of the cost of a disaster. The economics of disasters should therefore be addressed more in depth to find more favorable financial solutions, encouraging more preparedness and post disaster planning.

The Bangkok Workshop Issues

The basic issues to be addressed at the Bangkok workshop are the probability of and the magnitude of a distant large earthquake and its effects for Bangkok infrastructure and then addressing how to reduce consequences by building code implementation in Bangkok.

However, additional items of importance to consider and discuss are Damage Assessments, Insurance companies' role and involvement, Public Awareness, Media's involvement and coverage, Education about Risk, Hazards and Consequences and also other hazards for Bangkok.

It is important with a holistic approach in order to arrive at a useful and productive outcome of the Bangkok workshop.

Establishing a TIEMS Chapter in Thailand

TIEMS has an international network of more than 10 000 experts worldwide, and such a network can be very valuable for finding expertise and for the exchange of experience and knowledge. It is therefore suggested to form a Working Group in Thailand with representatives from the different stakeholders to establish a TIEMS Thailand Chapter, chaired by a local representative. The goal is to arrange a TIEMS workshop in the country focusing on the regional hazards and disaster response capabilities and introduce and establish a TIEMS Chapter and then join TIEMS worldwide activities and network. This way TIEMS Thailand chapter will be part of an international network of experts and all experience and knowledge will there be available for assistance to Thailand in addressing the hazards of Bangkok and remedies to reduce the consequences of any disasters that might strike.

Climate Change and Emergency Management

As a closing remark I like to remind you that Bangkok is facing other hazards as well, for example floods and climate change may increase the risk and magnitude of this hazard.

I think that the most challenging issue of our time is the climate change and its possible consequences for our living conditions on the earth, and this is a topic that needs full attention also from the experts in emergency and disaster management. I therefore like TIEMS to arrange a conference dedicated to the subject of "Climate Change and Emergency and Disaster Management" in Nepal, where also visiting the sites "on top of the world" and see what is happening in this important area of the world, concerning changes to the glaciers and its consequences. I like the Bangkok workshop audience to join me in these efforts and take part in such a workshop, discussing issues which might have a large impact on the safety of Bangkok.

As TIEMS President, with my upcoming 70th birthday, 12th of May 2012, I like to dedicate this day to focus on this subject, and invite all my friends and colleagues in the global emergency and disaster management community, to come to this TIEMS conference in Nepal, which is planned to be arranged week 19th 2012 (7 – 13 May). My birthday wish is that you all support this important event by coming and that we all together address the issue of "Climate Change and Emergency and Disaster Management" with a clear concluding message.

22nd - 23rd July 2011

The Rama Garden Hotel & Resorts,
Bangkok, Thailand

CLOSING ADDRESS BY

**REAR ADMIRAL THAWORN CHAROENDEE, RTN., EXECUTIVE ADVISOR, NATIONAL DISASTER WARNING CENTER,
MINISTRY OF INFORMATION AND COMMUNICATION TECHNOLOGY**

Excellencies, Ladies and Gentlemen

I have my honor and pleasure to extend to you my sincere appreciation on behalf of the Executive Director, of National Disaster Warning Center (NDWC) Group Captain Somsak Khaosuwan who is on his mission in Trad Province.

As you know, the National Disaster Warning Center was established 6 years ago to be responsible for Tsunami early warning and mitigation systems as well as other natural disasters systems including earthquakes, floods and landslides, severe storms, wildfire and drought. We are now working to develop the early warning and mitigation systems via the Indian Ocean Tsunami Warning Systems and the Pacific Ocean Tsunami Warning Systems of the Intergovernmental Coordination Group (ICG/IOTWS and ICG/PTWS) of the Intergovernmental Coordination Group of UNESCO.

At the eight session of ICG/IOTWS held at the Australian Bureau of Meteorological Agency in Melbourne in May this year, we have established three Indian Ocean Regional Tsunami Information Services to provide Tsunami Bulletin for the Indian Ocean countries. There will be the Indian Ocean Wide Tsunami exercise on 12 October 2011 to test the systems.

The organization of this workshop entitled "Stakeholder Consultation Workshop on the Effects of Distant Large Earthquakes on Infrastructure in Bangkok: Legal, Engineering and Risk Reduction Perspectives" is really a good initiative. The NDWC would like to promote this kind of activity particularly in promoting integration and partnerships among various stakeholders, namely: the Bangkok Metropolitan Administration, Government Departments, private sector and business entrepreneurs, academic institutions, and non-government organization. We are able to share less learned with both local and international experts to develop practical Thailand earthquake risk reduction measures.

I believe that the road map and proposed actions to deal with earthquakes in aspects of legal engineering and risk reduction will need the continued actions and support. The NDWC will be glad to cooperate and coordinate with BMA, private sector, academic institutions and non-governmental organization to implement these important missions.

Last but not least, I would like to thank the International Ocean Institute (IOI) for extending your kind invitation to NDWC to take part in the workshop. On behalf of NDWC, I look forward to having strong future cooperation with the IOI and its partners on multi-hazards early warning and mitigation systems. Thank you.

CLOSING ADDRESS BY

**H.E. DR. SMITH DHARMASAROJA,
CHAIRMAN OF FOUNDATION OF NATIONAL DISASTER WARNING COUNCIL, CHAIRMAN OF THE ADVISORY
BOARD OF THE INTERNATIONAL OCEAN INSTITUTE THAILAND OPERATIONAL CENTER, FORMER VICE
MINISTER TO THE OFFICE OF THE PRIME MINISTER**

Excellencies, Distinguished Experts, Ladies and Gentlemen,

On behalf of the Foundation on National Disaster Warning Council, I would like to thank all experts, co-chairs, facilitators and all participants for your contribution to this workshop which I believe has been successful in presenting the current state of seismic risk in Bangkok from distant large earthquakes; earthquake risk reduction solutions with experiences from Japan, Mexico, U.S.A. and Turkey; risk management; decision support systems and concepts of operation; cognitive capacity and mitigation preparedness; public and public agency response; involvement of private sectors and business entrepreneurs to advocate people in Bangkok.

I do hope that you have established contacts and made friendships which may be sources of future cooperation.

We would like to express our sincere gratitude to our sponsors who help make our workshop possible. I would like also to thank the Secretariat for the efficient and pleasant organization of this workshop.

And finally, I would like to thank our two MCs, Ms. Pimkarn Sapprung and Ms. Pasawan Pisanbutra, for their excellent and courteous performance.

I look forward to cooperating and working with you to implement effective measures on earthquake risk reduction for Bangkok in the near future. For the international experts, I hope you enjoy your stay in Bangkok and have a safe and pleasant journey back home. Thank you.

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