APEC-WW-2012 Country Report: Philippines

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ABSTRACT: Disseminating knowledge, building on already existing methods, and encouraging best practices; current initiatives in the Philippines on research, education, and building regulations related to wind engineering are presented in this paper. In research, an on-going project to quantify the vulnerability of key building types existing in Metro Manila to severe wind using computational fluid dynamics (CFD) is presented. In education, the 9th International Advanced School (IAS9) on Wind Engineering was hosted by the Institute of Civil Engineering of the University of the Philippines in Diliman. In regulation towards Green Buildings, the rating system by the Philippine Green Building Council and the Quezon City Green building ordinance in 2009 are briefly discussed.

KEYWORDS: Vulnerability Curve, Computational Fluid Dynamics, IAS9, Green Building

1 INTRODUCTION

Current initiatives in the Philippines on research and education related to Wind Engineering are discussed in this paper. Air quality initiatives and a tax credit system towards promoting green buildings within a local government setting are also presented.

The University of the Philippines Diliman through the Institute of Civil Engineering (UPD-ICE) has an on-going research project with the Philippine Atmospheric, Geophysical, and Astronomical Services Agency (PAGASA) and the Philippine Institute of Volcanology and Seismology (PHIVOLCS) to quantify the vulnerability of key building types in the Greater Metro Manila Area to earthquake, floods and severe wind. Thus, a group of researchers and faculty members in UPD-ICE are developing vulnerability curves of identified key building types in the area using empirical, heuristic and analytical approaches in close coordination with PAGASA and PHIVOLCS project teams. An analytical approach using computational fluid dynamics (CFD) was developed to simulate damage on existing buildings. This allows the quantification of damage providing the means to estimate the vulnerability of the structure to wind loading.

In the field of education, the 9th International Advanced School (IAS9) on Wind Engineering was hosted by the ICE at the National Engineering Center (NEC) of the University of the Philippines Diliman from August 13-16, 2012. The Global Center of Excellence (GCOE) Program under Prof. Yukio Tamura of the Tokyo Polytechnic University (TPU), entitled "New Frontier of Education and Research in Wind Engineering," sponsored the event and invited distinguished engineers and researchers on wind engineering from around the world as lecturers. More than sixty (60) participants from the academe, government, and private civil engineering practitioners attended the courses on Structural and Environmental Wind Engineering. The IAS9 and Prof. Tamura's special lecture for undergraduate students created a lot of interest in wind engineering which the ICE plan to address by providing a basic wind engineering course for its undergraduate students.

The most recent initiatives in the Philippines pertaining to air quality would be in the aspect of green buildings. One is a rating system by the Philippine Green Building Council (PGBC), while another is a tax credit system based on green building features being promoted by the Quezon City Government, one of the cities within Metro Manila, the capital of the Philippines.

2 GREATER METRO-MANILA AREA - RISK ANALYSIS PROJECT (GMMA-RAP)

The Philippine Atmospheric, Geophysical, and Astronomical Services Agency (PAGASA) and the Philippine Institute of Volcanology and Seismology (PHIVOLCS) of the Department of Science and Technology (DOST) are implementing a collaborative project with Geosciences Australia (GA) and CSCAND Agencies, with financial support from AusAID, called "Enhancing Greater Metro Manila's Institutional Capacities for Effective Disaster/Climate Risk Management towards Sustainable Development or the Risk Analysis Project." The objective of this Project is to analyze the risk from tropical cyclone severe wind, flood and earthquake in the GMMA area through the development of fundamental datasets and information on hazard, exposure and vulnerability towards strengthening the resilience of communities to the impacts of natural disasters [PAGASA-PHIVOLCS-UPD-ICE Memorandum of Agreement 2012].

In connection with this project, PAGASA and PHIVOLCS tasked the University of the Philippines Institute of Civil Engineering (ICE) in Diliman to develop vulnerability curves of key building types found in the Metro-Manila area to become part of the software they are developing to estimate risk. The title of the project is, "Development of Vulnerability Curves of Key Building Types in the Greater Metro Manila Area, Philippines." This project encompasses vulnerability curves for three major natural hazards in the country: severe wind, earthquake and flood.

2.1 *Project Objectives*

There are two main objectives of the project: 1. To identify building types existing in the Greater Metro Manila Area, Philippines and propose a building typological system in terms of structural type and materials used for construction, and 2. To develop a basic suite of vulnerability curves of key building types in the Greater Metro Manila Area, Philippines which can be used in risk assessment of impacts of severe wind due to tropical cyclone, flood, and/or earthquake.

2.2 *Project Activities*

In close coordination and collaboration with PAGASA and PHIVOLCS project teams, the major project activities of the Institute of Civil Engineering (ICE) researchers include:

1. Identify key building types in the project area and propose a building typological system, including wind-sensitive special structures (such as billboards, transmission and communications towers), potentially applicable in the entire Philippines, for severe wind due to tropical cyclone, flood and earthquake.
2. Perform systematic review of damage due to historical severe wind, flood and earthquake to identify extents of damage to key building types for given intensity levels.
3. Identify typical repair strategies or schemes to estimate the repair costs for damage due to severe wind, flood and earthquake for a few key building types (e.g., three dominant types for each hazard) determined through consultation with PAGASA and PHIVOLCS.
4. Together with PAGASA project team, PHIVOLCS project team, CSCAND agencies, GA and Local Government Units (LGUs), participate in vulnerability development work-

shops where Philippines engineers participate to build consensus on the identified key building types for which vulnerability models will be developed, the identified repair strategies, and methodologies to develop vulnerability curves for severe wind due to tropical cyclone, flood inundation and earthquake.

5. Perform structural analyses for selected buildings types as identified and/or confirmed in the workshop activity to estimate structural behavior and damage due to severe wind and/or earthquake.
6. Develop vulnerability curves for the key building types with respect to severe wind due to tropical cyclone, flood and earthquake
7. Together with PAGASA project team, PHIVOLCS project team, CSCAND agencies, LGUs, and GA conduct building evaluation survey in the Program Area as required to provide engineering advice to PHIVOLCS-DOST project team in the development of building exposure database and corresponding methodologies.
8. Together with PAGASA project team, PHIVOLCS project team, CSCAND agencies, LGUs, and GA, compile, select, enhance and/or develop methodologies and assist, as maybe needed, in case of actual damage assessment.

2.3 *Typology of Key Building Types and Special Structures in the GMMA considering Severe Wind Hazard*

During the course of discussions with the PAGASA project team, it was agreed that priority will be given to structures that are historically sensitive to wind damage during wind storms in the development of vulnerability curves. Thus, building types that are normally used as residential structures - low-rise buildings (1-2 stories) up to medium-rise buildings (3-7 stories), together with lattice-type structures are being prioritized in the development of vulnerability curves. Table 1 below lists the key building types grouped based on the material used for construction and the wind-sensitive special structures in the GMMA.

Table 1: Key Building Type Typology and Special Structures

Building Group	Building Type	Structural Type or Description
WOOD	W1*	Wood, light frame
	W3	Bamboo
	N	Makeshift
MASONRY	MWS	Concrete hollow blocks with wood or light metal
	CHB	Concrete hollow blocks
CONCRETE	CWS	Reinforced concrete moment frames with wood or light metal
	C1*	Reinforced concrete moment frames
STEEL	S1*	Steel moment frame
	S3*	Light metal frame
	S4*	Steel frame with cast-In-place concrete shear walls
SPECIAL STRUCTURES	BB	Billboards
	PT	Power transmission towers

*with similar group type in HAZUS-MH

2.4 *Development of Vulnerability Curve of Key Building Types to Severe Wind*

There are different methods used to develop vulnerability curves: empirical, heuristic and the computational/analytical approaches. Figure 1 shows the computational approach used in the development of vulnerability curves. In the methodology used, the fragility curves for slight, moderate, extensive, and complete damage states are first derived for a population of building models that incorporate different building attributes which affect the behaviour of the structure when subjected to wind loading. Building attributes that are considered in the building database include differing roof angles, floor area, one- and two-storey buildings, roof material, window material, roof eaves and fire walls.

Definitions of different damage states from Hazus-MH (Vickery et al. 2006) are followed. Moreover, three different wind directions were considered in the analysis: longitudinal, lateral, and inclined at a 45^0 angle. The wind pressure distribution on a model building is determined per wind speed using computational fluid dynamics (CFD) in ANSYS CFX. The effect of turbulence is also included in the analysis. Figure 2 shows a sample model of a residential building with resulting wind pressure distribution. The damage state is determined by comparing the wind pressure on the building surface to threshold values determined from experimentation. After completing the analysis of all models, the percent (%) probability of exceedance of a damage state is computed for each wind speed used, providing data points for the fragility curves. Then cumulative probability distribution functions are fitted to the data points for slight, moderate, extensive and complete damage. The resulting curves are the fragility curves of the building. With the fragility curves, the final step involves the use of a corresponding damage index per damage state to derive the vulnerability curve. Figure 3 shows the vulnerability curve of the structure.

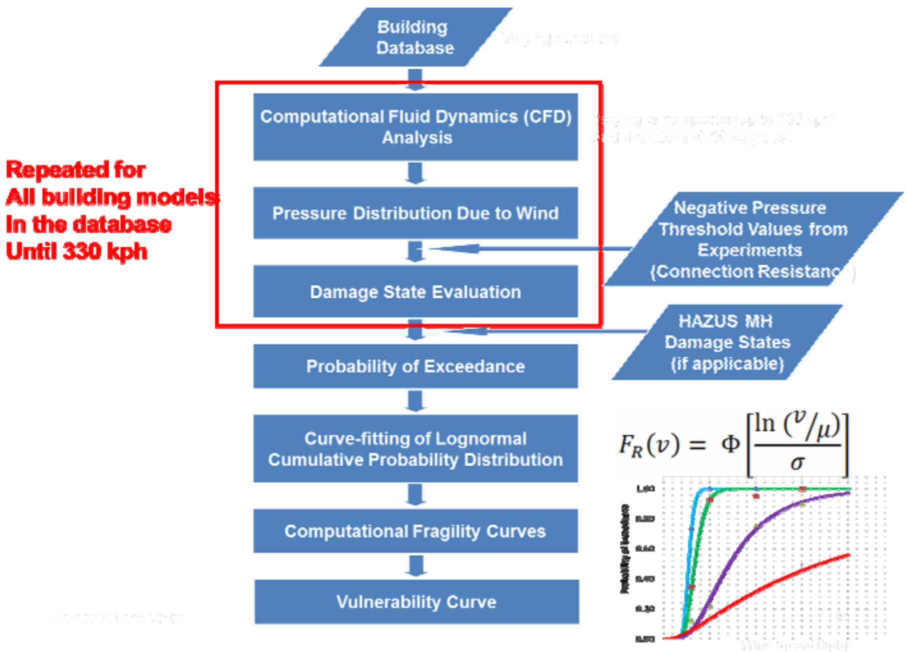


Figure 1: Methodology

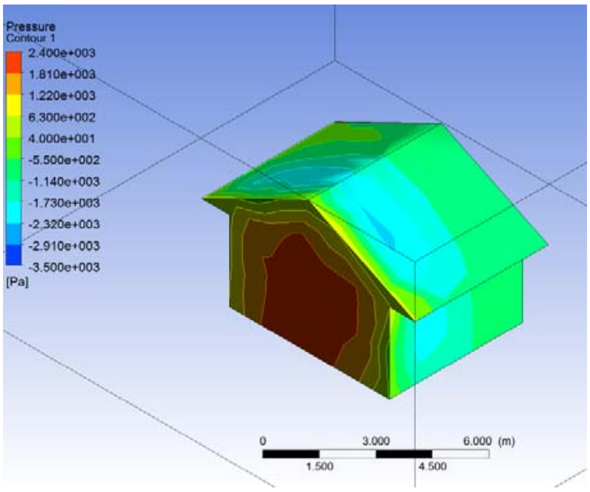


Figure 2: Sample Model Wind Pressure Distribution

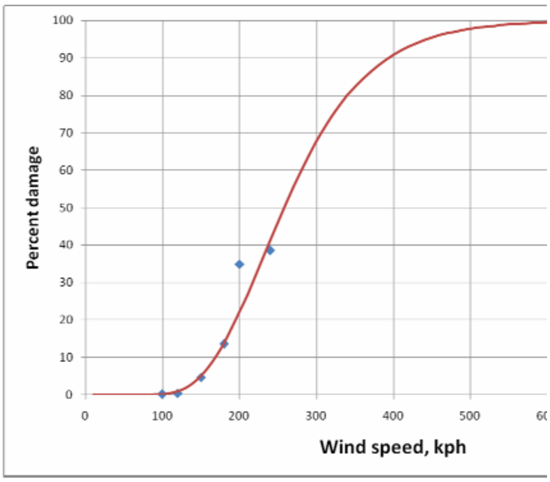
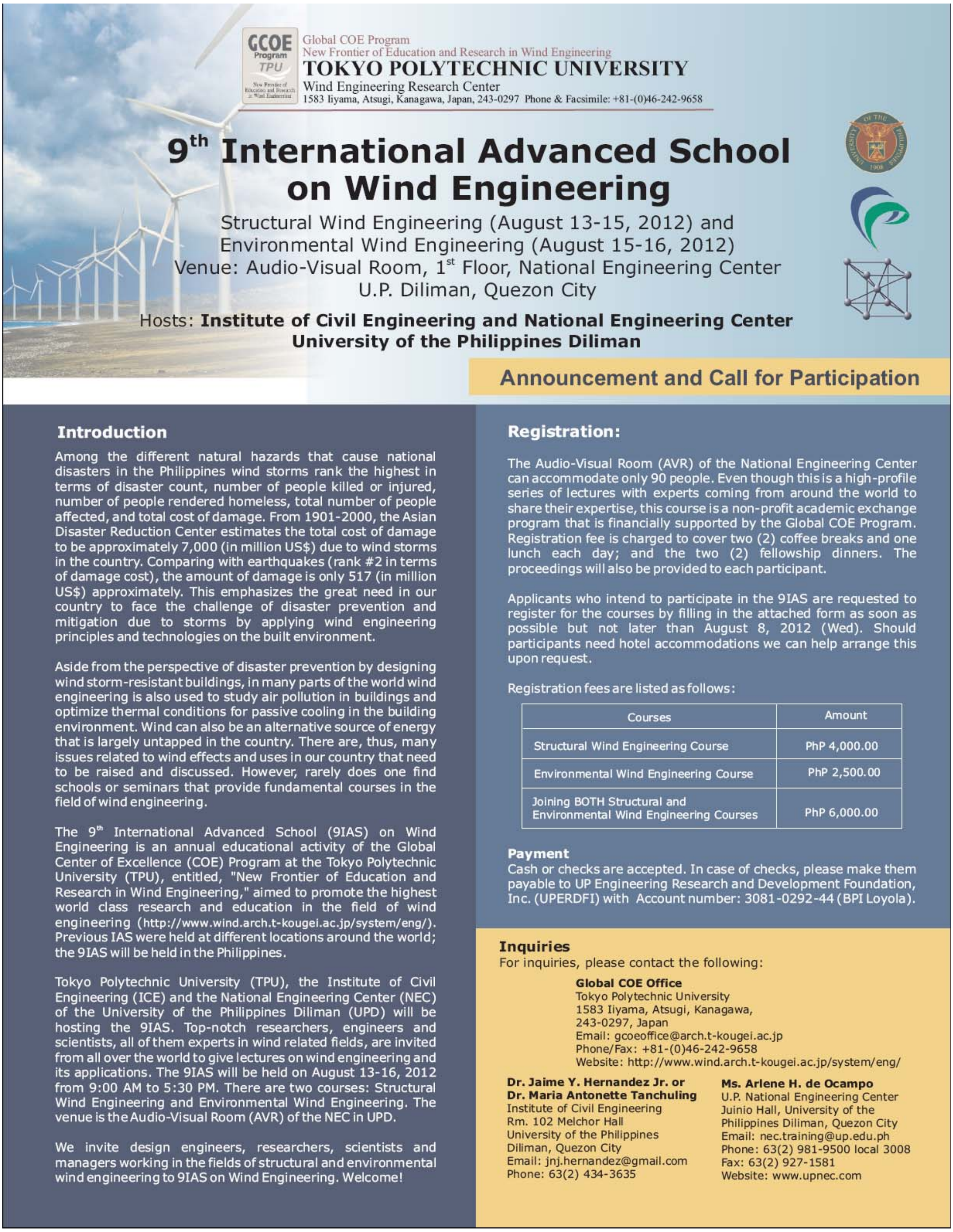


Figure 3: Vulnerability Curve

3 9TH INTERNATIONAL ADVANCED SCHOOL ON WIND ENGINEERING (IAS9)

The 9th International Advanced School on Wind Engineering was held in the University of the Philippines Diliman (UPD) campus from August 13-16, 2012. The IAS9 is the 9th annual lecture series on wind engineering sponsored under the Global Center of Excellence program "New Frontier of Education and Research in Wind Engineering" of the Tokyo Polytechnic University (TPU), Japan. This year's host is the Institute of Civil Engineering in collaboration with the National Engineering Center (NEC) of UPD. There are two main courses: Structural Wind Engineering and Environmental Wind Engineering. A total of 32 lectures were given by invited professors from different universities around the world. Figures 4 and 5 show the invitation, names and affiliation of invited lecturers, topics presented, and other details of the program.

Figures 6 and 7 show the class photograph of the Structural and Environmental Wind Engineering Courses. Over 60 participants from the academe, professional engineers, and government agencies attended the IAS9. A separate special lecture was made by Prof. Yukio Tamura for undergraduate students during his visit to introduce the field of wind engineering. Prof. Tamura gave a lecture on the following topics: 1. Aerodynamic characteristics of tall buildings with unconventional configurations, 2. Recent topics of wind resistant design of buildings with special reference to Tokyo Sky Tree, and 3. Damping devices to suppress wind-induced response of buildings and structures. More than one hundred (100) undergraduate students attended the special lecture and appreciated Prof. Tamura's sharing of his expertise and experience in research and education on wind engineering. This special lecture generated a lot of interest in wind engineering so that the ICE plans to offer a basic wind engineering course next year for undergraduate students who are interested to do research on this field.



Global COE Program
New Frontier of Education and Research in Wind Engineering
TOKYO POLYTECHNIC UNIVERSITY
Wind Engineering Research Center
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9th International Advanced School on Wind Engineering

Structural Wind Engineering (August 13-15, 2012) and
Environmental Wind Engineering (August 15-16, 2012)
Venue: Audio-Visual Room, 1st Floor, National Engineering Center
U.P. Diliman, Quezon City

Hosts: **Institute of Civil Engineering and National Engineering Center**
University of the Philippines Diliman

Announcement and Call for Participation

Introduction

Among the different natural hazards that cause national disasters in the Philippines wind storms rank the highest in terms of disaster count, number of people killed or injured, number of people rendered homeless, total number of people affected, and total cost of damage. From 1901-2000, the Asian Disaster Reduction Center estimates the total cost of damage to be approximately 7,000 (in million US$) due to wind storms in the country. Comparing with earthquakes (rank #2 in terms of damage cost), the amount of damage is only 517 (in million US$) approximately. This emphasizes the great need in our country to face the challenge of disaster prevention and mitigation due to storms by applying wind engineering principles and technologies on the built environment.

Aside from the perspective of disaster prevention by designing wind storm-resistant buildings, in many parts of the world wind engineering is also used to study air pollution in buildings and optimize thermal conditions for passive cooling in the building environment. Wind can also be an alternative source of energy that is largely untapped in the country. There are, thus, many issues related to wind effects and uses in our country that need to be raised and discussed. However, rarely does one find schools or seminars that provide fundamental courses in the field of wind engineering.

The 9th International Advanced School (9IAS) on Wind Engineering is an annual educational activity of the Global Center of Excellence (COE) Program at the Tokyo Polytechnic University (TPU), entitled, "New Frontier of Education and Research in Wind Engineering," aimed to promote the highest world class research and education in the field of wind engineering (http://www.wind.arch.t-kougei.ac.jp/system/eng/). Previous IAS were held at different locations around the world; the 9IAS will be held in the Philippines.

Tokyo Polytechnic University (TPU), the Institute of Civil Engineering (ICE) and the National Engineering Center (NEC) of the University of the Philippines Diliman (UPD) will be hosting the 9IAS. Top-notch researchers, engineers and scientists, all of them experts in wind related fields, are invited from all over the world to give lectures on wind engineering and its applications. The 9IAS will be held on August 13-16, 2012 from 9:00 AM to 5:30 PM. There are two courses: Structural Wind Engineering and Environmental Wind Engineering. The venue is the Audio-Visual Room (AVR) of the NEC in UPD.

We invite design engineers, researchers, scientists and managers working in the fields of structural and environmental wind engineering to 9IAS on Wind Engineering. Welcome!

Registration:

The Audio-Visual Room (AVR) of the National Engineering Center can accommodate only 90 people. Even though this is a high-profile series of lectures with experts coming from around the world to share their expertise, this course is a non-profit academic exchange program that is financially supported by the Global COE Program. Registration fee is charged to cover two (2) coffee breaks and one lunch each day; and the two (2) fellowship dinners. The proceedings will also be provided to each participant.

Applicants who intend to participate in the 9IAS are requested to register for the courses by filling in the attached form as soon as possible but not later than August 8, 2012 (Wed). Should participants need hotel accommodations we can help arrange this upon request.

Registration fees are listed as follows:

Courses	Amount
Structural Wind Engineering Course	PhP 4,000.00
Environmental Wind Engineering Course	PhP 2,500.00
Joining BOTH Structural and Environmental Wind Engineering Courses	PhP 6,000.00

Payment
Cash or checks are accepted. In case of checks, please make them payable to UP Engineering Research and Development Foundation, Inc. (UPERDFI) with Account number: 3081-0292-44 (BPI Loyola).

Inquiries

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Website: www.upnec.com

Figure 4: Front page of the Invitation for the IAS9 in the University of the Philippines

Programme

Below is the schedule of activities of the 9IAS on Wind Engineering.

Structural Wind Engineering (August 13-15,2012)

Time	Topics	Lecturer
August 13 8:00-9:00	Registration	
9:00-9:45	Opening Program	
9:45-10:30	The planetary boundary layer	Richard G.J. Flay
10:30-10:45	Coffee Break	
10:45-11:30	Bluff body aerodynamics	
11:30-12:15	The Gust factor approach for analysing the along-wind response of tall structures	
12:15-13:30	Lunch	
13:30-14:15	Advances of operational modal analysis for building structures	Lingmi Zhang
14:15-15:00	Advances of structural system identification and its potential for wind engineering application	
15:00-15:15	Coffee Break	
15:15-16:00	Structural condition assessment based on flexibility from ambient structural response	
16:00-16:45	Actively-controlled wind tunnels	Shuyang Cao
16:45-17:30	CFD applications to some structural wind engineering problems	
18:00-20:00	Fellowship Dinner (Structural)	
August 14 9:00-9:45	Most efficient observations of random fields I	Yukio Tamura
9:45-10:30	Most efficient observations of random fields II	
10:30-10:45	Coffee Break	
10:45-11:30	Strong winds and their characteristics	Shuyang Cao (TBC)
11:30-12:15	Understanding wind codes and standards: Fundamentals behind their provisions I	Ted Stathopoulos
12:15-13:30	Lunch	
13:30-14:15	Understanding wind codes and standards: Fundamentals behind their provisions II	
14:15-15:00	Understanding wind codes and standards: Fundamentals behind their provisions III	
15:00-15:15	Coffee Break	
15:15-16:00	Development of fragility curves of key building types due to severe wind loading using CFD I	Institute of Civil Engineering
16:00-16:45	Development of fragility curves of key building types due to severe wind loading using CFD II	
16:45-17:30	Development of fragility curves of key building types due to severe wind loading using CFD III	
August 15 9:00-9:45	Monitoring techniques in wind engineering	Yukio Tamura
9:45-10:30	Estimation of the design wind speed	Michael Kasperski
10:30-10:45	Coffee Break	
10:45-11:30	Specification of the design value of the aerodynamic coefficient	
11:30-12:15	Identification of the effective pressure distribution	

Environmental Wind Engineering (August 15-16,2012)

Time	Topics	Lecturer
August 15 12:00-13:00	Registration	
13:00-14:15	Wind-induced dispersion of pollutants in the urban environment	Ted Stathopoulos
14:15-15:00	Green Building Rating System in the Philippines	Institute of Civil Eng'g
15:00-15:15	Coffee Break	
15:15-16:00	Properties of Urban and Industrial Canopy Layer Flows	Michael Schatzmann
16:00-16:45	Issues with validation of RANS CFD flow and dispersion model	
16:45-17:30	Issues with validation of LES CFD flow and dispersion	
18:00-20:00	Fellowship Dinner (Environmental)	
August 16 9:00-9:45	Indoor Air Quality	Institute of Civil Eng'g
9:45-10:30	Energy conservation effects of hybrid ventilation in high-rise office buildings	Ryuichiro Yoshie
10:30-10:45	Coffee Break	
10:45-11:30	Prediction of urban environment based on engineering CFD models	Akashi Moshida
11:30-12:15	Analysis of urban environment to guide urban design and site planning I	
12:15-13:30	Lunch	
13:30-14:15	Analysis of urban environment to guide urban design and site planning II	
14:15-15:00	Influence of form of building groups on urban ventilation	Ryuichiro Yoshie
15:00-15:15	Coffee Break	
15:15-16:00	Simultaneous measurement of fluctuating velocity, temperature and concentration in non-isothermal flow	
16:00-16:45	Closing Program	

Limited slots for participants, so please register early!

Certificate of Completion:

Certificates of completion will be given to participants at the closing program of the courses for Structural and Environmental Wind Engineering courses.

Lecturers' Profile:

1. **Richard G.J. Flay**
   Department of Mechanical Engineering
   The University of Auckland, New Zealand
2. **Ted Stathopoulos**
   Dept. of Building, Civil and Environmental Engineering
   Concordia University
   Montreal, Quebec, Canada
3. **Lingmi Zhang**
   Nanjing Institute of Vibration Engineering
   Nanjing University of Aeronautics & Astronautics, China, P. R.
4. **Michael Kasperski**
   Ruhr-Universität Bochum
   Fakultät für Bau- und Umweltingenieurwissenschaften
   Bochum, Germany
5. **Shuyang Cao**
   Department of Bridge Engineering
   Tongji University
   Shanghai, China, P.R.
6. **Yukio Tamura**
   Tokyo Polytechnic University
   Iiyama, Atsugi, Kanagawa, Japan
7. **Michael Schatzmann**
   Meteorological Institute
   University of Hamburg
   Hamburg, Germany
8. **Akashi Mochida**
   Department of Architecture and Building Science
   Graduate School of Engineering
   Tohoku University, Sendai, Japan
9. **Ryuichiro Yoshie**
   Tokyo Polytechnic University
   Iiyama, Atsugi, Kanagawa, Japan
10. **Institute of Civil Engineering**
    College of Engineering
    University of the Philippines Diliman
    Quezon City, Philippines

9th IAS on Wind Engineering
13-16 August 2012

registration form:

Last Name First Name MI

Position/Title:

Company:

Mailing Address:

Email address:

Mobile number Fax:

I will attend: (Please check)

- ❍ Structural Wind Engineering Course
- ❍ Environmental Wind Engineering Course
- ❍ Joining BOTH Structural and Environmental Wind Engineering Courses

Signature:

This form maybe submitted through fax (927-1581) or email (nec.training@up.edu.ph).
Include copy of deposit slip if payment has been made.
Payment details at the front page.

Figure 5: Back-page of the Invitation to the IAS9 held in the University of the Philippines

Figure 6: Class Photograph of the Structural Wind Engineering Course (with Distinguished Lecturers Front row L-R: Shuyang Cao, Ryuichiro Yoshie, Lingmi Zhang, Yukio Tamura, Adeline Pacia, Benito Pacheco, Ted Stathoupoulos, Richard Flay, Jaime Hernandez Jr.)

Figure 7: Class Photograph of Environmental Wind Engineering Course (with Distinguished Lecturers: Yukio Tamura, Michael Shatzmann, Ted Stathoupoulos, Akashi Mochida, Ryuichiro Yoshie, Michael Reyes, Benito Pacheco, Jaime Hernandez Jr.)

4 BERDE (BUILDING FOR ECOLOGICALLY RESPONSIVE DESIGN EXCELLENCE)

Established in 2007, the Philippine Green Building Council of the Philippines is an association of building and construction industry leaders from both the private and public sectors. It developed the first green building rating system in the country called BERDE. Over the course of five years, it has attracted a membership of 150 corporations.

There are separate rating systems for new construction and old construction. Under the new construction category, there are 11 aspects to be considered, e.g. Management, Land use and ecology, water, energy, transportation, indoor environment quality, materials, emissions, waste, heritage conservation and innovation.

The specific criteria which has an impact on air quality are summarized in the table below. It covers all aspects of air quality, ranging from the micro-scale pollution inside buildings, to the local effects of air pollutants in terms of air emissions, and the global scale of greenhouse gases. The rating system is an incentive for building owners to minimize impacts to air quality.

Category	**Requirement**	**Criteria**
Land Use and Ecology	Pollution control during construction	Erosion control during construction
	Prevention of Heat Island Effect	Open grid pavement system
		Natural shading using trees and vegetation
		Vegetated roofing
Energy	Energy efficient lighting	A set minimum luminous efficacy for all light fittings and fixtures
	Natural Ventilation	Natural ventilation should be designed wherever possible to minimize the cooling load required and save energy
	On-site energy generation	Use of renewable energy technologies like solar panels, wind energy, hydro energy, and other related renewable energy harnessing systems
	Energy Efficient Building Envelope	design of the building envelope which enables low heat gain into the interiors for all spaces, and low air infiltration in air conditioned spaces
	Energy Efficient Equipment	encourage the use of energy efficient rated equipment.
Transportation	Alternative transportation (bicycles, low emission and energy efficient vehicles) proximity to key establishments, public access, contribution to public transport amenities, public transport access	use of alternative and greener mode of transportation and providing enough parking to encourage use of alternative transportation, and reduce emission, congestion and hardscapes. The category also deals with the proximity of key establishments, public access, and transport amenities to further reduce the extended travels
Indoor Air Quality	Indoor Air quality	No Smoking policy in buildings
		Installation of CO2 and NO2 sensors to trigger fresh air fans
	Microbial contamination prevention	Duct systems in the building are designed in compliance to avoid microbial growth in the duct system. Provision of entryway mats at all public entrances.
	Low VOC Environment	internal finishes should contain low volatile organic compounds

5 QUEZON CITY GREEN BUILDING ORDINANCE

The Quezon City Green Building Ordinance was passed in 2009, and its Implementing Rules and Regulations (IRR) was formulated in 2010. It stipulates mandatory requirements for new buildings and defines additional, optional requirements to be able to receive tax credits. The Green Building Tax Credit (GBTC) is computed as the product of the Real Property Tax (RPT) and Factor of 15, 20 or 25 depending on the points garnered based on the Green Point Score.

According to its IRR, there are 6 features which are considered: land sites/sustainability, energy efficiency, water efficiency, materials and resources, indoor environment quality and sewage treatment plant. There are minimum criteria to be met, and additional points for prescribed features.

Of these 6 features, the one with direct relevance to air quality is the category on indoor environment quality. The mandatory requirements include minimization of exposure of building occupants, indoor surfaces or finishes, and ventilation air distribution systems to Environmental Tobacco Smoke (ETS). The additional features include Indoor Air Quality (IAQ) Performance, Construction IAQ Management Plan, Low Volatile Organic Compounds Emitted Materials and Refrigerant Management.

This city ordinance should be lauded for being the first initiative in the country to give incentives for building owners to install green building features. It will be interesting to see its implementation in the coming years.

6 CONCLUSIONS

In research, the collaboration between UPD-ICE, PAGASA, and PHIVOLCS in developing vulnerability curves for key building types in GMMA will provide an estimate of the risk due to wind storms in the Philippines. For some of the identified building types an analytical approach was developed using computational fluid dynamics that compute for the wind pressure distribution on the existing structure. Threshold values of connections determined from empirical tests are then used to evaluate the damage state of the building. In education, the IAS9 was very successful in its objective of promoting world class research and education on wind engineering. Lastly, in regulation and promotion of Green building, the BERDE and the Quezon City ordinance 2009 are current initiatives that strengthen the acceptance of Green building in the country.

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