

TECHNOLOGY

Asian Outlook on Engineering and Technology

Civil Computing: A Brief History of ACECOMS

Integrating Environmental
Sustainability
Disaster Resilience in Building Codes

Role of Technology
in Today's Disaster Management

Bottom-Up Nanotechnology
A Pathway to Commercialization

Modal Separation
Response Spectrum Analysis
Results from ETABS

GIS-based
Facility Information
Management Systems

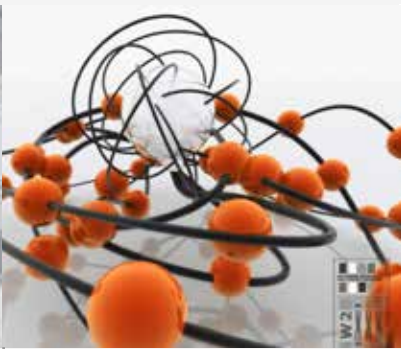
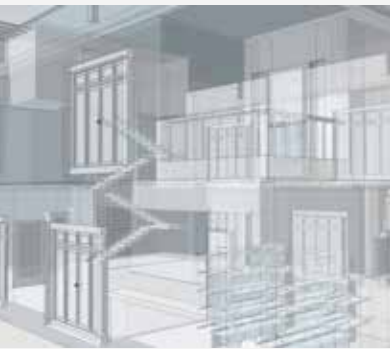


THE
[Inaugural Issue]

Formerly "Civil Computing"

www.consulting.ait.asia

Featuring



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Technology *Asian Outlook on Engineering and Technology* (M40-0318-0113), is published bi-annually by AIT Consulting, Asian Institute of Technology, P.O. Box 4, Klongluang, Pathumthani 12120, Thailand. Copyright © 2013. AIT Consulting. All rights reserved.

ISSN 2286-9158

Editorial



Editor in Chief

Naveed Anwar, Ph.D.

Editorial Team

Siddharth Jabade, Ph.D.

Olga Shipina

Jen Pangilinan

Kim Escobin

Lay-out and Design

Pitirudee Angkhananuchat

Khattiyanee Khancharee



AIT Consulting

aitconsulting@ait.asia

www.consulting.ait.asia



ACECOMS

acecoms@ait.asia

www.acecoms.ait.asia

km. 42 Paholyothin Highway
Khlong Luang, Pathumthani
12120, Thailand

Tel : +(662) 524 6388

: +(662) 524 5533

Fax : +(662) 524 6655



DEAR READER

I would like to welcome you to the inaugural issue of the "Technology" magazine.

This publication is a forum for professionals and researchers to share and disseminate their contributions to the technological development of the Asian region. The magazine will draw upon the undertakings of the Asian Institute of Technology (AIT) and in particular those of AIT Consulting, the Asian Center for Engineering Computation and Software (ACECOMS), and the Habitech Center at AIT.

"Technology" builds upon the foundation laid by its pre-cursor "Civil Computing", a magazine published for over 15 years by ACECOMS, focusing on the engineering, technology, and the computing aspects of civil and structural engineering. This new issue now has a broader mandate and will cover various aspects of engineering, technology, environment, development, and management, with an emphasis on the regional context.

With over 50 years of excellence in these areas across the region, AIT - together with its partners, provides a strong platform for knowledge sharing. AIT Consulting, ACECOMS, and the Habitech Center, along with several centers of excellence including AIT Extension, CSR Asia at AIT, Center of Excellence in Nanotechnology (CoEN), Yunus Center at AIT, and ASEAN Regional Center of Excellence on Millennium Development Goals (ARCMDG), embody an outward focus to provide an excellent avenue to spread and utilize this knowledge to society at large, and professionals in particular.

I would like to invite you to join us in making this publication useful and valuable by sending us your feedback, contributing your own articles, achievements, and opinions on matters relevant to the technological development of Asia.

Naveed Anwar, Ph.D.

Executive Director, AIT Consulting

Director, ACECOMS

Affiliate Faculty, Structural Engineering, AIT

Nurturing Innovative Minds in Institutions...

Integration of Intellectual Property Rights



The role of an engineer has transcended the narrowness of geographical boundaries in this flat world of globalization. The transnational and cross-cultural competitive world demands innovation abilities of an engineer beyond technical skills.

Educational institutes are wellsprings of knowledge. They contribute to the development of young minds. Educational institutes prepare the students to respond to the ever-changing contours of social and economical needs of the society and thereby the nation. To take up this challenge it is necessarily to seed, nurture and create open, inspired, prepared, and enriched minds. To sustain the fierce competition, it is necessary to develop in students the ability to perceive the future, learn continually from the exhaustive global knowledge bank and innovate to meet evolving needs of society.

Intellectual Property (IP) system could be effectively used as one of the tools to seed and nurture creativity and innovation capability in students. Intellectual Property Rights (IPR) provides a legal framework that facilitates innovation by granting limited protection to the innovator against illegitimate copying and unauthorized use, in return for the innovator disclosing his creation to the society. The IPR system in effect provides a platform for the equitable sharing of knowledge so that others have access to protected knowledge for further legitimate development, with a proviso that any exploitation of IPR is done with the consent of the IPR holder, with reasonable benefits and returns to him.

Patent is one of the tools of IP. In the context of a patent, an invention pertains to technological problem-solving or technological improvements in relation to an article of manufacture or a manufacturing process. These technological changes add new functional features or improve the current functionality of a product, process, or machine. An invention may be a major breakthrough that results in the creation of an entirely new product or process, or it may be an incremental

improvement to a known product or process. Such an invention may be in a new or improved material, machine, apparatus, testing, or measuring equipment, component of a product, or a method or a process for making any of these. It could also be a new use of an existing material or a new combination of prior known but separate features that produce an unexpected new result when so combined.

In operational terms, a patent is a grant by a sovereign or state to a person giving him exclusive right to stop others from making, using, exercising, and vending his invention for a limited period of time, in exchange for disclosing his invention in a patent specification in a manner such that a person skilled in the art can reproduce the invention without undue experimentation. The patent system requires a disclosure of the invention in a specified manner, patent specification, defined by the statute.

It is well established that a significant portion of information related to technology resides in patent applications and granted patents that does not appear in other publication platforms.

The documents in the patent system is one of the most well-structured, indexed and retrievable documentation of technology. Patent search can be strategically used in the early process of research for effective technology development process. Patent search in research can be carried out to understand the trend of the new technology through patent information and to determine the main point of the technology described in the patent. The public availability of free patent databases over the internet provides a rich source of technical information provided in the patent documents.

It is necessary to effectively use the IP system in research and development in institutions. The richness of the patent documents needs to be well exploited in the research by students to develop innovative technologies in educational institutions.

The proposed approach is to seamlessly integrate Intellectual Property Rights (IPR) in technical education by incorporating the IPR process in the student thesis / projects from a very early stage so that the students get exposed to significance of prior art searches, analysis of prior art in the context of the problem they are solving, developing solutions that are novel, have tailored inventive steps and are useful.

The system is designed to catalyse the initial creation of a core group from interested students and / or faculty from departments or research groups or fields of studies. The core group is exposed to the basics of IPR in structured training programmes, taught how to identify problems, how to conduct patent searches, how to design inventions to solve the identified technical problems, how to design inventive steps in an invention, how to read patents and interpret claims. The IP literate core group then helps other students on how to approach their projects.

Such is a stress and burden free approach that does not add IPR as yet another subject but integrates and internalizes it in the student thesis itself. It adds value to the "learning" ability of the students and instills in them ethical values and trains them to observe, critically analyse and provide innovative solutions thereby nurturing innovations. The problem-based "learn as you do" system naturally induces a student to explore and exploit the richness of existing knowledge (prior art), contextually build on it and provide technical solutions to problems as he assesses it, and in the process fosters innovations and creative minds. 🌐

Author

Siddharth Jabade, Ph.D.



Director, Innovation and Intellectual Property Rights, AIT Consulting

References

Jabade, Siddharth, Abhyankar Hemant and Ganguli Prabuddha (2008) "Model IPRinternalise™ – Integrating Intellectual Property Rights in Technical Education"; World Patent Information

Civil Computing: A Brief History of ACECOMS

Rooted in the MicroACE Club

In 1985, a group of engineers and computer enthusiasts, led by Prof. Worsak Kanok-Nukulchai, then Assistant Professor at the Asian Institute of Technology (AIT), formed an informal club to provide an early impetus for microcomputers, an emerging technology at that time.

The group met regularly, developing simpler and more “controllable” versions of structural analysis programs, using finite element methods and procedures. As their grasp of microcomputers became renowned, the MicroACE members began to share their knowledge by conducting trainings targeting professional circles.

Building blocks

In a span of 10 years, the club produced three types of software – MICROFEAP 1 & 2, with Dr. Somporn Attesawarong as one of key authors and XETABS, authored by Prof. Worsak Kanok-Nukulchai.

In 1993, it was decided that the club's potential to contribute to the industry could be greater if it was to evolve into a formal operation and cover a more extensive scope. The establishment of a center culminated in 1995 when the Asian Center for Engineering Computations and Software (ACECOMS) was launched, headed by Prof. Worsak Kanok-Nukulchai as Founder and Director. ACECOMS was first situated in AIT's School of Engineering and Technology (SET) - formerly the School of Civil Engineering. Dr. Naveed Anwar, who started the center together with Prof. Worsak Kanok-Nukulchai, was appointed later as the center's second Director and continued the responsibility for leading ACECOMS to not only become a self-sustaining center but also as the region's first in its field. Today, ACECOMS carries out research and consulting services on specialized computing needs, such as failure investigation, design reviews, and evaluation of structures. The center also offers training and continuing education and continues to develop software specializing in engineering functions.



"Civil Computing"

In August 1995, ACECOMS published its first newsletter titled "News and Views" to report its activities. Originally published thrice a year, the newsletter was changed to "Civil Computing" to connect to a greater audience of professional engineers all over the world. The magazine now has a readership of over 8,000 members, accepting contributions from professionals, academics, and researchers worldwide. Over the past several years, "Civil Computing" has chronicled the advancement of high technology and in part ACECOMS, by highlighting the center's accomplishments and contribution to the industry, and the development of the region more broadly.

One notable issue was published in early 2005 as a tribute to the victims of the 2004 Asian Tsunami where evaluation of the structural damage in the region was presented. Recently, the magazine outlined the Thailand flood of 2011 - 2012, which devastated the country, flooded the AIT Campus and forced the Institute to relocate to Bangkok for several months.

The swiftness of engineering and technological development over the last decade is also inscribed in the 38 issues of "Civil Engineering." In 2003, the magazine reported the world's mega-structure achievement – the Hong Kong International Airport. In 2003, the magazine also featured the construction of the 321-meter-tall Burj Al Arab in Dubai, United Arab Emirates, as the world's tallest hotel at the time. The magazine tracked the progress of technology from what were once cutting-edge to now household staples, such as Bluetooth, the Wireless LAN (WLAN), and even wireless keyboards.

ACECOMS and AIT Consulting

Drawing from the resources existing at AIT, AIT Consulting (AITC) was established as a new organization to facilitate the institute's integrated expertise and services. The organization's vision is to assist in the application of science and technology to develop the Asian region, unify the strengths of the schools, units and experts at AIT, and increase the reach of AIT even further. Today, AITC and ACECOMS function symbiotically, synergizing on projects covering software development, seminars, and capacity building.

"Technology" - Turning a New Page

As this new year unfolds, the new magazine will continue to update readers with the latest developments in civil computing while featuring articles covering the five expertise of AIT Consulting.

"Technology" will also be an avenue to share new research findings based on current and past projects handled collectively by AIT. Defining Institute-level events and achievements will also be announced through "Technology." The magazine will be published bi-annually and will from now on provide a more diversified and comprehensive supplement for ACECOMS members, partners, the AIT community, and the general public.

ACECOMS TIMELINE

1985

MicroACE Club

Founded by Prof. Worsak Kanok-Nukulchai

1995

ACECOMS was formally established



2000

ACECOMS

celebrated its 5th Anniversary

Satellite Centers

formed in association with renowned universities, professional organizations, and consulting firms



SOFTWARE

1985 - 1995

MicroFeap P1 & P2

software developed by Dr. Somporn Attesawarong & Prof. Worsak Kanok-Nukulchai

XETABS software developed by Prof. Worsak Kanok-Nukulchai



1996

SDL-1

Software package consisting of several reinforced concrete design modules developed by Dr. Naveed Anwar

1997

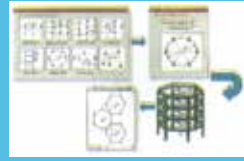
GEAR 97

software developed consisting of programs for assisting civil and structural engineers with design work

1999

BATS 99

3D building analysis software developed, a Windows version of XETABS



2000
GEAR 2000
2nd version released

2001

BATS 2001

2nd version released with enhanced features for more effective building analysis and design



GEAR 2003
3rd version released

TRAINING & CONFERENCE

1985 - 1995

M/SEAP

Training workshops



1998

O-SCAAD

One-day Seminars on Computer-Aided Analysis and Design of structures introduced



2000

I-SCAAD

International Seminars on Computer-Aided Analysis and Design of Structures introduced

2000

I-WCAAD
International Workshops on Computer Aided Analysis and Design of Structures introduced

2002

ACECOMS Satellite Center Convention

31 January - 2 Feb 2002

encouraged centers to operate more independently in their native countries and to use local means to generate more resources and research development activities in Civil Engineering field



PROJECTS

1993

Study on the oldest pagoda in Thailand

Studied the effect of vibration from additional vehicular traffic on the stability of the Phra Pathom Chedi, due to the proposed construction of the new Buddha Bucha road



2004

Design of 2 Box Girder Bridges for Thimpu Expressway in Bhutan

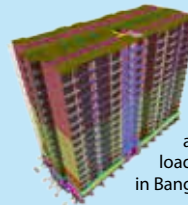
Conducted design of Semtokha Rongchu bridge, 50m, and Ngabi Rongchu bridge, 102m, located on Thimpu-Babesa Expressway for the Department of Roads, Ministry of Communications, Royal Government of Bhutan



2005

Design review of a Concord residential building in Dhaka, Bangladesh

Conducted an independent review of a 16-Storey apartment which had used a reinforced cement-sand block masonry load bearing wall system for the first time in Bangladesh



ASSOCIATES



1996

Association with Software Consultants Ltd., UK
Software: PROKON



1997

Association with G+D Computing, Australia

Software: Strand7



Association with Superior Software Solutions, USA
Software: GRASP



1998

Association with RoboBAT, France

Software: RoboBAT

2002

Association with Computers & Structures Inc., USA

Software: SAP 2000, CSI BRIDGE, ETABS, SAFE, PERFORM 3D, CSI COL



MAGAZINE ISSUES



Jul - Aug 1995
"News & Views" released for the first time



Jan - Jun 2000
Renamed to Civil Computing: Computer Applications in Civil Engineering"



Jul - Dec 2000
Millennium issue highlighted ACECOMS 5th anniversary



Jan - Mar 2001



Apr - Sep 2001



Oct 2001 - Feb 2002



Mar - Sep 2002



Oct 2002 - Mar 2003



Apr 2003 - Aug 2003



Sep 2003 - Mar 2004
Highlighted history of ACECOMS with an in depth account of Associate Centers' activities in 12 countries

2005

ACECOMS

celebrated its 10th Anniversary

2010

ACECOMS

celebrated its 15th Anniversary

AIT CONSULTING
was established
June 2010

2011

ACECOMS

joined hands with
AIT Consulting



2005 Con-Prime

Concept, Practice and Implementation in Engineering Seminar series marked ACECOMS 10th anniversary

ConPrime-1 March

included topics on modeling, analysis and design of buildings and was attended by over 50 engineers from around the globe.

ConPrime-2 June

included topics on concept modeling and analysis of finite element and featured a special lecture by Ashraf Habibullah, CEO, CSI Inc



2006

ConPrime-3 February included topics on analysis and design of bridge structure and featured a special lecture by Dr. Narendra Taly, professor, Civil Engineering, California State University, Los Angeles

EASEC-10

"Reaching the world" August The East Asia-Pacific Conference on Structural Engineering and Construction held in Bangkok, Thailand was co-organized by ACECOMS under AIT

2010

Mega Projects Seminar

"Challenges for Structural Engineers" April featured guest speaker, Udom Hungspruke, Senior Vice President and Principal, Thornton Tomasetti, USA and the main structural designer of Petronas Twin Towers, Malaysia



ACEE-2010 December

3rd Asia Conference on Earthquake Engineering was organized by ACECOMS



2008

Design and dynamic analysis of tallest steel stack in Thailand

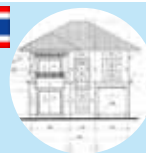
Conducted design, dynamic and wind response analysis for the 135m high Patkol chemical stack which serves as a chimney for the petrochemical processing industry



2009

Seismic evaluation of a Pruksa residential building

Conducted independent seismic evaluation of a two-story precast bearing wall system for a residential building



Design of 2 Lagos Bagadry Crossing Bridges

Conducted overall review and detailed design for two flyover bridges, 30m and 50m, located in Lagos-Bagdry express way in Nigeria



2011

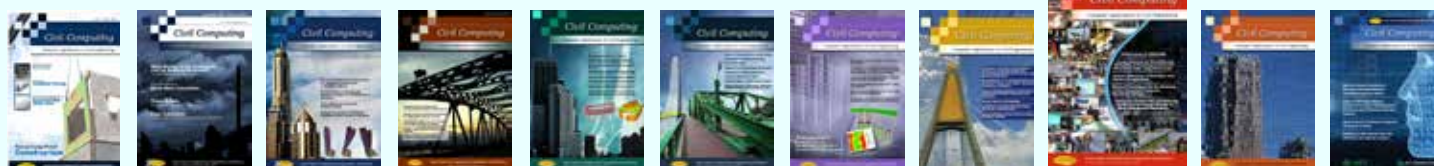
Structural design of largest steel factory in Bangladesh

Conducted structural development and design of the 40,000 sqm steel factory building for Pharmaceutical Co., Ltd., the largest Pharmaceutical Company in Bangladesh



Salient ACECOMS Members

VSL (Thailand) Co.,Ltd.	Concord Architects & Engineers Ltd.	
Team Consulting Engineering and Management Co.,Ltd	FREYSSINET PHILES, INC.	
Italian-Thai Development Public Co., Ltd.	Meinhardt Philippines	
Meinhardt (Thailand) Ltd.	Hyder Consulting Philippines, Inc.	
Pruksa Real Estate Co., Ltd.	Ove Arup & Partners (Philipp Branch)	
	Sy^2 + Associates, Inc.	



Apr - Aug 2004 Sep 2004 - Feb 2005 Mar - June 2005 Jan - May 2006 Feb 2007 Aug 2007 May 2008 Jan 2009 Mar 2010 ACECOMS 15th Anniversary Issue Mar 2011 Jun 2012



News & Updates



AIT Consulting provided technical assistance and support to several Asian Development Bank funded projects. Two recent activities are highlighted below:

ADB performs Asset Inspection in Sri Lanka, Project Procurement-Related Review in Mongolia



Hambanthota, Sri Lanka: *H/Vihargala School was one of the five schools inspected for ADB*



Erdene Soum, Mongolia *One of the highway access roads reviewed for project compliance*

The Asian Development Bank's (ADB) Office of Anticorruption and Integrity conducted a project procurement-related review (PPRR) of selected ongoing ADB-financed projects to determine compliance with applicable ADB's policies, guidelines, and loan/grant agreements. In 2012, ADB engaged the services of AIT Consulting to conduct asset inspections and project procurement reviews of two PPRRs relating to ADB-financed projects in Sri Lanka and Mongolia.

In Sri Lanka, five educational facilities that are part of the ADB-financed

project "Education for Knowledge Society Project" (EKSP) were inspected. EKSP aims to improve the quality, relevance, management, effectiveness, and equity of access to secondary and tertiary education, and training programs in rural and disadvantaged areas of Sri Lanka.

While in Mongolia, the construction of a railway crossing, two link roads and an access road were reviewed to determine whether quality was maintained as per project requirements. 🌐

ADB's Transport Forum promotes Sustainable Transportation

"Inclusive and Sustainable Transport" was this year's theme in the ADB's transportation forum held on 6-8 November 2012 in Manila, Philippines. The most critical issues facing transport in the Asia Pacific region today were discussed and debated in the forum. The forum program spanned the breadth of current issues in inclusive and sustainable transport including key sessions on urban transport, road safety, green freight and transport technologies, climate change resilience, mode choice, socially inclusive transport, road asset management, and cross-border transport.



The event brought together the world's leading transport experts, representatives from various consulting organizations, key developing member country officials, and ADB transport experts. Various government representatives, consulting organizations, and donor agencies joined the

forum making the event ideal for knowledge exchange in themes covering future trends in transportation development, and professional networking.

During the meeting, ADB shared the leading aspects of their work in member countries covering building low-carbon, safe, accessible, and affordable transport systems. Engr. Samat Sukenaliev, Project Development Engineer, represented AIT Consulting in this forum. 🌐



AFGHANISTAN

Afghanistan's Ministry of Higher Education strengthens Education Initiatives



AIT, Thailand Dr. Naveed Anwar (left) discusses potential partnerships with H.E. Prof. Obaidullah Obaid, Minister of Higher Education, Afghanistan (right) and other officials from MoHE Afghanistan



AIT, Thailand L-R: Mr. Mohammad Qasim, Project Manager, MoHE-SHEP Partnership Project; Dr. Naveed Anwar, Executive Director, AIT Consulting; Dr. Jonathan Shaw, Executive Director, AIT Extension; Prof. I.M. Pandey, Vice President of Academic Affairs, AIT; Prof. Habibullah Habib, Chancellor, Kabul University; H.E. Prof. Obaidullah Obaid, Minister of Higher Education, Afghanistan; Prof. Said Irandoust, President, AIT

Afghanistan's Ministry of Higher Education (MoHE Afghanistan) is set to further rehabilitate and strengthen the quality of the country's education system by implementing the project "Strengthening Higher Education Program" (MoHE-SHEP). The program, funded by the World Bank, focuses on strengthening institutional development, standards and content development, training and professional development, study abroad programs, English language training, and an Afghan Master's program that supports 12 core universities in Afghanistan and nine regional universities.

In 2008, MoHE-SHEP established a partnership with the Asian Institute of Technology (AIT). A total of seven students from Afghanistan completed higher education at the Institute since then. Currently 15 candidates are pursuing degrees in AIT. H.E. Prof. Obaidullah Obaid, MoHE Afghanistan, visited AIT in October 2012 to sign a Memorandum of Understanding (MoU) to affirm the current collaboration with the Institute. His Excellency also expressed MoHE Afghanistan's desire to join the AIT Council. He then announced that they wish to send more than 100 students to study at the undergraduate level, and about 30-

40 students for study at the master's and doctoral degree programs.

MoHE Afghanistan also met with AIT Consulting (AITC) to discuss the need for a staff development program in order to boost the quality of faculty members in Afghanistan. In response, AITC is now working with AIT Extension, a center that brings over 25 years of experience in training and continuing education, to organize two professional development programs on Basic Research Methodology and Quality Assurance for faculty members and research staff from Afghan universities in early 2013. 

Professional Development Program on Research and Teaching Methodologies for Balkh University Faculty




AIT, Thailand Dr. Naveed Anwar with the training participants from Balkh University, Afghanistan outside the AIT Consulting office

MoHE Afghanistan continues to uplift the quality of the country's education system through the AIT-BU (Balkh University) partnership. The Ministry requested AIT Consulting to assist in organizing a professional development program on Research and Teaching Methodologies for 14 faculty members from the Faculty of Engineering.

The training was held on 1 - 14 August 2012 at AIT and aimed to enhance the participants' capa-

bilities on teaching methodologies, the key issues and concepts of the research process, and enhance their knowledge and skills and conducting research in the areas of engineering and sciences. This program used a variety of training methods, combining interactive lectures with a balance of participatory learning techniques such as group discussions, brainstorming, demonstration, observation, project work, case studies, and hands-on practices. Field visits to Kasetsart University,

Mahidol University, and Thailand Science Park (NSTDA) were also incorporated to observe the educational facilities' best practices.

Resource persons and facilitators for the training courses were drawn from AIT, prominent academic institutions, and training institutions in Thailand. For more information about the training please see page 40. 

 **MYANMAR**

UNESCAP and UN HABITAT support Myanmar's Building Code Initiatives



Following the success of its recently completed project "Incorporating Environmental Sustainability and Disaster Resilience in Building Codes," the United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP) showed an increased interest to support the Myanmar National Building Code (MNBC) project. Earlier, UNESCAP partnered with AIT for the analysis of the building codes of nine countries in the Asia-Pacific region and documented seven good practices for green and resilient buildings while focusing on building code enforcement.

MNBC's goal in developing the code is to prioritize protection against the uncertain occurrence of the two most common natural disasters in Myanmar: earthquakes and strong winds. The Ministry of Construction (MOC) and its technical partner the Myanmar Engineering Society (MES) have been working towards developing and enforcing proper and stricter building codes through the

Myanmar National Building Code (MNBC) project. The ministries are drafting the code in accordance with ASEAN building standards to bring Myanmar in line with neighboring countries and improve the structural elements of the buildings in the country.

UN-HABITAT, the United Nations Human Settlements Program, an agency that promotes socially and environmentally sustainable towns and cities, is leading this project and has selected various regional and international experts and institutions to review the seven different parts: 1) Planning, Environment, Administration and Legislation, 2) Architecture and Urban Design, 3) Structure, 4) Soil and Foundation, 5) Building Services, 6) Materials and Construction Practices, and 7) Safety. UNESCAP with the help of AIT Consulting, will be reviewing the third part of the code which includes wind design criteria, seismic design criteria, and other criteria relating to concrete, steel, masonry, and design. 🌐

Structural Peer Review of Diamond Inya the Tallest Building in Myanmar

Myanmar Golden Wing Co., Ltd. (MGW), a well-reputed local real estate developer, is planning to build a high-end residential condominium set to become the tallest building in the country.

The new condominium called Diamond Inya View Palace Building, located near Inya Lake, Yangon, will have an approximate floor area of 106,680 sqm and will be 34-story tall, 9-stories higher than Myanmar's current tallest building located in Mandalay, which is 25 stories tall.

AIT Consulting has the privilege of taking part in this project by conducting a Structural Peer Review of Diamond Inya View Palace Building. The main objective of the Structural Peer Review is to evaluate the structural system and design of the building in terms of suitability of selected structural systems, cost effectiveness, efficient use of materials and other resources, and conformance to building codes, standards and established engineering practices, with a special emphasis on the effects of earthquakes, wind, and other applicable demands. 🌐

Collaboration Efforts in Myanmar

Two of the most established companies in Myanmar, Suntac Technologies and Shwe Taung Development Co. Ltd (STDC) are in collaboration with AIT Consulting (AITC).



Suntac Technologies is a subsidiary of the Suntac Group of companies, established in April 1999 to enhance the rapid technological growth and infrastructural development within Myanmar through the provision of a comprehensive range of technological services.



Shwe Taung Development Co. Ltd., established in 1990 has been dedicated to achieve sustainable and healthy growth and has set out its mission to be a part of the rebuilding processes of the nation.

AITC Executive Director Dr. Naveed Anwar and Project Coordinator Engr. Thauung Htut Aung visited Myanmar to discuss the possible collaboration between AITC and the two organizations. Suntac is interested in software development collaboration for Building Construction Materials Estimation. Shwe Taung Group is collaborating with AIT Consulting, particularly for capacity building in the areas of construction management and structural engineering. 🌐



Yangon, Myanmar *Diamond Inya View Palace Building*


MYANMAR

"Recent Developments in Structural Design of Tall Buildings" Seminar, Conducted in Myanmar

On 12 September 2012, Myanmar Engineering Society (MES) in collaboration with AIT Consulting organized a seminar in Yangon on the recent developments in the structural design of tall buildings. The seminar was held at the MES building. MES members and invited structural and civil engineers attended the seminar which focused schematic design, structural systems, re-

cent codes, standards and guidelines, seismic and wind loadings, analysis procedures, performance-based design, modeling, and the analysis and design issues in tall buildings. Dr. Naveed Anwar, Executive Director, and Engr. Thaung Htut Aung, Project Coordinator, both from AIT Consulting were the key speakers in the seminar. 🌐



Yangon, Myanmar Dr. Naveed Anwar (Top right) and Engr. Thaung Htut Aung (Bottom right)


PAKISTAN

NUST Shows Interest to Initiate Educational Programs in Collaboration with AIT



AIT, Thailand NUST delegates at the AIT Consulting office

A delegation from the National University of Sciences and Technology (NUST), a public university founded by the government of Pakistan in 1981, led by Engineer Muhammad Asghar, Rector of NUST visited the Asian Institute of Technology (AIT) on 12 October 2012 to discuss mutual collaborative activities between AIT and NUST and to initiate programs of interests.

NUST showed interest to initiate dual degree programs and one semester programs at the post

graduate levels, two-stage undergraduate programs, faculty and student exchange programs, internship opportunities for AIT Undergraduate students, conducting joint research projects, and organizing joint international conferences in Pakistan and / or beyond the region.

The delegation toured around the campus and interacted with the AIT President, Vice Presidents, Deans, Professors, Directors, unit heads, NUST

scholars at AIT, and AIT students from Pakistan. The delegation also visited AIT Consulting where Dr. Naveed Anwar briefed the group about the projects and activities of the organization. The delegation was impressed by AITC's activities and is seeking collaboration between AITC and NUST Consulting for joint projects in Pakistan and beyond. 🌐

 **PHILIPPINES**

International Conference addresses Global Challenges in Civil Engineering Education



Manila, Philippines Dr. Naveed Anwar at the ICCEE2012

The Department of Civil Engineering, De La Salle University-Manila in cooperation with the Association of Civil Engineering Educators of the Philippines (ACEEP) hosted the ICCEE2012 – International Conference on Civil Engineering Education Conference 2012 with the theme “Addressing Global Challenges in Civil Engineering Education” on 9-10 November 2012.

The forum was held to establish a platform for Civil Engineering (CE) educators, researchers, practitioners, school administrators and students to exchange information, and share lessons and discuss strategies on how civil engineering education can be improved to produce globally competitive and socially responsible professional civil engineers. ICCEE2012 was comprised of keynote sessions by distinguished speakers, parallel sessions on a variety of topics by presenters from

academe, industry and government, a seminar/workshop on Outcomes-based Education for young Civil Engineering instructors, a student research poster presentation, ICCEE 2012 Awards, Various Exhibits and the 10th National CE Education Congress.

One of the keynote speeches delivered during the forum entitled “Developing Interactive, Computer-based Learning Tools for Civil Engineering Students” focused on the interactive application for the computer-aided learning of civil engineering curriculum (see full article on page 35). The paper was authored by Dr. Naveed Anwar, Executive Director, AIT Consulting, Asian Institute of Technology, Thailand; Prof. Ricardo P. Pama, President, University of the Cordilleras, Baguio City, Philippines and Prof. Jayanta Pathak, Professor, Civil Engineering, Assam Engineering College, India.

 **SRI LANKA**

“Greening the Construction Industry” Symposium promotes Sustainability



A growing demand for building projects that use environmentally-friendly and energy-efficient materials implies an increased environmental awareness. Rising energy costs over the past few years have spurred a green movement in the construction industry worldwide.

To further promote green building awareness, the Green Building Council of Sri Lanka (GBCSL) a national, non-profit organization that is committed to developing a sustainable property in-

dustry for Sri Lanka, organized a symposium on “Greening the Construction Industry” held on 5 October 2012 at Hilton, Colombo. Among those invited was Dr. Naveed Anwar, Executive Director, AIT Consulting. The symposium was opened by Prof. Ranjith Dissanayake, Chairman, Board of Education & Training of GBCSL, followed by a keynote on Greening the Construction Industry by Prof. Sarath Kotagama, Professor of Environmental Science, University of Colombo. An address by the chief guest Mr. P.H. L. W. Perera, Secretary, Ministry of Construction, Engineering Service and Housing, concluded the symposium.

Non-linear Analysis of Structures seminar conducted at Central Engineering Consultancy Bureau, Sri Lanka

A seminar focusing on Non-linear Analysis of Structures held on the 6 October 2012 in Sri Lanka was well attended by engineers from the Central Engineering Consultancy Bureau (CECB).

Non-Linear Analysis, which is a key part of structural engineering, plays an important role in the design of new and existing buildings and is becoming a popular tool for performance evalu-

ation of structural systems at the life safety and collapse prevention levels.

AIT Consulting’s Executive Director Dr. Naveed Anwar was invited by CECB’s Addl. General Manager Eng. K.L.S. Sahabandu, also Vice President of the Society of Structural Engineers Sri Lanka, to conduct the seminar.

International Conference on Sustainable Built Environment (ICSBE-2012)



Around 300 engineers from all over the world participated in the International Conference on Sustainable Built Environment (ICSBE-2012) held at Earls Regency, Kandy, Sri Lanka on 14 -16 December 2012. The ICSBE is a non-profit, educational organization with the mission to provide an international forum for the presentation and discussion of frontier research related to Sustainable Built Environment and their related technologies. The conference is embraced by the mainstream engineering community as the leading forum for the presentation of research and the place to build relationships with leading engineers in their field from around the world.

Dr. Naveed Anwar, Executive Director, AIT Consulting delivered a keynote speech at the conference on “Integrating Environmental Sustainability and Disaster Resilience in Building Codes” (see full article on page 16).

 **SRI LANKA**

Ministry of Ports and Highways focuses on Sustainable Infrastructure Projects



The Ministry of Ports and Highways is the apex organization in Sri Lanka for the ports and highways sector and is responsible for the formulation of relevant policies programs and projects to achieve the socio-economic development, mobility, connectivity, and accessibility needs of the people of Sri Lanka. The Ministry's vision is to become a leading partner in developing Sri Lanka as the "Emerging Wonder of Asia" by providing an island-wide modern road network and world-class maritime facilities.

On 3 October 2012, Dr. Naveed Anwar, Executive

Director, AIT Consulting, had the opportunity to meet Mr. R. W. R. Pemasiri, Secretary, Ministry of Ports and Highways, Sri Lanka to discuss a possible collaboration between the two organizations. The meeting was also attended by Mr. L.V.S Weerakoon, Design Office (C.P), Road Development Authority, and Ms. Ireshika Karunathna, Assistant Consultant. The Ministry expressed keen interest in working together for both ongoing and future projects. Proposals covering the delivery of a Professional Development program on Public Private Partnership (PPP) for the transportation sector and a workshop in the area of sustainable infrastructure projects are currently being developed by AIT Consulting.

Society of Structural Engineers, Sri Lanka



On 3 October 2012, Dr. Naveed Anwar was invited for a dinner by the President of SSESL, Prof.

Ruwan Weerasekera, also Professor of Civil Engineering (Division of Building and Structural Engineering) and Vice President of SSESL, and Engr. K.L.S. Sahabandu, also Corp. Additional General Manager, Central Engineering Consultancy Bureau. They discussed possible collaboration between SSESL and AIT Consulting and began planning for a workshop and training on the topic of Tall Building Design in 2013.

Sustainable Highway Infrastructure Workshop in Sri Lanka, a well-attended Event

More than 70 engineers and government officials involved in infrastructure and highway development projects in Sri Lanka attended the Sustainable Highway Infrastructure workshop. The workshop was organized by Ministry of Ports and Highways, Sri Lanka in collaboration with the University of Peradeniya, Sri Lanka and the Asian Institute of Technology, Thailand held on 16 December 2012.

The workshop's theme focused on the need for new and existing infrastructure to comply with

high-quality technical standards, to meet strict environmental and health standards, and anticipate future demographic developments, in context of the 21st century.

The topics covered were relevant to the participants, emphasizing on the aspects of user costs, energy consumption, and long term environmental benefits as a sustainable solution for highway development. Dr. Naveed Anwar, Executive Director, AIT Consulting, opened the first session with an overview on Sustainable Infrastructure.

Chief guest Mr. R.W.R. Pemasiri, Secretary, Ministry of Ports and Highways, Sri Lanka opened the seminar which was followed by four consecutive sessions providing the participants an overview on the environmental sustainability, green design, and construction practices of a given highway project.

For more information on sessions and experts please see page 41.

 **THAILAND**

Bangkok's Action Plan for Earthquake Disaster Prevention and Mitigation kicks off



Thailand's Department of Disaster Prevention and Mitigation (DDPM), Ministry of Interior is in the process of developing an Action Plan for Earthquake Disaster Prevention and Mitigation for Bangkok to establish a safe and secure urban environment against potential earthquakes.

DDPM engaged several international experts including Panya Consultants Co., Ltd. (PANYA), a Thai Consulting Organization focusing on services in socio-economic, environmental and technological areas and Dr. Pennung Warnitchai, a renowned expert and Associate Professor at the Structural Engineering field of study at

AIT's School of Engineering and Technology to assist in developing the plan. Dr. Warnitchai is highly accomplished in the structural engineering industry and has helped shape Thai government policy-making by serving on a number of expert teams for drafting national standards and amending the ministerial regulation. Dr. Warnitchai is also an expert member of the Board of Directors for Thailand's National Disaster Warning.

Dr. Warnitchai and his team, including engineers mobilized through AIT Consulting, will be responsible for conducting a probabilistic seismic hazard assessment (PSHA) and preparing PSHA maps for Bangkok for bedrock site condition, conducting and measuring the shear-wave velocity soil profiles in Bangkok, conducting seismic performance evaluation of buildings in Bangkok, developing and modifying the HAZUS computer code for studying the seismic risk of buildings in Bangkok, and evaluating the effect of an earthquake to Bangkok. The action plan is scheduled for completion by the end of 2013. AIT Consulting will be assisting in this development of the software and various other aspects.

Advisory Board and Technical Council discuss expansion to New Areas of Expertise




AIT, Thailand AIT Consulting's Advisory Board

The second meeting of the board and council was held on 7 August 2012 at the AIT Consulting (AITC) office. AITC's Semi-Annual Report was presented highlighting the various projects, proposals, and activities executed in 2012. The newly established Innovation and Intellectual Property Rights Unit, Quality Management System and the recent office renovation were also discussed during the meeting.

The Advisory Board meeting focused on resource management and AITC's expansion to more areas of expertise, particularly, Energy, IT & GIS, and Management. Topics covered within the Technical Council meeting also centered on AIT Consulting's expansion, resource management, and proposed initiatives such as E-learning and Mobile Application development.

The Advisory Board and Technical Council are the key elements of AITC's overall organizational structure, established to drive the organization forward and take an active role in overall operations and growth. The Advisory Board is comprised of representatives from AIT's partner institutions, international organizations, industry representatives, AIT alumni and members of the AIT Administration and provides overall guidance for the office. The Technical Council members are

comprised of members from the AIT administration, deans of the schools, faculty members, and directors of various centers at AIT, and offer guidance and advice on technical matters related to the projects undertaken by AITC. 

Advisory Board members

- **Prof. Said Irandoust**, President, Asian Institute of Technology (meeting Chair)
- **Mr. Jose A. Sy**, President and CEO of SY^2+ Associates
- **Prof. Elizabeth Siew Kuan Ng**, Director, LLM, Faculty of Law, NUS
- **Mr. Vatana Supornpaibul**, Director, Executive Director, Amata Corp
- **Prof. Worsak Kanok-Nukulchai**, Vice President, Resource Development, AIT
- **Dr. Barbara Igel, Dean**, School of Management, AIT
- **Dr. Jonathan Shaw**, Executive Director, AIT Extension
- **Mr. Tuck Oon Choong**, AIT Senior Alumni
- **Dr. Naveed Anwar**, Executive Director, AIT Consulting and Board Secretary

Technical Council members

- **Dr. Barbara Igel, Dean**, School of Management
- **Professor Sivanappan Kumar**, Professor of Energy Field of Study, AIT
- **Dr. Pennung Wanitchai**, Associate Professor of Structural Engineering, AIT
- **Dr. Sandro Calvani**, Director of ARCMDG, AIT
- **Dr. Saeed Zaki**, Managing Director of dwp
- **Dr. Naveed Anwar**, Executive Director of AIT Consulting and Council Secretary

AIT Consulting moves back to Newly Rebuilt Office after the Flood



Before Flood



During Flood



After Flood

The first of June 2012 marked AIT Consulting's return to its fully refurbished office at the Asian Institute of Technology (AIT), Pathumthani, after a temporary relocation to Two Pacific Place, Sukhumvit, Bangkok for almost six months. Its relocation since the 21 October 2011 was necessitated by the floods of the 2011 monsoon, which

devastated 65 of Thailand's 77 provinces. The AIT campus also succumbed to the flood waters and was completely inundated with some areas submerged up to three meters for over two months.

Rebuilding the new office began early in April 2012. AIT Consulting utilized in-house architects

to redesign the office. Though the existing building structure remained the same, the interior was remodeled to increase inter-unit accessibility, functionality, and energy efficiency. 🌐

Innovation and Intellectual Property Rights Unit launched in AIT Consulting



A new unit called the Innovation and Intellectual Property Rights (IIPR), headed by Dr. Sidharth Jabade, was recently launched by AIT to be housed in AIT Consulting. IIPR will serve to facilitate the effective use of the IP system to retain competitiveness, maximize profits and accelerate sustainable development.

The unit will spearhead activities related to the identification and protection of inventions, system developments for routing these inventions, and capacity building to create IP awareness. All of the above prioritize the protection of in-house inventions from AIT.

The newly established unit now plays a role in one of the Asian Institute of Technology's (AIT) prime 5-year research on sustainable decentral-

ized wastewater management. This research, led by Dr. Thammarat Koottatep, Associate Professor at AIT's School of Environment, Resources and Development (SERD), Environmental Engineering and Management (EEM) field of study, received a 5M USD grant from the Bill and Melinda Gates Foundation through the Reinventing the Toilet program.

IIPR is tasked to establish the structured innovation management process which includes the integration of IP and integrated process from ideation stage. Specifically, the IIPR unit will be involved in detailed patent search, patent analysis, patent landscape, technology gap assessment, patentability evaluation, design of experiments, patent cluster design, drafting and filing of applications in Thailand and other countries. 🌐

38 companies join AIT Career Fair



AIT Consulting booth at the career fair

A record number of 38 companies, with several industry recruiters from Vietnam and Malaysia, joined the bi-annual AIT Career Fair held early November.

The career fair offered a full range of job placement availabilities, internship opportunities, information on long-term career prospects, on-the-job training, research partners, and opportunities for networking with company representatives. The fair was held at the AIT Conference Center and attracted a healthy number of AIT students.

AIT Consulting was among the companies that joined the Career Fair to recruit future employees and showcase the organization's projects and activities to the broader AIT Community. The booth, managed by Mrs. Clarisa Cuarez, Human Resource Manager and Mrs. Olga Shipina, Marketing Officer, was visited by over 100 job seekers and inquiring students. 🌐

Integrating Environmental Sustainability and Disaster Resilience in Building Codes

By Dr. Naveed Anwar, Adnan H. Aliani, and Wathanyu Amatyakul

Buildings constructed today are likely to dictate city and town development and consumption patterns for the next 20 to 30 years. The way we design, build, and maintain our buildings will influence the sustainability of a city and the health and safety of its inhabitants for decades to come.



Background

Buildings constructed today are likely to dictate city and town development and consumption patterns for the next 20 to 30 years. The way we design, build, and maintain our buildings will influence the sustainability of a city and the health and safety of its inhabitants for decades to come. Today, many problems that cities cope with can be addressed by using and enforcing building codes. Disaster resilience, energy efficiency, and prevention of diseases are all issues that are influenced by building codes. Resilience to earthquakes, for example, is very much linked to construction. In earthquakes of approximately the same strength, 2 people died in California (United States, 2003), while 41,000 people lost their lives in Bam (Iran, 2004). Experts agree that most of the difference is attributed to the high standards of earthquake safety that California sets in its building code. In other words, many lives could have been saved by implementing and enforcing better building codes. The same is true for extreme weather events like cyclones and hurricanes, which are likely to occur more often with climate change; much of the destruction can be prevented by constructing safer buildings.

For environmental issues, buildings are extremely important too. Buildings consume energy in all phases of their lifecycle. Designing and constructing buildings that use resources efficiently is one of the best ways to address sustainability in a city. By incorporating disaster resilience and environmental design in the building codes, buildings in the future can be more people and environment friendly. This will decrease the carbon-footprint of cities and their impact on the environment, while increasing people's quality of life.

Most of the cities in the Asia-Pacific region are experiencing rapid urbanization and increased energy use (Figure 1). To accommodate the influx of these people, many buildings will be built in these cities in the coming years. Building growth is expected to be higher in the developing cities in Asia as it is less developed compared to developed cities in the world. In many of these developing Asia-Pacific countries, buildings are not built in an environmentally friendly manner as often times, current building codes do not take into account environmental issues and some of these countries lack building codes, or have codes with very low compliance rates. Therefore, improving the building codes of developing countries will have a greater impact as building growth is expected to be higher in this region and the responsibility is shared between various stakeholders (Figure 2) for their implementation, training and creating awareness among practicing engineers.

Authors:



Naveed Anwar, Ph.D.
Executive Director, AIT Consulting



Adnan H Aliani
General Secretary, United Nations Economic and Social Commission for Asia and the Pacific



Wathanyu Amatyakul, Ph.D.
Researcher, Asian Institute of Technology

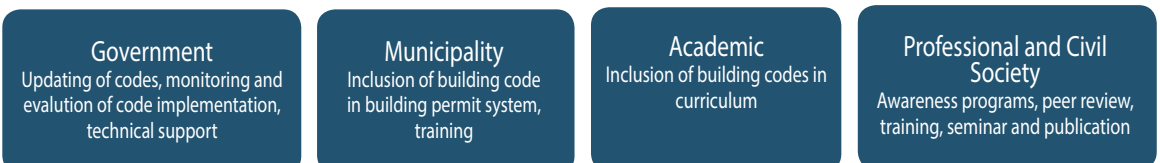


Figure 2 Major Stakeholders and Their Roles

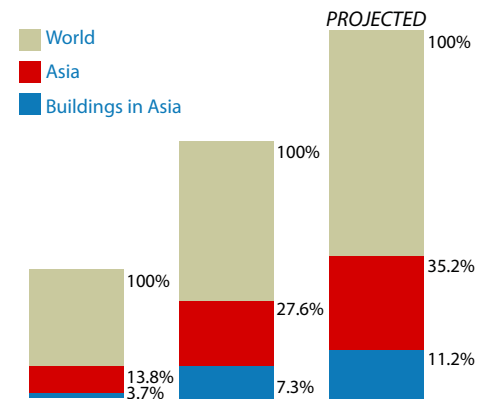


Figure 1 Asia's growing share of world energy use

Study Objectives

The overall research objective is to identify elements of environmental sustainability and disaster resilience both vertically, across government levels, and horizontally, across construction sectors, in codes that govern planning, design and construction of buildings in urban areas that can be integrated into building codes in developing countries in the Asia Pacific region. The specific objective of this research is to gain an overview of the current integration of environmental sustainability and disaster resilience in building codes and building code compliance in the Asia-Pacific region, the challenges, and strategies in building code enforcement, and to identify good practices in enforcing building codes.

Research Design

Methodology

The methodology used for this study is briefly mentioned below.

Identify Reference and Target Country

The main objective is to review the building codes of countries that are known to have integrated environmental sustainability and disaster resilience in their existing building codes and to identify elements of environmental sustainability and disaster resilience in these codes that can be integrated in building codes in developing countries in the Asia Pacific region. The first step involved identifying countries that are known to have integrated environmental sustainability and disaster resilience in their building codes. These countries will serve as the reference countries. In addition, the developing countries in the Asia Pacific region identified were known to have poor building codes; these will serve as the target countries.

Develop Analytical Framework

The building codes of the reference and target countries were reviewed to determine the elements of environmental sustainability and disaster resilience. An analytical framework was developed to determine the integration of the elements of environment sustainability and disaster resilience for the reference and target countries.

Analyze the Building Codes

The building codes of the reference and target countries were analyzed based on the analytical framework that was developed in the previous step.

Integrate Environmental Sustainability and Disaster Resilience in Building Codes

Based on the analysis, the element of environmental sustainability and disaster resilience that was integrated in the building codes was compared among the reference and target countries. The elements of the building codes from the reference countries that can be integrated into the building codes of the target countries were identified.

Organize Expert Group Meeting to Identify Challenges and Strategies in Building Code Enforcement

Even though there are building codes in some of the developing countries, the building codes do not have any value, as developers and designers do not comply with the codes. To make the building codes effective, the code has to be enforced. To identify the challenges and strategies in enforcing building code, the researchers organized an expert group meeting.

Identify Good Practices in Enforcing Building Codes

To make the building codes effective, it has to be first enforced. Through literature review and Expert Group Meetings, good practices were identified in enforcing building codes.

Analytical Framework

Building codes can be used to regulate many different aspects such as structural strength, accessibility, health, and safety. These regulations are integrated in technical provisions, which are grouped in categories. Categories differ from country to country. This research used the following categorization:

1. Structural Design
2. Building Materials
3. Buildings and Services (including building envelope, lighting, ventilation, heating, air-conditioning, and electrical, mechanical, and energy systems)
4. Plumbing (including sanitary, water, and waste treatment)

5. Fire Prevention
6. Landscaping
7. Construction Practices

The scope of this research project limits that the only prescriptions that will be analyzed are those that address environmental sustainability and disaster resilience. These can be grouped under any of the above categories. In environmental sustainability, for example, prescriptions minimizing water loss may appear under 'plumbing', while rules prohibiting the use of energy intensive appliances would be grouped under 'buildings and services'. For this research the following six categories were identified for environmental sustainability.

1. Material Conservation & Resource Efficiency

This element deals with the need to minimize the amount of resources used to increase the use of environmentally friendly materials.

2. Energy Conservation & Efficiency

This element includes regulations aiming to minimize energy use and maximize the use of renewable energy sources.

3. Water Conservation

This element includes prescriptions that minimize water use both within (water conserving fixtures) and around (water retention facilities) the house.

4. Soil & Land Conservation

Regulations related to this element include those that attempt to avoid wind erosion of the land surrounding the building.

5. Solid Waste Reduction

Building codes can address solid waste reduction both during construction (construction waste) and during use (household waste).

6. Air Pollution Control

This element deals with the potential of buildings to minimize air pollution. An example is by using environmentally friendly building materials or by building green roofs and using plants around the building.

For a building code to have integrated environmental sustainability well, it should address all six categories. However, some issues may be more important than others, depending on the local context. Similar to environmental sustainability, six categories has been identified for disaster resilience.

1. Wind Load Resistance

This element addresses factors such as mean roof height, design pressure, wind velocity, and connections between roofing felt and sheet metal.

2. Snow Load Resistance

This includes prescriptions for the strength of the roof and other structural elements.

3. Seismic Load Resistance

To withstand earthquakes, a building should use a certain minimum quality of building materials and have a strong structure.

4. Rain & Flood Load Resistance

Examples of prescriptions under this category are raising the ground floor above average flood levels or re-siting buildings outside flood-prone areas.

5. Wildfire & Bushfire Resistance

Prescriptions under this heading help to prevent the spread of bushfires and minimize the impact such as prescribing fire resistant materials.

6. Landslide Resistance

This includes prescriptions detailing how to minimize damage when the ground under the house would move.

As opposed to environmental sustainability, a building code does not need to address all of these six categories in order to have 'well implemented' disaster resilience. It depends on the relevance of the disaster to a country. In tropical countries, snow load resistance is usually not an issue, while in dry countries, floods are not likely to happen. Some of the above elements of environmental sustainability and disaster resilience can only be addressed under one building code category while others should be dealt with in more categories. The diagram in Figure 3 shows how this could be done. This model was used as the analytical framework.

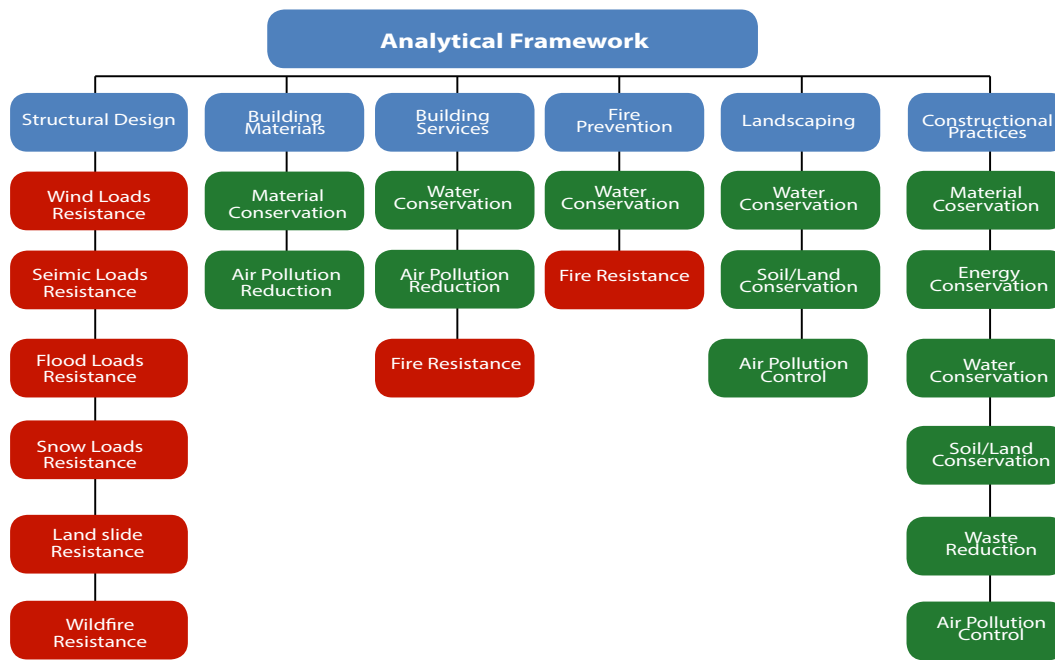


Figure 3 Analytical framework: The six elements of disaster resilience (red) and the six elements of environmental sustainability (green) should ideally be integrated under the above categories

Analysis of Building Codes

All of the target and reference countries have some type of rule governing building. In most countries analyzed, these rules are included in a proper building code issued under one single law, but in Thailand, the regulations are scattered over various ministries and therefore less coherent. In Sri Lanka, the same is true, but moreover, these regulations only apply to the city of Colombo.

Another difference between the countries is that some countries have a prescriptive building code, outlining exactly which materials and which techniques can be used

(USA-California, India, Bangladesh, Thailand, Sri Lanka, and the Philippines), while others have a performance-based building code, which only states the minimum or maximum values a building design has to live up to, leaving it to the owner, developer and/or designer to decide how to make sure that happens (Singapore, Australia and the UK). Although performance-based building codes allow more flexibility and innovations, it is harder for developing countries to implement them since it requires a lot of capacity from architects, engineers, and local government staff to make and check such calculations.

There are but a few countries that have integrated all aspects of environmental sustainability

Integration of Environmental Sustainability and Disaster Resilience in the Building Codes

Originally, building codes were adopted to improve safety and health in and around buildings. The concept of using a building code to address environmental concerns is relatively new to developing countries in the Asia-Pacific region. This is why not all environmental sustainability aspects have been dealt with sufficiently in their building codes.

USA-California, Singapore, and India have integrated all aspects of environmental sustainability. In case of California and Singapore, these requirements are followed, but in India, compliance is generally low. Other reference countries (Australia and the UK) have only integrated a few elements. The most well integrated element is energy efficiency. All countries either already have requirements for energy efficiency or are working on it. All building codes and regulations discussed have been updated recently, with Australia updating their code annually, except for Bangladesh and Sri Lanka, both countries are currently in the process of updating.

Water conservation is another element that is relatively well implemented, especially in reference countries. There are,

Environmental Sustainability	USA	Singapore	Australia	UK	Thailand	India	Bangladesh	Philippines	Sri Lanka
Material conservation & Resource efficiency	●	●	●	●	●	●	●	●	●
Energy conservation & efficiency	●	●	●	●	●	●	updating	voluntary	updating
Water conservation	●	●	●	●	●	●	updating	●	●
Land and soil conservation	●	●	●	●	●	●	●	●	●
Soil waste reduction	●	●	●	●	●	●	●	●	●
Air pollution control	●	●	●	●	●	●	●	●	●

Figure 4 Integration of Environmental Sustainability in Building Codes and Regulations

● = integrated, ● = integration status undetermined

Not all countries are equally prone to all disasters, and therefore, some disaster resilience elements are not applicable everywhere. Almost all the disaster resilience prescriptions have been included in the building code chapters on structural design. The only exception is fire resistance where in India and California, there is a separate code for fire safety; while the Philippines has requirements for fire-resistant construction materials.

Wind load resistance has been integrated in the code of all countries. Only Sri Lanka has voluntary prescriptions, other countries have mandatory rules that should safeguard buildings from storms and typhoons. The same is true for seismic loads; all countries that are prone to earthquakes have addressed this in their building code. This is not surprising, since this is the common reason for countries to draft a building code in the first place. Snow loads have

however, also many elements that are not well addressed including land and soil conservation, air pollution and solid waste reduction. The building codes in Singapore, California, and India address the environment around the house by including landscaping regulations. One example is to minimize air pollution and to improve water and soil conservation.

Interestingly, all reference countries have integrated energy efficiency and water efficiency with the other chapters of the code (energy in the sections dealing with appliances and constructional practices, water in the section on plumbing), but all other elements of environmental sustainability are generally dealt with in a separate 'green code' (such as the California Green Building Code or the Code of Environmental Sustainability in Singapore) and not integrated with the other requirements.

Target countries have similarly isolated energy efficiency, which is usually addressed in a separate building code which is not mandatory or not enforced, while most other elements of environmental sustainability are not addressed at all. Apparently, prescriptions relating to environmental sustainability are usually first included in voluntary guidelines, and then transferred to mandatory, but separate building codes, before they are mainstreamed into the 'normal' chapters of the main building code.

been addressed in each country that is vulnerable to it, except for the UK.

Less well addressed are rain & flood loads and landslide resistance. Out of the target countries, Bangladesh has the only code that currently addresses floods and is in the process of updating them. In 2011, many countries in South and South-East Asia were affected by major floods, leaving many homes damaged or even destroyed. With climate change, it is expected that such floods and the related loss of lives and goods, will happen more often, unless countries adapt.

Incorporating flood loads and landslide resistance in building codes and enforcing those is one good step in that direction. The reference building codes from the USA and Australia could serve as an example. Wildfire and bushfire

resistance is another element that is not integrated in most building codes analyzed. The Philippines is the only country addressing it in their building code. Again, the building codes of the USA and Australia, and the regulations of the Philippines could be used as an example for integrating

this element into other target country building codes as necessary. In India, the building code gives the local authorities directions on how to construct safe buildings in areas that are prone to more than one disaster.

Disaster Resilience	USA	Singapore	Australia	UK	Thailand	India	Bangladesh	Philippines	Sri Lanka
Wind Load	●	●	●	●	●	●	●	●	voluntary
Snow Load	●	N/A	●	●	N/A	●	N/A	N/A	N/A
Seismic Load	●	N/A	●	N/A	N/A	●	●	●	N/A
Rain and Flood	●	N/A	●	●	●	●	updating	●	●
Wildfire and Bushfire Resistance	●	●	●	N/A	●	●	●	●	N/A
Landslide Resistance	●	●	●	●	●	●	●	●	●

Figure 5 Integration of Disaster Resilience in the Building Codes and Regulations
 ● = integrated, ● = integration status undetermined

Building Code Enforcement

Challenges and Strategies in Building Code Enforcement

Even when countries have a building code that incorporates environmental sustainability and disaster resilience, it is often poorly enforced. In the Expert Group Meeting the

participants identified the challenges which are provided in the table below.

Table 1 Challenges and Strategies in Building Code Enforcement

Challenges	Strategies to Overcome
Lack of Awareness	<ul style="list-style-type: none"> Invest in education; both in the curriculum and in building strong school buildings as demonstration projects Build linkages with academic institutions Use the mass media and organize large-scale events such as 'earthquake awareness day' or 'building code day'
Code-compliant buildings are more expensive to construct	<ul style="list-style-type: none"> Establish different building codes for different buildings; complicated buildings should use a more sophisticated code than simple houses (e.g. Nepal). The code documents should be affordable and easily accessible
Lack of Capacity and Knowledge	<ul style="list-style-type: none"> Implement continuous training programmes to professionals, contractors and masons. Start with formal education curricula, but also use mobile training facilities and international development projects to build capacity Use third party verification by government accredited agencies/firms/individuals (e.g. China, Republic of Korea) if local government doesn't have the capacity to check building permit applications Use South-South learning to exchange experiences
Accountability and Enforcement Framework	<ul style="list-style-type: none"> Implement financial, fiscal or zoning incentives (e.g. India, Republic of Korea, Japan) Make housing loans dependent upon completion certificate Establish a stronger penalty system for corruption and non-compliance, particularly for larger, more complex buildings
Lack of coordination between authorities	<ul style="list-style-type: none"> Establish one regulatory body to coordinate enforcement Set up an awareness raising program to inform stakeholders about their roles

Good Practices of Building Code Enforcement

Almost all countries in the Asia-Pacific region have building codes. However, not all building codes incorporate elements of environmental sustainability and disaster resilience and not all codes are enforced strongly. ESCAP and AIT documented six practices in the Asia-Pacific region that were successful in increasing the share of green and/or resilient buildings. Some of the practices are presented below:

1. Keep it simple.

Nepal didn't have a building code until 2003. That building code has four different levels: the simpler the building design, the simpler the rules set for the design in the code. However, there is a need of strong building code enforcement. The city of Dharan decided to make compliance even easier and start with five rules that all new construction should follow. By explaining these rules to all stakeholders involved, compliance has risen quickly.

2. Raise awareness.

In central Vietnam, the NGO Development Workshop France has set up a programme to strengthen existing housing against damage caused by typhoons. The basis of the programme are ten simple construction rules, but the strength of the programme lies in the extensive awareness raising programme, which includes cultural events, radio and television broadcasts and adapting local myths and lyrics of songs to explain the importance of disaster preparedness. When one strengthens one's house according to above-mentioned ten rules, one can apply for a special housing loan.

3. Provide incentives.

Incentives, in whatever way, shape or form, can be a very effective means of encouraging compliance, as it can reduce the costs for the developer or buyer. Three major types of incentives were explored for this report:

a. Offer special housing loans.

In India, the National Housing Bank, with support from the German KfW Development Bank, established a housing loan programme where availability of loans is made dependent upon energy savings. Only when a new building is expected to consume 30 per cent less energy than a reference building, the developer is eligible for this specific housing loan, and the buyers of the apartments are eligible for sub-loans. Although additional incentives haven't been implemented yet in India, the programme could be made more attractive for developers by offering lower interest rates or preferential tax treatment.

b. Relax zoning restrictions.

Every building developer in the Republic of Korea must choose which energy saving measures he wants to implement from a list provided by the government. Every implemented measure is awarded with points. To receive a construction permit, one has to implement at least 60 points worth of measures. But if one manages to implement more than 70, 80 or even 90 points, zoning restrictions (e.g. maximum building height) are increasingly relaxed. In cities where space is scarce, developers can often earn back the extra investment in energy efficiency by renting out or selling this extra floor space, while it doesn't require any additional investment from the government.

c. Offer tax breaks.

Japan has chosen to look at housing from several viewpoints: housing quality (quality of construction material and techniques), safety (seismic resistance), environmental sustainability (energy and water efficiency) and the aging population (adaptability). Owners and developers who build or retrofit their houses according to certain quality standards set by the government can apply for a 'Long-life Quality Housing 'certificate'. With this certificate, they are eligible for tax breaks on their income, real estate and individual inhabitant tax. Even though the programme started less than three years ago, around 25% of all newly built detached houses are certified.

4. Attack the issue from all sides.

Singapore has made green building a national priority and has, for this purpose, drafted a green building master plan. Under this master plan, a variety of incentives for greening new and existing buildings have been established including partly mandatory for the minimum requirements set in the building code are raised every few years and are enforced strongly, and partly voluntary highlighting financial incentives, educational programmes, and awareness raising. Different instruments are geared towards different stakeholders such as technicians, CEOs, and project managers. The programme would not have been as successful as it is without the strong political backing shown by various government agencies.

5. Transfer responsibility to the private sector.

With the economic boom, more and more complex buildings were constructed in Chinese cities. Now, certified Supervision Companies are charged with this task; only with their signature for compliance can building developers get a building permit. This reduces the need for capacity building in every single local government and also transfers the checking cost from the public to the private sector.

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Methods to Implement Building Codes Effectively

Several methods have been identified to implement building codes effectively which are briefly discussed below.

1. Flexibility vs. simplicity: introduce a building code with various levels.

National governments are often the main driver for developing or reviewing a building code. A proper building code needs to be laid down in a law, such as the Building Act, to make enforcement possible. A basic precondition for any code development process is good cooperation between all relevant stakeholders, including national and local governments, architects, engineers and developers. This is important to avoid problems at the local level with implementing complex or impractical building codes developed at the national level. To resolve the issue of implementing complex building codes separate building codes for different types of buildings can be developed.

2. Low capacity in local governments: introduce private sector supervision.

Building plans have to be checked for compliance by local government staff but some local governments may lack the technical capacity to review complex plans. In such cases compliance checking of technically complex plans can be outsourced to private supervision companies.

3. Low awareness: incentivizing developers and owners.

This has already been discussed in the good practices section. National and local governments are important stakeholders to increase building code compliance, but owners and developers play a major role, too. They are the ones who will have to invest their time and money in constructing a building with higher quality, while it is usually easier and cheaper in the short term to construct a non-compliant building. When considering incentives to persuade them, it is important to recognize the difference between smaller low-cost housing projects and big commercial projects. The people paying for construction have different motives in investing, varied incentives should be made available.

Conclusion

Originally, building codes in the Asia Pacific region were aimed at improving health and safety in and around buildings. The concept of using building codes to further environmental design is something relatively new in the region. This is mainly why, in Asian building codes, disaster resilience is usually better covered than environmental design.

Five countries were considered as reference countries. The analysis of the building codes of a total of nine countries demonstrated that out of all the target developing countries, India is the only country that has addressed all six elements of environmental design. However, most of the building codes are voluntary and the parts that are mandatory are usually not much complied with.

Other target countries only address energy efficiency, although also mostly in a voluntary way and in a less comprehensive way than the reference developed countries have done. Solid waste management, air pollution control and land & soil conservation are items that are relatively new, even to reference country building codes.

The conclusions with regards to disaster resilience are slightly more positive. Resistance against storms and ty-

phoons were integrated as evident in all the building codes analyzed. Resistance against earthquakes is also well integrated. All countries that lie in or are close to seismically active areas have sections on seismic loads. There are, however, other important elements of disaster resilience that some countries have not been dealing with well. Floods, landslides, and wildfires are hazards overlooked in most building codes.

The documented good practices show that this can start both from the national and the local level. It may be easier to raise awareness, from the local level in order to reach the general public. When a strong regulatory system is in place, starting enforcement from the national level may be more effective, for example by implementing nation-wide fiscal, financial, or zoning incentives.

To ensure a sustainable and disaster resilient city, national and local governments should focus on integrating environmental sustainability and disaster resilience in building codes and also focus on enforcing the building codes in practice. To encourage developers and designers to build environmental friendly and disaster resilient buildings, governments may provide them incentives. 🌐

To ensure a sustainable and disaster resilient city, national and local governments need to focus on integrating environmental sustainability in building codes

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Natural Disasters

Visayas Earthquake-Philippines

February 2012



The Pacific 'Ring of Fire' proved deadly once again when at 11:49 a.m. on 6 February 2012, an earthquake of magnitude 6.9 Mw rocked through the Philippine Visayan Islands. The 11-kilometre-deep tremor killed 113 people and caused both widespread panic and property damage amounting to USD \$8.6 million. State authorities claimed that the cause of the quake was a previously undiscovered fault line; a "blind fault" 20 kilometres below the earth between the island provinces of Cebu and Negros Oriental. However, Environment Studies Professor Lemnuel Aragonés maintained that this fault had been known since 2008, when Negros Occidental hired private geologists to create a land use map for the province.

Nevertheless, the quake's epicentre was between both of the highly populated provinces, causing them to bear the brunt of the damage. With this epicentre having been only 72 kilometres (45 miles) North of Dumaguete in Negros Oriental, the recorded seismic activity in the city reached an intensity of 7 on the PHIVOLCS Earthquake Intensity Scale (PEIS). PHIVOLCS or Philippine Institute of Volcanology and Seismology had subsequently given a level-two tsunami alert, causing a panicked and unnecessary evacuation towards higher ground in tourist-populated area, Cebu City. By the next day alone, State seismologists had recorded over 1600 aftershocks. The strongest of these struck with a magnitude of 6.2 Mw happened four hours after the original quake. The Philippine National Police as well as Cebu-based mining volunteers assisted in rescue and retrieval operations.

Thankfully, no tsunamis had resulted from and thus aggravated the calamity, as the Tañon Strait between the islands of Negros and Cebu was found to be too narrow a gap to allow much movement of water. 🌊

Source: [Interaksyon News](#), [Sunstar News](#), [GMA Network News](#)

Floods in Northeast India

June 2012



Towards the end of June 2012, Northeast India faced what the Assam state minister described as "the worst flooding in the state since 1998." Officials report that the tragedy had claimed 124 lives, 16 of them from landslides alone. Following months of what the chairman for the Indian Tea Association (ITA) described as "the worst-ever drought seen in the past 15 years," workers had been looking forward to the annual monsoon rains for relief. However, this relief had taken a dark turn that week when a surfeit of torrential rains caused the Brahmaputra river to overflow, flooding all 27 districts in the Assam state. Over 40 embankments were breached, affecting the states of Arunachal Pradesh, Manipur and Meghalaya, and subsequently displacing over six million inhabitants. In Upper Assam, those in the river island Majuli had not experienced flooding so fierce since 1950. The repercussions of the calamity had been widespread, grievously affecting the diverse ecosystem the beautiful region is known for. The floods had not only swept away over 2,000 vil-

lages, but had also left predictions for Assam's tea harvests at an all-time low; a death knell for the economy of the world's largest tea-growing region. Another point of pride for Assam, the Kaziranga National Park, was also devastated in the floods' aftermath. More than 540 of the World Heritage Site's carefully conserved wildlife were killed, including 13 of the one-horned Indian rhinoceroses Kaziranga had painstakingly bred from near-extinction.

Officials report that over 480,000 people at the time had settled into government-run relief camps, and Prime Minister Singh had ensured that relief operations would have the "full assistance of the army." Once comfortably able to house two-thirds of the World's Indian Rhino population, the state of Assam found itself, in the aftermath, struggling to relocate the thousands of people unable to recover the homes they had lost in the disaster. 🌊

Source: [Au News](#), [Yahoo](#), [BBC World News](#), [Reuters](#), [DNA India](#)

North Korean Floods

July 2012



For months since mid-July 2012, North Korea grappled with devastating floods in 23 counties that claimed 175 lives, destroyed 8,600 houses and left 400 people missing and over 212,200 inhabitants homeless. Originally caused by Tropical Storm 'Khanun,' the first tropical cyclone in two years to directly impact both North and South Korea, the floods were exacerbated by torrential

rains on the 29th - 30th of July, and again on the 17th - 20th of August.

The North and South Pyongyang provinces were most affected, with approximately 442 millimetres (17.4 inches) of rain recorded in a 24-hour period in Pakchon County, North Pyongyang, alone. The floods' devastation included submerging over 65,000 hectares of agricultural land and demolishing over 60 factories. According to the Korean Central News Agency (KCNA), the deluge had also swept away 179,000 tonnes of coal and 200 pieces of equipment at the Kaecheon and Tokchon mining complexes, severely affecting the region's mining infrastructure. In a country still suffering from the ravages of its worst famine in a

decade, which had left six million people at risk of starvation in 2011, such destruction to North Korea's agriculture and industry was nothing short of a disaster.

In the wake of resulting chronic food shortages that threatened two-thirds of North Korea's population of 24 million, the country had turned to international aid, asking for assistance from the Red Cross and the UN's World Food Programme to name a few. Vietnam had pledged a donation of 5,000 tonnes of rice, and even South Korea pledged wheat and medicines in aid. This was the first of this type of contact between North and South Korea since Kim Jong Il's death in December 2011, but the neighbouring nation states were willing to temporarily lay aside their decades-old tension for the sake of providing relief to the calamity's hundreds of thousands of victims. 🌐

Source: *The Guardian UK, Business Recorder News, The Telegraph UK*

Typhoon Bopha Philippines

December 2012

Every year about 20 typhoons hit the Philippines often causing death and devastation. Last year, more than a thousand people were killed with hundreds still missing in the destruction left by Typhoon Bopha in Mindanao, the southern island of the Philippines.

National Disaster Risk Reduction and Management Council Executive Director Benito Ramos said that the toll would exceed the 1268 recorded deaths from Tropical Storm Sendong (Wushi) which hit Mindanao in 2011.

Bopha swept across eastern Mindanao in December with monster winds gusting up to 200 kilometers per hour, causing flash floods and landslides, flattening communities and banana plantations, and prompting President Ninoy Aquino to declare a state of national calamity.

The Typhoon, known locally as Pablo, was the strongest and costliest storm to hit the Philippines in 2012, according to the country's emergency management agency. It recorded a cost of \$898 million (USD) in damage as it caused massive damage to infrastructure and agriculture, destroying large tracts of coconut and banana farms and left 1.2 million families homeless.

To help the Philippines recover from the disaster, the UN Office for the Coordination of Humanitarian Affairs has issued a global appeal for \$65 million. 🌐

Source: *CNN, Reuters, Philippine Daily Inquirer*

Typhoon Haikui

August 2012



The first week of August 2012 saw a typhoon, dubbed 'Haikui' ('sea anemone' in Chinese), ravage its way through China, the Philippines, and parts of Japan. The damage this typhoon wreaked throughout the region was both extensive and devastating. Over eight million people were reported to have been affected, with 105 people killed, and property damage increasing up to a crippling USD \$2.09 billion.

Aptly similar to the sea anemone's deceptively harmless appearance, Typhoon Haikui did not reveal its true sting until six days after it was first detected, when Japan's Joint Typhoon Warning Center (JTWC) officially classified it as a 'Category 1' typhoon. Initially, it had been identified as a mere 'tropical depression.' Nevertheless, in the ten days it reigned – or rained, as it were – the cyclone submerged 184,800 hectares of land in China's Zhejiang Province, and 90% of Metro Manila, Philippines.

The breakdown of the rest of the considerable destruction it had wrought is as follows: Japan, the country least affected by the calamity, reported

Source: *The Guardian UK, Xinhua News*

rainfall up to 230 mm (9 in.) in Okinawa, enough to cancel 353 flights from Naha International Airport and impacting over 70,000 passengers. In China, economic stronghold Shanghai and provinces Zhejiang and Anhui were most affected, with 374,000 people evacuated from Shanghai alone. The third typhoon in a week to hit China's Eastern coast, Haikui devastated 4,452 homes in Zhejiang and its resulting floods similarly inundated 4,473 homes in Anhui. The former's provincial observatory reported wind speed up to 150 km/hour during the time. Meanwhile in Manila, Philippines, authorities were faced with over 783,000 evacuees displaced by the capital city's worst floods since 2009.

Relief efforts for both China and the Philippines continued throughout August, as police, soldiers, and construction experts worked tirelessly to save the thousands stranded on rooftops, boats, and notably, on what was once a scenic tourist attraction in China's Anji County when floods swamped a bridge to safety. In Manila, rubber boats had become standard fare as over 130 emergency crewmen used whatever means necessary to navigate the metropolis' flooded streets. 🌐



The photo shows aerial view of the damage caused by Typhoon Bopha in Mindanao, Philippines. Most of the fatalities are in the provinces of Compostela Valley and Davao Oriental. (Photo by Asst. Sec. Rey Marfil/Malacañang)

Role of Technology in Today's Disaster Management



Following the Indian Ocean Tsunami (December 2004), countries in the Asia-Pacific Region have indeed stepped up their preparedness to face disasters. Similar events in the following years for instance, Cyclone Nargis of Myanmar in 2008, and the earthquakes in China (2008), Haiti (2010), and Japan (2011) served as reminders to nations, forcing each to assess and reassess their preparedness on various fronts.

sana and Parma, this system was set up in the same year on a trial basis.

Following the Haiti Earthquake, the International Federation of Red Cross and Red Crescent Societies (IFRC), with the help of local mobile phone operators developed a system for communications and delivered vital information to over 1.2 million subscribers. The Trilogy Emergency Response Application (TERA system) was developed as SMS communication for disaster affected communities.

Author



Rajan Gengaje, Ph.D.
Head, United Nations Office for the Coordination of Humanitarian Affairs, Indonesia

Fresh in memories of those residing in Thailand and in the region is the quick reliance on communication technology available – how people resorted to Facebook, Twitter, and SMS for alerting friends and relatives as flood waters started rising in various parts of Bangkok in 2011.



Figure 1 Centuries-old technology: Chinese vessel used as the Emperor's seismograph notify occurrences of earthquakes. Following a tremor, the quantity of water spilled from the mouths of the horned animals would help predict the quake's intensity. (Museum in Beijing, China)

Though the levels of preparedness and the 'state of being prepared to face an overwhelming disaster' vary across countries, one could easily admit that today's emergency management moved several notches up more than what was practised by disaster managers two decades ago. In the run for sharpening response preparedness of communities and nations, technology has had and will always play a crucial role.

In the Philippines for example, the Surveillance in Post Extreme Emergencies and Disaster (SPEED), a project supported by the World Health Organization (WHO), uses SMS or text messages on mobile phones or the internet to alert emergency health officials to dangerous situations and send them health information, and receive data on health conditions in communities and reports of disaster damage. In response to a series of typhoons in 2009, typhoon Ket-



Figure 2 Remotely controlled, pilotless small helicopters with still and video cameras used by the Chinese Search and Rescue Teams for surveying disaster affected areas where access is difficult (National Search and Rescue Training Center, Beijing, China)



Figure 3 Modern day technology: Cabled sound and light probes used by search and rescue teams today for tracing victims under the debris of a fallen structure.



Figure 4 A caved-in building constructed as it is for the training of search and rescue personnel. One and a half floors of the building are below ground, as if caved in following an earthquake. This makes the search and rescue training life-like.



In Indonesia, the Jakarta Disaster Management Agency (BPBD) is using local knowledge and community-based mapping system called OpenStreetMap, to provide both accurate and up-to-date information as well as a mechanism to gather, maintain, and distribute open data. This is noted up as a first step in understanding the potential impact of a flood to know and map where all people, key structures, and logistic hubs are located.

With the advent of latest media technology, we often see cameras reaching the disaster affected site, wherever it is across the globe, even before any rescue personnel arrive

Figure 5 Advanced concrete cutters/drills used by search and rescue personnel under training

Table 1 Overview of technology at work across selected phases of disaster management

Selected Phases of Disaster Management	Technology at Work	Users	Purpose
Early Warning, Early Action	<ul style="list-style-type: none"> • Satellite imagery • GIS • Computer Modelling 	<ul style="list-style-type: none"> • National authorities • Global weather watch institutions • Regional Organizations • INGOs, NGOs, CSOs • Responding armed forces 	Informing people in harm's way and moving them to safer havens
Search & Rescue	<ul style="list-style-type: none"> • Advanced earth moving equipment • Concrete/steel cutters • Sound probes • Mobile clinics/hospitals • Trained search dogs 	<ul style="list-style-type: none"> • Search and Rescue professionals • Responding armed forces 	Saving maximum number of lives in shortest possible time and providing immediate medical assistance on-site
Impact and Needs Assessment	<ul style="list-style-type: none"> • Modern digitizers • Printers • Plotters • Cameras • Handheld devices 	<ul style="list-style-type: none"> • Assessment personnel • Other responders 	Quickly mapping the extent of impact and urgent needs of the affected
Emergency Communications	<ul style="list-style-type: none"> • VHF/UHF radios • Wireless sets • SATPHONES • Internet/Facebook/Twitter • SMS texts 	<ul style="list-style-type: none"> • Emergency responders • Affected communities • Governments • Responding organizations 	Ensuring that key messages reach targeted persons and quick decisions are made
Recovery/ Rehabilitation	<ul style="list-style-type: none"> • Earthquake and flood-proofing techniques • Retrofitting techniques • Cyclone/flood shelters 	<ul style="list-style-type: none"> • Governments • Communities • INGOs, NGOs, CSOs • Private sector enterprises 	Building back better, ensuring safety against potential disasters

on the scene. Media today, plays a crucial role in not only informing about the event, but also inducing pressure on rescue personnel and decision makers, raising an appeal about the event and in bringing to light the reality on the ground.

The use of technology spans all phases of managing an emergency. Table 1 provides a quick overview of the technology at work across selected phases of disaster management. The Early Warning System related technology used today for securing early warnings and simplifying the scientific information for the common man's use helps in informing the people in harms way and getting them out to safer havens. Similarly, the computer-based modelling technology helps in forecasting and depicting worst case scenarios helping governments and other organizations in taking precautionary measures.

The latest technology used by Search and Rescue Teams as well as Emergency Health Practitioners ensures that maximum lives could be saved in the minimum possible time and best health care is available to the affected.



Figure 6 A Japanese Search and Rescue Team member using latest technology to trace trapped victims under the debris (Japan Disaster Relief Team, Sichuan Earthquake-2008, China)

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TERA communication system, <http://www.ifrc.org/en/what-we-do/beneficiary-communications/tera/>

Advanced Information Management technology and tools now help us ensure that quality information about the disaster impact and the needs of affected people are available to the decision-makers as well as responders on-site.

The satellite photo imagery used in comparing the before and after scenarios for a disaster affected site helps decision makers gauge the scope of what has happened. The combined use of science and technology for the management of the dead and missing, and most recently the communications technology used by governments, communities, responding organizations as well as media persons – are all constant reminders that today's disaster response relies heavily on the technology available.

The use of technology is of course not limited to emergency response. In preparing to respond, and in all initiatives taken to reduce risk and mitigate impact, several facets of varying technology are seen at work. It is understood that for a nation, the 'state of being prepared' to face an overwhelming emergency is dependent on a number of factors including resource availability, training, institutional, legal-policy sup-

port available, and political commitment required to boost preparedness initiatives. The choice and use of technology seems to be conditioned by somewhat similar factors.

In the Asia-Pacific Region many countries have embraced advanced technology for managing disasters.

While technology-users continue to engage in meeting the omnipresent challenges:

- which one is the appropriate technology?
- why use it?
- what resources will be required for its sustained use?
- what know-how and training will be required?
- how to minimize costs and maximize impact?
- how to simplify its use?
- how to multiply its users?

the affected communities of tomorrow will be looking forward to the gains of science and technology in helping them quickly restore their lives. The onus of bearing a range of technology-related responsibilities thus lies on many shoulders. 🌐

In Focus

ASEAN Economic Community 2015

In Southeast Asia, particularly in Thailand's capital city, Bangkok, the central topic of conversation is all about the approaching ASEAN Economic Community (AEC) which is all set for 2015. The AEC is anticipated by the larger ASEAN Community to boost political security, economic and socio-cultural cooperation. Envisioning a single market and production base, the AEC seeks to transform the ASEAN into a region with free movement of goods, services, investment, skilled labor, and freer flow of capital.

AEC, Learning from the EU

There is a tendency to view the European Union's progress as a model for the AEC especially since the EU is the natural dialogue partner for the ASEAN. Differences originate from the two regional blocs' principles in governance. ASEAN leadership reiterates respect for sovereignty, territorial integrity and national identity while the EU is committed to integration through member state unanimity.

1 | ASEAN economic integration is slightly market-driven, while the EU is government-driven. A market-driven scheme is more feasible to adopt "open regionalism" which widens the cooperation to non-member states, while EU's custom union is exclusive only among its member state.

2 | ASEAN's decision making method is bottom-up with an inter-governmentalism mechanism known as soft regionalism, while the EU's is top-down with a supra national body mechanism known as hard-regionalism.

3 | The region may not adopt a single currency similar to EU. Rather, the ASEAN will become a free trade area but will require more time to become an economic and monetary union, which is what the EU is.

Thailand and the AEC

Among the 10 member countries, Thailand is arguably the most enthusiastic about AEC 2015. On October 2012, the Royal Thai Government inked an eight-point strategic plan prepared by the National Economic and Social Development Council. The plan outlines the strengths and weakness of Thailand's overall capacity to engage the one ASEAN community in preparation for 2015.



AEC	EU
Market driven	Government-driven
Bottom-up method	Top-down approach
No single currency	One currency – Euro



Bottom-Up Nanotechnology and a Pathway to Commercialization

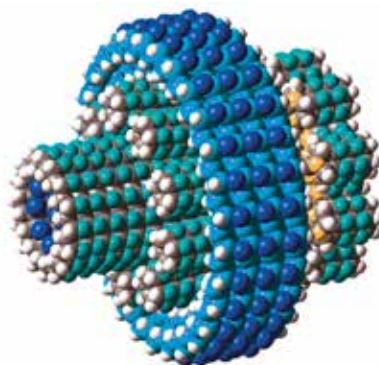
By Prof. G. Louis Hornyak

Nanotechnology is an enabling technology – it can make all products better. Bottom-up nanotechnology is chemistry at the nanoscale. The technology is usually quite remarkable and easy to make with relatively inexpensive ingredients. Perhaps affordable products can be made and distributed to those in need.

Introduction

The perspective presented is from an institution of higher learning that performs research on a regular basis. Such an institution is the Asian Institute of Technology (AIT) with general focus on its Center of Excellence in Nanotechnology (CoEN), from which bottom-up nanoscale materials are discovered, produced, and integrated into devices. In essence, CoEN, otherwise known as the Nano Center, develops ideas through research then through its ideal partners and enablers such as AIT Consulting. If accomplished properly and with a little bit of luck, then it's a win-win situation. First, terminology needs to be defined.

1. Bottom-Up Nanotechnology is nanotechnology made in an inexpensive way. It is a way of synthesis that does not require sophistication or too much expertise. The term "bottom-up" refers to the synthesis of nanomaterials from atoms and molecules by simple, straightforward chemical processes. No high-tech lithography or particle beams required. No extreme vacuum or plasmas are required. No extreme temperatures or pressures needed. All work is accomplished under mild conditions of temperature, pressure, and pH with readily available and usually inexpensive chemicals. From such processes, nanomaterials can be synthesized from the bottom-up. Concomitantly, such bottom-up nanotechnologies become attractive to industry due to straightforward scale-up potential – akin to the way of chemical products. Bottom-up nanotechnology based materials and devices offer a facilitative route to application and subsequent commercialization.
2. AIT Consulting is a center at the Asian Institute of Technology that functions to enhance the application of science and technology towards development of the Asian region. It offers solutions in technology, engineering, environment, development, and management that bring a successful sustainable growth strategy to the rapidly developing world. As a researcher, it would be the first place to go on campus to find out where to begin development of a potential application once conceived, tested, and benchmarked.
3. Commercialization is the application of science for the purposes of commerce. The concept is as old as civilization itself. In this day and age, the same principles apply if people like it, they'll buy it. If it is affordable, they'll buy it. And lastly, if it is absolutely necessary, it will be made available.
4. CoEN located inside AIT campus, is the training ground for students to conduct research and outreach program. This is where bottom-up technology is developed.



Nanotechnology is an enabling technology – it can make all products better.

Nanotechnology

Nanotechnology is defined as technology based on materials that have nanoscale dimensions. It is a technology based on size and size alone. According to the National Science Foundation of the United States, nanomaterials, in order to qualify, must reside between one and one hundred nanometers along at least one dimension. It is within these boundaries that nanomaterials begin to demonstrate the so-called "remarkable properties" which are properties that differ significantly from bulk material counterparts. The best example would be the 5th century Rome's Lycurgus Cup housed in the British Museum. It is ruby red if lighted from the inside, from transmission, and green when viewed from the outside, by reflection. Following scanning the electron microscopic analysis (SEM), researchers discovered that gold and silver nanoparticles embedded in soda glass matrix were responsible for the dichroic properties. Next, quantum dots (QDs) made of cadmium selenide, fluorescent at different colors depending on size – large ones (ca. 8 nm diameter) fluoresce red light while small ones (less than 2 nm diameter) fluoresce violet light. These QDs are used in cancer location and imaging. Lastly, carbon nanotubes are the strongest materials known to science with measured and simulated Young's modulus greater than 1 TPa (terapascal).

Because of their small size, nanoscale catalysts are extremely reactive due to higher surface atom-to-volume atom ratio. Because of their smallness, nanoscale catalysts have monstrous specific surface area ($m^2 \cdot g^{-1}$) giving them great efficiency in reaction processes. For the same reasons, nanocomposites which are traditional composite materials that employ nanoscale materials, have immense interfacial surface area – achieved with significantly lower fill factor percentage. These so-called advanced composite materials demonstrate superior mechanical, electrical, optical and thermal properties.

Biology also relies on nanomaterials. For example, enzymes control metabolic processes that turn over vital substrates at astronomical rates, such as catalyzing at greater than a million per minute. There are thousands of them, and all are nanoscale in size. Structures like tendons are composed

Author:



Prof. G. Louis Hornyak, Ph.D.
Center of Excellence
in Nanotechnology
Asian Institute of
Technology

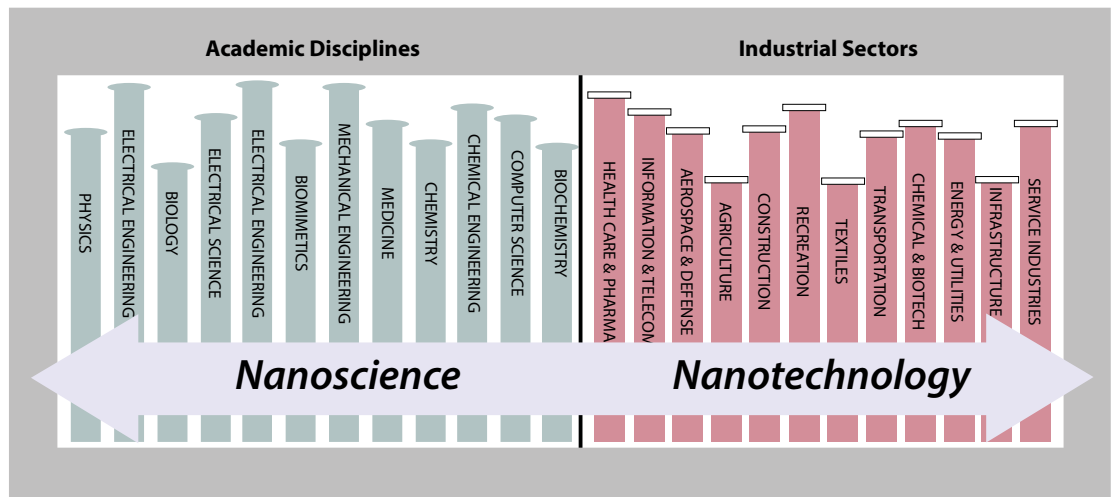


Figure 1 The horizontal nature of nanoscience and nanotechnology is shown – cross cutting all academic disciplines and industrial sectors respectively

Many feel that nanotechnology is the next industrial revolution.

of nanoscale fibers. Photosynthesis is a process mediated by nanoscale membranes and components. All organelles in cells are made of nanoscale materials. All living things are made from the bottom-up. All living structures and functions must go through the portal of Nature's nanotechnology.

Nanotechnology is based on nanoscience. Nanoscience is the study of Nature's nanotechnology. Nanotechnology is the application of nanoscience for the purposes of commerce. Nanotechnology is interdisciplinary and convergent. Nanotechnology is disruptive. Nanotechnology is an enabling technology – it can make all products better. Nanotechnology is horizontal – in that it cuts across all industrial vertical sectors (Figure 1). Many feel that nanotechnology is the next industrial revolution.

Figure 1. Graphic displaying the horizontal nature of nanoscience and nanotechnology is shown – cross cutting all academic disciplines and industrial sectors respectively. Several thousands of "nano-enhanced" products already populate the marketplace. Products such as antibacterial socks, stain free pants, high performance tennis racquets, nanoencapsulated herbal face creams, impact resistant paints, smart windows, self-cleaning ceramics, and numerous others that have been in existence for years. Let it be forgotten, the electronics industry has been nanonized for well over a decade, hence the increased memory and speed. The node distance, which is half pitch between repeating structural units, in chips is now at 22 nm. The societal implications of nanotechnology are taken seriously nowadays – more seriously than ever before as governments and private organizations are taking up the banner of nano-safety and other aspects of nanotechnology's impact. For example, nanotechnology, now more than ever, requires partnerships, especially between and among academia, governments and industries (Figure 2).

Figure 2. Graphic of the relationship between and among academia, government and industry is shown on the left.

On the right, the realistic scenario at AIT is depicted. The role technology enablers is to help an idea navigate its way to commercialization. Icons for non-governmental organizations (NGOs) and the public are not shown in the figure although they also [lay vital roles in partnership scenarios]. The Nano Center at AIT partners with government organizations out of sheer necessity. Specifically, without facilities provided by the Thai government's laboratories nearby like NANOTEC, and there would be no way to observe what was synthesized. In other words, these are, SEM, transmission electron microscopy (TEM), x-ray diffraction (XRD), surface area measurement (BET), Raman spectroscopy and other big ticket techniques. For example, TEM costs \$1 million or so USD, and is required to characterize what exactly was synthesized. Without these instruments via the vital partnership, the laboratory would be blind to the nanoscale. One of the prime directives of the center is to publish papers. Without images of the nanomaterials, no publisher would accept manuscripts. Another objective is to build relationships with industry. Without NANOTEC, that also would not be possible. Without images of nanoscale materials and precise data, no industry or VC would consider investing in Nano Center projects.

Funding from the government is also an important aspect of the Center's effective operation. The monetary fund obtained from industry provides another source of revenue. Grant funds from private organizations are consistently pursued. And of course, revenues received from student fees keep the ball rolling. Without question, students are the vital component of the Center's prime directive – education. Therefore, the partnership relationship depicted in Figure 2 must be well oiled in order for this 21st Century laboratory to succeed.

The partnership scenario is enriched by the input of AIT Consulting. Scientists and engineers are scientists and engineers. They are not lawyers. They are not businesspersons – although many might believe otherwise. Scientists and engineers may not have the expertise or allotted time

Scientists and engineers must partner with AIT Consulting to initiate the pathway to commercialization.

that is required to develop a competitive product. What should they do? The answer is simple. They must partner with an organization that is capable of molding the larger partnership as depicted in Figure 2 – a group that is capable of integrating the whole picture. Here at AIT, the scientist and engineer must partner with a group like AIT Consulting, hence constituting the initiation of Stage I.

Bottom-Up Nanotechnology

Bottom-up nanotechnology is chemistry at the nanoscale. Instead of synthesizing new chemicals, bottom-up processes result in the synthesis of nanoscale materials. Nearly any material can be made into a nanoscale particle – a nanoparticle or NP. Metals such as Lycurgus cup, the semiconductors (stained glasses of the Middle Ages and quantum dots), metal oxides and ceramics (titanium dioxides, zinc oxides, silica, iron oxides, aluminum oxides), polymers (biopolymers, polystyrene) and many more are examples of materials that can be fabricated into NPs. The chemical procedures are straightforward and minimal expertise is required. The raw materials are, for the majority of cases, very cheap. And finally, process conditions are mild. The temperature of synthesis rarely exceeds 100 °C, the boiling point of water, and the pressure is usually at the atmospheric condition. Characterization is inexpensive as fees charged by NANOTECH to use their instrumentation are quite reasonable.

The next step involves what to do with the nanomaterials? The answer to this question is multifold. First, the nanomaterials can become a product in and of itself, if the demand for its use exists. Silver nanoparticles can be synthesized and

be sold as a raw material for subsequent incorporation into paints, textiles and other materials. Secondly, the nanomaterial can be fused with other materials and chemicals to form complex assemblies. A targeted drug delivery nanosystem used to kill cancer or superhydrophobic (water repellent) surfaces are examples of this. Lastly, the nanomaterial can become incorporated within a device of some sort. Dye-sensitized solar cells, gas sensors, pressure sensors, photocatalytic water purification systems, and capacitive desalination serve as prime examples. All of these materials and systems have the characteristic of straightforward scalability.

A Potential Process for an Example

The Bottom-Up Technologies: From the bottom-up, a simple but facilitative means of synthesizing superhydrophobic surfaces has been devised and tested. As it turned out, nearly any kind of surface can be rendered water repellent. Cotton fibers, silica glass, polyester fibers, indium tin oxide (ITO), silicon, and numerous other substrates have been treated with zinc oxide (ZnO) nanostructures to yield the desired effects. Cotton fibers, which are naturally superhydrophilic, can be made superhydrophobic. Is it possible to render the material antibacterial as well? Silver nanoparticles could be applied at strategic areas on clothing just as easily. A flexible multifaceted technology has been developed from the bottom-up. What to do next? The textile industry has a need for water repellent clothing. The textile industry has a need for antibacterial clothing. Can these methods be applied to textiles and turned into win-

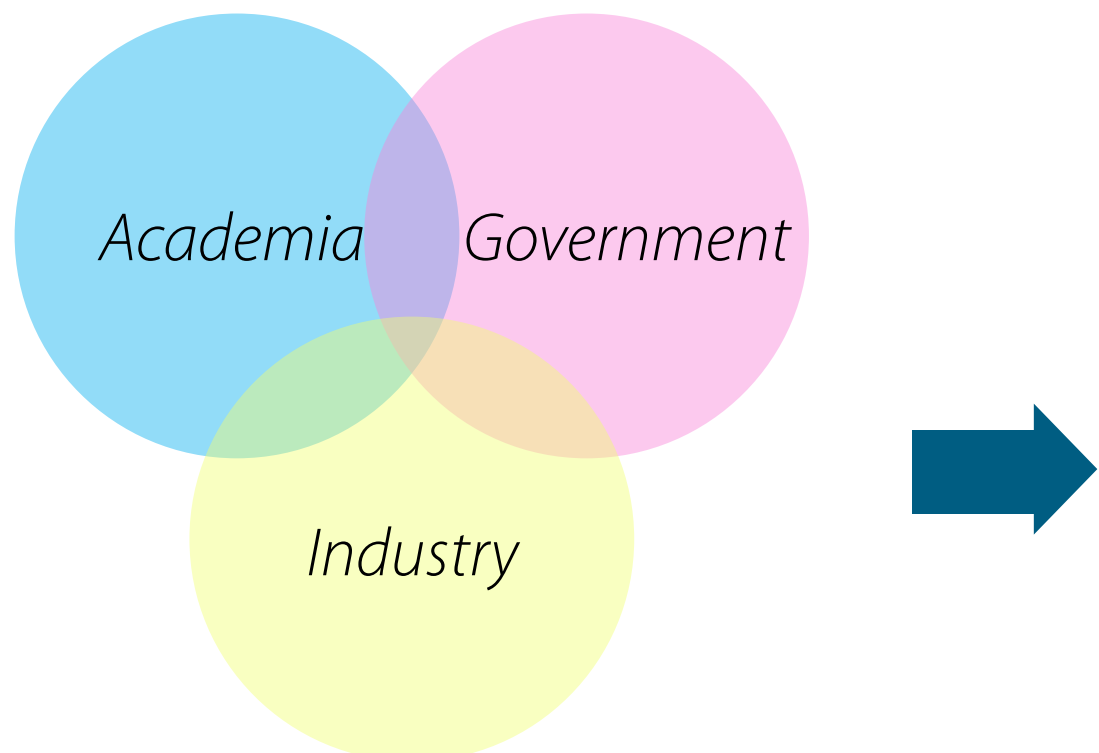


Figure 2 Graphic of the relationship between and among academia, government and industry is shown on the left. On the right, the realistic scenario at AIT is depicted. The role technology enablers is to help an idea navigate its way to commercialization. Icons for non-governmental organizations (NGOs) and the public are not shown in the figure although they also lay vital roles in partnership scenarios.

ning products in the marketplace? And even more importantly, can products developed from this new technology be made available for those who are in need?

What to Do Next? Commercial potential can be huge. Funding for this project was previously accumulated from various sources of industries and government sources and secured by the Nano Center. The result was a product that has potential for commercialization. Up until now, only laboratory bench results have been shown to be successful. Now it is time for the partnership to kick in. An organization such as AIT Consulting can help navigate through the next stages with steps that include: literature search, patent search, and filing for a patent application and eventually, the patent itself. Intermediary organizations, like AIT Consulting, or technology transfer and legal offices of the Institute handle transfer of the technology from the Institute to the principals or spinout-company thereto formed.

Before proceeding, if the project requires more funding in order to traverse the "death valley" of ideas – the point in time where a great idea lives or dies depending on its ability to attract such gap funding. After the bench studies are concluded, proofs of concept and prototype development are required in order to move forward. Scientists and engi-

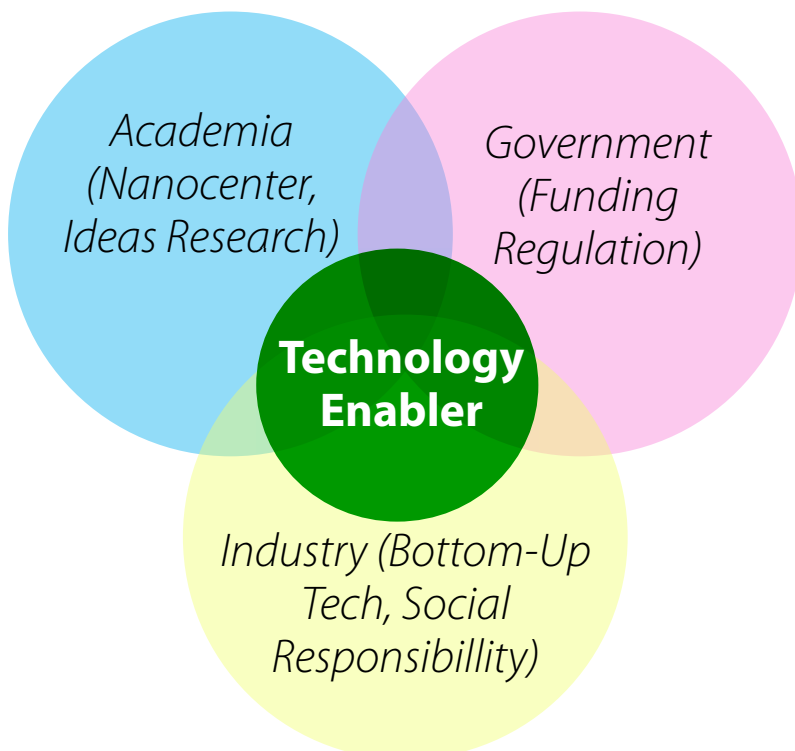
neers need help at this stage. And from the perspective of the university, its "own technology" needs to be protected in accordance with the agreement between the investigator and the school. This is where AIT Consulting can facilitate the next stages of development. The scientist and engineer can now gain energy from the partnership as it grows and reaches out to more aspects of the pathway to commercialization.

Stage 1 begins as Nano Center partners with AIT Consulting for Bottom-Up Nanotechnology's commercialization.

Conclusion

The bottom-up nanotechnology is the driver of the process. The technology is usually quite remarkable and easy to make with relatively inexpensive ingredients. This is attractive to the industry because in addition to enabling its product line, it indicates that the scale up of the process is likely if not outright probable. Perhaps affordable products can be made and distributed to those in need.

The stages to get there however require assistance from intermediary groups that specialize and enable processes outside the technology. Stage I was discussed as the one that gets the technology ready for commercialization. Scientists and engineers forged the first critical relationship. The next stage is in the hands of its partners and technology enablers such as AIT Consulting. 🌐



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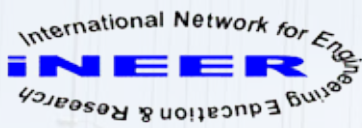
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AIT Consulting website (<http://www.consulting.ait.asia>)

INTERNATIONAL CONFERENCE ON ENGINEERING EDUCATION AND RESEARCH 2013 ICEER 2013:

The Power of Collaboration in Engineering Education

Marrakesh, Morocco, July 1-5, 2013



Themes/Topics of Conference

- Smart Learning and Research in Mobile and Social Age
- Laboratory experiences: on-site, online; at home and mobile labs
- Distance Education: Methods, technologies, and assessment
- Innovation and e-learning methodologies
- Energy, Mine, Biotechnology and Transportation Innovative Education and Research
- Smart Grid Education
- ICT and Lifelong Learning
- Engineering Project Management Education
- Accreditation Systems for Engineering Education
- Internationalization of the Curriculum
- Outreach Engineering Education Programs
- Entrepreneurship in Engineering Education Programs
- International and Regional Campus Networks
- Partnerships and Stakeholders (industries, governments, universities, international and regional organizations)
- Financing research and development and Research Valorization

Important dates:

Abstract Submission	: 30 January 2013
Abstract Acceptance Notification	: 15 February 2013
Full Paper Submission	: 10 March 2013
Final Acceptance Notification	: 10 April 2013
Camera Ready Submission	: 25 April 2013
Conference period	: 26-29 June 2013

For more information please go to:
<http://iceer2013.labader.org/>

Check your Concrete IQ

1. The addition of diagonal braces in the basic tubular structure increases the shear lag between opposite faces. (TRUE/FALSE)
2. Performance based design ensures that structure as a whole reaches a specified demand level - including both service and strength design levels. (TRUE/FALSE)
3. The member capacity is almost always more than the cross-section capacity at a critical location. (TRUE/FALSE)
4. Given a symmetrical building with no eccentricity between the mass center and stiffness center, the first two modes are translational, and third mode is purely torsional. (TRUE/FALSE)
5. Strut-and-tie modeling (STM) is an approach used to design B-regions in reinforced and pre-stressed concrete structures. (TRUE/FALSE)
6. The Floor Diaphragm (FD) is the structural system that transfers lateral loads to the lateral load resisting system and provides in-plane floor stiffness. (TRUE/FALSE)
7. The objective of macro-modeling is to determine local stress concentration, cross-section behavior, modeling of cracking, bond and anchorage. (TRUE/FALSE)
8. The slabs are assumed to be "resting on beam" when the beam stiffness is comparable to stiffness of supported slab. (TRUE/FALSE)
9. Sway is dependent upon the structural configuration as well as type of loading. (TRUE/FALSE)
10. One of the disadvantages of the limit state design is that it does not allow engineer to choose different patterns of moments to avoid the congestion of reinforcement at the support of the members. (TRUE/FALSE)

Developing Interactive, Computer-based Learning Tools for Civil Engineering Students



Introduction

Learning is a social process which proceeds by and through conversations and is constructed by the learners themselves. In engineering and other technological fields, the old learning paradigm was about what software / tools can do. The new learning paradigm is all about what learners can do. The mentor is second only to the learner in impacting learning effectiveness. The effective mentor helps the student strengthen their values, improves learning efficiency to reduce time required for learning and provides resources that include a course curriculum, reference materials, planned learning activities or lessons, and independent assigned tasks or homework (Kevin 2008).

One of the important roles of technology in learning is to assist the mentor in their effort to facilitate learning. Whether a specific technology is appropriate for assisting with the learning process is a matter of comparing the benefit or value of the technology with the cost or risk associated with its use. The ultimate goal of any technology implementation should be to enhance learning process without the failure of the technology itself.

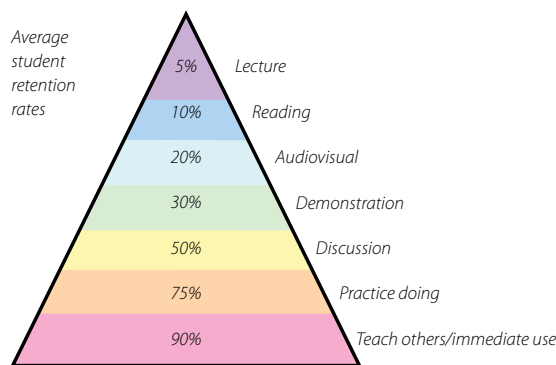


Figure 1 Learning Pyramid
Source: National Training Laboratories, Bethel, Maine

At present, automated computing is the main means for the application of engineering knowledge. The growth and development in the application of computing tools and technologies, and the development of new paradigms has been incremental and linear. One of the most efficient ways of learning is by “doing and practicing”. It has been well established now that average student retention rate is very high for teaching methods which involve practical involve-

ment of learners (as shown in Figure 1). Many fields have taken significant advantage of the recent advancements in computing technology in order to adapt, apply, and enhance the way people learn these fields. However the key expertise required for efficient exploitation of computational potentials is in interpreting data and converting it into “information and knowledge” in their presentable forms (Figure 2).

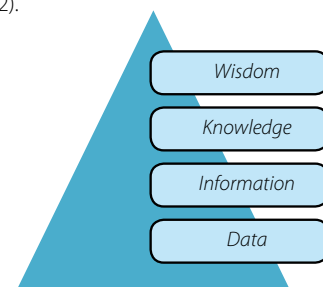


Figure 2 DIKW Model

This paper reviews some of the recent developments in the computing side, introduces computer based interactive tools, and explores how they may be used to improve the way civil engineers understand the problems and use more innovative, effective, and efficient techniques to grasp necessary understanding of engineering concepts.

Emerging Technologies, Tools and Paradigms

In recent years many innovative instructional methods were developed for both technical and nontechnical courses and emphasize the free discussion and expressions of student opinions, with minimal teacher-centered presentation of information since the involvement of students is critical for effective classroom learning (Richard 2000). The instructional approaches based entirely on self-paced computer-assistance are extremely effective. This paper also surveys some interactive learning tools for instructional as well as self-study methods in Civil Engineering.

Often the developments which are going on, in various fields related to computing software and hardware are done independently with a particular focus, including the development of new Human Computer Interfaces (HCI),

Authors:



Naveed Anwar, Ph.D.
Executive Director, AIT Consulting



Ricardo P. Pama, Ph.D.
President, University of the Cordilleras, Baguio City, Philippines



Jayanta Pathak, Ph.D.
Professor of Civil Engineering, Assam Engineering College, India

the new display technologies and devices, the Brain Computer Interface (BCI), and in Robotics to name a few. Several new integrated devices such as the smart phones, the tablet, and slate computers have become more popular. A similar development is happening in computing paradigm and software with the special focus on visualization. The wide spread use of intranet, intranet, and more recently cloud computing is changing the way computers are being used, and information is being shared and stored (Anwar 2011). Different theories and technologies related to various components in the system are now been processed and formatted with a view of setting standards for a unified approach of learning (Figure 3).

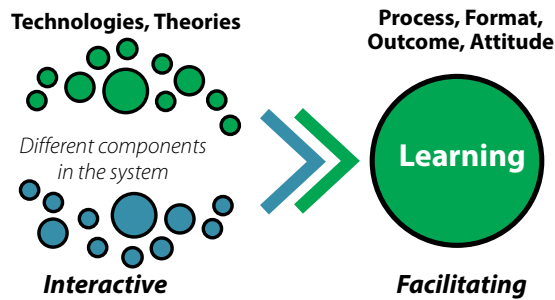


Figure 3 Towards an efficient learning system
Source: Heng Luo et al., 2011

The practicing civil engineers are involved in a broad spectrum of activities and tasks, such as, conception, selection, and development of structural systems, suitable for a particular application, preliminary sizing and design of structural components, coordination and collaboration with several other disciplines to consider their requirements, such as with architects, mechanical and services engineers, electrical engineers, and geotechnical engineers. All these skills require an extensive, rigorous, and efficient instructional system in universities.

The World Wide Web offers educators a new medium to deliver teaching and learning material – one which brings

LEARN CIVIL – An interactive self tutor program for civil Engineering curriculum

A computer program was developed to facilitate an interactive way of learning civil engineering (CE) subjects. The program was designed with the curriculum to run in parallel with the theory classes. The programs aim to make the engineering concepts familiar and clear to the students. It is an easier, friendly, and self-tutor platform for students to learn and understand the basics of engineering in a simple and fun way.

Key objectives of LEARN CIVIL includes generating a learning attitude among the students, to making them friendly with their subjects and not just memorize and cram for exams. LEARN CIVIL sets to lay a reinforced foundation stone for the four years degree program. It covers a wide spectrum of CE areas (courses modules) including engineering mechanics, strength of materials, theory of structures, surveying, fluid mechanics, structural analysis, design of concrete structures, design of steel structures, foundation

new and exciting ways of learning, and an alternative to traditional teaching techniques (Allen 1998). It is important to note that computers cannot improve the knowledge acquisition, or in other words learning, per se. Learning is a basic cognitive process, which has to be done by the learners themselves. This means that learning is an active process from a learner's perspective which is constructed by the learner (Holzinger 2006).

According to Ben Shneiderman (2002) "The old computing is about what computers can do; the new computing is about what people can do". Not only transmitting information, but by engaging the students in authentic tasks will also be the key for a successful learning approach. Thus, the fundamental idea of interactive learning is to help learners become actively engaged in collaborative work via various computer-supported processes. The example of "digital libraries" is quite obvious which are changing the way that we search and use resources in traditional libraries. In a networked information environment, users are allowed to access information anywhere and anytime. They are also leading to innovative ways for teaching and learning opportunities. For example, an instructor can develop learning objects based on traditional static text-based materials by using multimedia (images, videos, sounds, and animations) technology. Learners can explore these digital learning objects in dynamic and interactive ways at their own pace, rather than by following textual instructions (Yan Han 2006).

LEARN CIVIL is proposed to be an integral part of the curriculum as a unique tool which attracts students towards software based learning. It will also help to enhance the quality of the academic learning process and will contribute in the conceptual improvement of engineers in the construction industry, thus creating a new era in hi-tech studies and e-learning.

engineering, hydraulics, environmental engineering, soil mechanics, and water resource engineering.

The interface is simple and user-friendly. The left side tree view of the complete course structure makes it easy to select any topic from any of the subjects. The description of the selected form comes at the extreme bottom left corner providing the details of the form. The interface is also equipped with all the necessary tools on the top toolbar to open, new, save, print any file or data. The help section provided addresses common issues that students may come across. The graphics included in the project are attractive and self-explanatory. The theory button in each of the form provides the necessary theoretical help on the related topic. The examples used were mostly taken from the course modules / text books which will help the students in their understandings.

Figure 4 Some snapshots from "Strength of Materials" course module

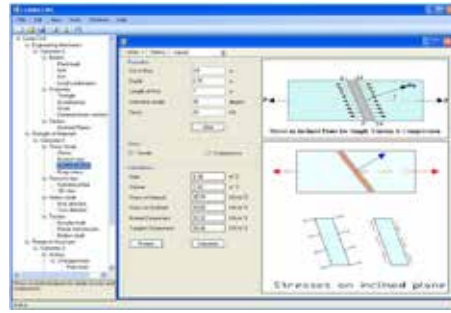


Figure 4.1 Stresses on inclined planes

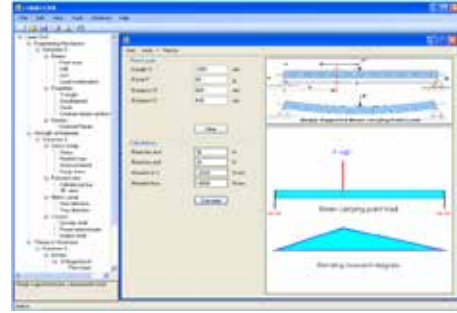


Figure 4.2 Loaded simply supported beam

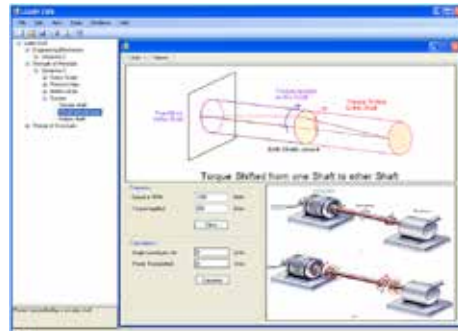


Figure 4.3 Power transmitted/circular shaft

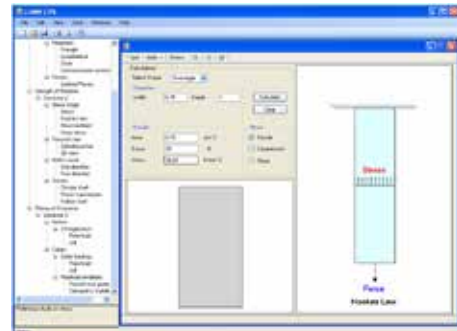


Figure 4.4 Stress strain study

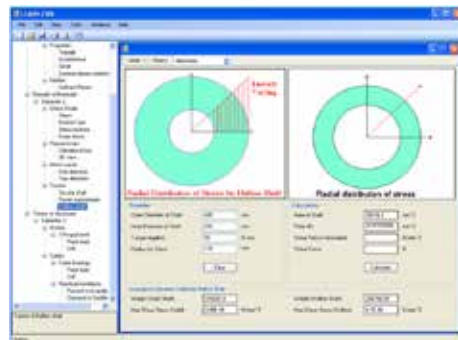


Figure 4.5 Stresses in a hollow shaft

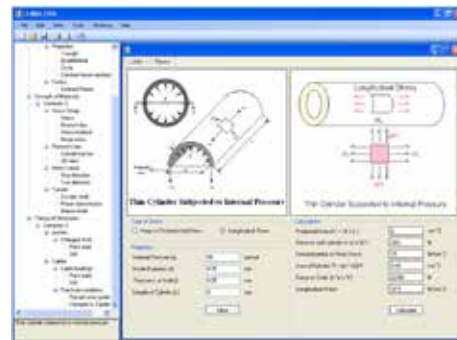


Figure 4.6 Cable carrying point load

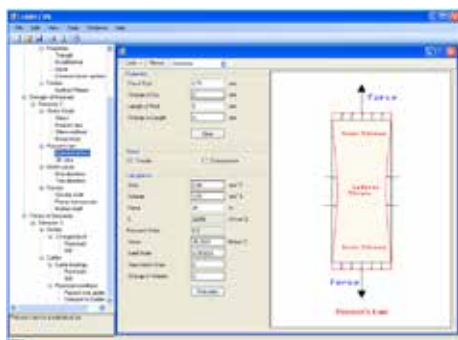


Figure 4.7 Poisson's law

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Discussion and Conclusions

The impact of knowledge explosion in almost all areas of engineering demands a rationalization of curriculums requiring a fundamental change in the current teaching and learning methods. In this paper, an efficient engagement of latest computing technologies in the interactive learning process was discussed with special emphasis on the civil engineering curriculum. A newly developed computer tool focusing on above mentioned facts was also introduced. Conventional instructional simplicity in conjunction with collaborative interactive software-based learning can successfully facilitate the knowledge transfer as well as understanding of engineering concepts. 🌐



Professional DEVELOPMENT

Customized Trainings for Sri Lanka Road Development Authority Engineers: Development of First Major Elevated Expressway in Sri Lanka

The Road Development Authority of the Government of Sri Lanka, with the support of World Bank is planning for the extension of the Southern Expressway in Sri Lanka. The expressway, which is still undergoing feasibility study and design, is going to be Sri Lanka's first elevated expressway connecting the city of Godagama to Hambantota. To equip the sector to undergo such a project, the Road Development Authority of Sri Lanka is eager to invest in the capacity building of its engineers to familiarize them

with different methods of Elevated Highway and Interchange Design and Construction and in turn become independent of external consultants.

To fulfill AIT's mission in regional capacity building and development, AIT Consulting and the Asian Center for Engineering Computations and Software (ACECOMS), organized two customized trainings for the Structural and Transportation Engineers from the Road Development Authority, Sri Lanka, as detailed below. 🌐

Customized Training on Design of Segmental Box Girder Bridges

18-27 June 2012, Bangkok, Thailand



Sri Lanka Road Development Authority engineers (first group) visit the Bangkok Skytrain purple line project (Mass Rapid Transit Authority of Thailand)

Topics

- Modeling and Analysis of Bridge Structures
- Various Techniques for Modeling of Bridges
- Design of Bridge Components
- Precast Segmental Bridge Construction Techniques
- Use of software and computing tool

The first training on Design of Segmental Box Girder Bridges was held from 18 June to 28 June 2012, for 6 engineers from the Road Development Authority, Sri Lanka at the Asian Institute of Technology, Bangkok, Thailand. The training focused on a "Theory and Practice" training methodology and was carried out by Dr. Naveed Anwar, Engr. Keerati Tuntasuwatana, and bridge specialist Dr. Songkiat Matupayont. Initial sessions focused on providing the necessary theoretical background while the subsequent sessions were used to demonstrate the practice on the use of appropriate design tools and soft-

ware. The training provided an overview on analysis and design of continuous and simply supported in-situ cast box girder bridges of various spans and provided guidelines and training on structural detailing and construction process of segmented box girder bridges. Two site visits were organized to enhance the training. The first was at Bangkok's Industrial Ring Road Bridge, also known as Bhumibol Bridge, followed by a visit to the Construction site of the Sky train purple line project for Mass Rapid Transit Authority of Thailand (MRTA). 🌐

Customized Training on Highway Design

16 - 25 July 2012, Bangkok, Thailand



Mr. Aswin Karnasuta from Thailand's Department of Highways, discussing Highway cross section elements



Dr. Sukit Yindeesuk from Thailand's Bureau of Locations and Design, Department of Highways, giving training on Highway Structures

The second training focused on Freeway Design and was held on 16 - 25 July 2012 at the Asian Institute of Technology, Bangkok, Thailand. Seven engineers from the Road Development Authority, Sri Lanka, attended the training. Initial sessions focused on providing the necessary theoretical background on freeway design, while the subsequent sessions provided an opportunity to demonstrate the use of appropriate design tools and software.

The training included areas such as design parameters, speed parameters, cross section, horizontal alignment, vertical alignment, traffic signs, and markings for freeway and interchange design. Dr. Kunawee Kanitpong, Associate Professor, AIT's Transportation field of study, and six other external experts from the Department of Highways, Thailand, were selected as resource speakers.

Freeway Design included topics on design parameters, speed parameters, cross section, horizontal alignment, vertical alignment, traffic signs and

markings for freeway and interchange design. Two site visits were organized for the participants: the Chalong Rat Expressway Control Center and the Express way project in Chonburi. 🌐

Topics

- Fundamental Consideration on Highway Design
- Highway Capacity Analysis
- Horizontal and Vertical Alignment Design
- Cross Section
- Roadside Design
- Interchange Design
- Pedestrian and Cyclists
- Freeway Road Markings and Traffic Signs
- Freeway Lighting System
- Access Management
- Road Safety Audit



The second group from the Road Development Authority, Sri Lanka, together with Dr. Kunawee Kanitpong (fourth from the right) and Dr. Naveed Anwar (fifth from the right)

Professional Development Program on Research and Teaching Methodology

1-14 August 2012, Bangkok, Thailand



L - R: Dr. Mohammad Nasir, Vice Chancellor for Academic Affairs, Balkh University; Dr. Naveed Anwar, Executive Director, AIT Consulting; and Prof. I M Pandey, AIT's Vice President for Academic Affairs during the Opening Ceremony

Established in 1986, Balkh University (BU) is the third largest university in Afghanistan, offering different fields of study. BU initiated a staff development program as one of the main activities in the university in order to strengthen the quality of its faculty members. In response to the request by the current AIT-BU partnership project and Balkh University, a professional development program on Research and Teaching Methodologies was organized by ACECOMS on 1-14 August 2012 for fourteen faculty members from Faculty of Engineering.

The training program aimed to enhance the participants' capability to teach methodologies following the key issues and concepts of the research process to enhance their knowledge and skills in developing and conducting research in areas of engineering and sciences.

Three site visits were also carried out to National Science and Technology Development Agency (NSTDA), Kasetsart University Research Development Institute, Faculty of Engineering, and Mahidol University. 🌐

Resource Persons:

- **Dr. Naveed Anwar**, Director, ACECOMS and Executive Director, AIT Consulting
- **Dr. Winai Wongsurawat**, Assistant Professor, School of Management, AIT
- **Dr. Willi Zimmermann**, AIT Extension, Associate Professor, School of Management, AIT
- **Dr. Siddharth Jabade**, Director, Innovation and Intellectual Property Rights, AIT Consulting
- **Dr. Wonsiri Punurai**, Deputy Program Director, Department of Civil Engineering, Mahidol University
- **Dr. Punchet Thammarak**, Senior Instructor, Structural Engineering, AIT
- **Dr. Pramin Norachan**, Structural Engineer, AIT Consulting
- **Mr. Jonathan Castillo**, Software Engineer, AIT Consulting
- **Dr. Waheed Iqbal**, Computer Science, AIT
- **Dr. Faisal Bukhari**, Computer Science and Information Management, AIT

Topics

- Key issues and concepts of research process
- Scientific research designs
- Latest scientific research development methodologies
- Statistical techniques used in research
- Writing research proposals, papers, and academic articles
- Teaching methodologies
- Implementation of the research structure



Dr. Winai Wongsurawat speaking on the topic of "Truth about Relativity"

Modeling, Analysis and Design of Structures using SAP2000

8-9 November 2012, Bangkok, Thailand

Topics

- Introduction to SAP2000
- Modeling, Analysis and Design of RC Beam
- Modeling, Analysis and Design of 3 Story RC Building
- Advanced Techniques for Modeling of Structures using SAP2000
- Modeling, Analysis and Design of Curved and 3D Steel Truss
- Modeling and Analysis of Framed Structure with Various Special Features



Engr. Keerati Tuntasuwatana, ACECOMS, (fifth from left) with the training participants from CH. Karnchang Public Company Limited

A training on Modeling, Analysis and Design of Structures using SAP2000 was held on 8-9 November 2012 for 7 engineers from from CH.Karnchang Public Company Limited, Thailand at the Asian Institute of Technology, Bangkok, Thailand. The training was conducted by Engr. Keerati Tunthasuwattana, ACECOMS and Mr. Thawatthai Danwangkhaw, Structural Engineer, AIT Consulting. 🌐

Sustainable Highway Infrastructure Workshop

16 December 2012, Kandy, Sri Lanka

A workshop on Sustainable Highway Infrastructure was organized by the Asian Institute of Technology, Thailand in collaboration with the University of Peradeniya, Sri Lanka and sponsored by the Ministry of Ports and Highways, Sri Lanka.

The workshop was held at the Earl's Regency Hotel in Kandy, Sri Lanka and was organized in context of the 21st century, when the need for new and existing infrastructure to comply with high-quality technical standards, and meeting strict environmental and health standards and anticipate future demographic developments is now essential.

Over 60 engineers and officials involved in infrastructure and highway development projects were selected by the Ministry of Ports and Highways, Sri Lanka attended the training. The training focused on sustainable highway bridge management, management of infrastructures, resource

efficiency in high way development, sustainable solution to retrofit damaged bridges, and experiences drawn from Sri Lanka.

The workshop was opened by the Chief Guest, Mr. R.W.R. Pemasiri, Secretary, Ministry of Ports and Highways, Sri Lanka and followed by four consecutive sessions providing the participants an overview on the environmental sustainability, and green design and construction practices of a given highway project.

The sessions exposed participants to the aspects of user costs, energy consumption, and long term environmental benefits that need to be factored in for a sustainable solution for highway development. Breakout sessions were scheduled in between the sessions so that the participants could present their queries, concerns, and ideas on the aspect of sustainability in infrastructure development specific to highway development. 🌐

Sessions

Session 1: Overview on Sustainable Infrastructure

Speaker : Dr. Naveed Anwar

Executive Director, AIT Consulting, Asian Institute of Technology, Thailand

Session 2: Sustainable Highway Bridge Management

Speaker: Prof. S. W. Garrity

Hoffman Wood Professor of Architectural Engineering, School of Civil Engineering , University of Leeds, England, UK

Session 3A: Management of Infrastructures

Speaker: Prof. Makarand Hastak

Professor of Civil Engineering, Head of Construction Engineering and Management, School of Civil Engineering, Purdue University

Session 3B: Resource Efficiency in Highway Development

Speaker: Jagath Rupasinghe

Engineer (West), Infrastructure Development, Auckland Transport

Session 3C: Deterioration Prediction And Optimized Decision Making For Effective Management Of Civil Infrastructure

Speaker: Dr. Sujeeva Setunge

Associate Professor, Discipline Head, Civil Engineering, School of Civil, Env. and Chemical Engineering, RMIT University, Australia

Session 4A: Retrofitting of Damaged Bridges: A Sustainable Solution

Speaker: Prof. Ranjith Dissanayake

Professor of Civil Engineering, University of Peradeniya, Sri Lanka

Session 4B: Sri Lankan Experiences

Speaker: Eng. S.B.Wijekoon

Senior Lecturer, Industrial Training and Career Guidance Unit, Faculty of Engineering, University of Peradeniya



Sustainable Highway Infrastructure Workshop



GIS-based Facility Information Management Systems

By Dr. Hamid Mehmood and Marium Sheikh

The world is growing in a fast pace, where the evolution of technologies is no longer bound by time. Activities once limited to a room now spread throughout the globe and exploit places to seek benefits. The clock does not tick in the seconds, it now also moves dollars, pounds since it is all business at the end of the day.

FIMS-The History

The world is growing with a pace, where evolution of technologies is no longer bound by time. Activities once limited to a room now spread over the globe and exploit places to seek benefits. The clock does not tick the seconds, it moves the dollars, the pounds and it is all business at the end of the day.

The world is raging with commercial and industrial advancements and the development of competitive facilities is inevitable. An ever increasing amount of capital is spent on the development of infrastructure to cater the needs of industries to the fullest. However, without management and proper maintenance of all the facilities in hand, not much can be expected. This is where Facility Information Management System, or FIMS, is needed. FIMS enables users to host the data and document on any facility. It renders ways to maintain and manage developed facilities and aims to improve their utilization. Any kind of FIMS can be developed keeping in mind the business and facility in hand. It can be made compatible with any activity which it is expected to handle and operate on. The scope of a facility varies considerably; it can be a building or even an entire mesh of infrastructural network. FIMS serves a range of facilities and maintains a proper database to assist in making sophisticated developments in business with smooth record information keeping.

As with the times, FIMS has progressed and can be modified to increase its capability. However, a more salient period for bringing this technology forward was the early 90's. Due to the global economic downfall, which has been more or less consistent, the need for cutting down the operation and maintenance cost of facilities was felt. This resulted in the development and installation of an automated facility management system to sufficiently decrease the unnecessary cost and highly enhance the performance of the industries. This system was introduced in the form of various units each operating and looking after a diverse aspect of the subjected facility. Gradually it was realized that these segregated systems came with certain limitations and a better approach was put forward - the integration of all the domains of a facility and their management at a single end. FIMS is comprised of many basic components for its establishment and installation. It consists of a carefully laid IT infrastructure which covers the company's infrastructure, a local area network solely for the facility management department, internet access, and specific hardware necessary to finish and accessorize the activities. It is laden with Computer Aided Designs (CAD) to assist in the formulation of automated building architecture for looking after the facilities and keeping them in view. For quick and efficient analysis, management of documents and records in elec-

tronic format, FIMS is equipped with an Electronic Document Management System (EDMS). FIMS allows the user to view and manipulate information while tapping on the keyboard as FIMS consists of a Computerized Maintenance Management System (CMMS) and a Computer Aided Facility Management (CAFM) system for operating over space. It has various other applications for key management, cable management, fleet management, custodial and project management systems. For a reliable hold on the capital, its movement and all monetary transactions, FIMS enjoys the service of the Capital Planning and Management System (CPMS). Dealing with customers is monitored with a Specialized Service Request System (SRS). It renders an interface to the company's inside business activities. With time and better technology, improvements have been made continuously to this system to cover the loopholes and achieve higher quality. And like every other technology, the advancement for FIMS is in progress with a major emphasis on enhancing its capability using geographic information system (GIS).

FIMS is comprised of many basic components for its establishment and installation. It consists of a carefully laid IT infrastructure which covers the company's infrastructure

From CAD to GIS

While from the very inception of FIMS, the CAD-based FIMS dealt particularly with the interior of the buildings and facilities, the system proved to be a signify a milestone in development of automated systems and computerized structures to assess

the state of workflow. However, as the domain for workflow broadened and activities spread over more space, using CAD proved to be more or less limited. This system fails to get hold of the information that is outside its entity of work. Water and power supply of an infrastructure will be present inside the facility, but the story begins outside, covering the pipelines and underground areas to the source. CAD's incapability to serve and look after the facilities that tend to occupy more space is a huge drawback. With the scale of every process stretching over places and ever increasing geographic implications falling into place, there comes a need to use GIS. It should however be noted, that GIS is not suggested to replace CAD, its appropriateness can only be explained if it is integrated with the existing FIMS. CAD served to monitor the inside environment which it is very best at, GIS on the other hand will prove its worth for the exterior of the facilities. It is required to guard those parts of the facilities that are not bound by space and tend to stretch the scope of the facilities. It can cover activities over scales ranging from a room to the complete globe. It is considered most suitable for amalgamation with FIMS since it bonds and integrates itself very easily with every system. It is a friendly technology which benefits in every possible way.

Authors:



**Hamid Mehmood,
Ph.D.**

Asst. Professor,
Institute of Geographical
Information Systems
National University of
Sciences and Technology,
Pakistan



**Marium Sheikh,
Research Associate /
BE Geoinformatics
Candidate**

Institute of Geographical
Information Systems
National University of
Sciences and
Technology, Pakistan

GIS

Before picking out the functions that particularly refine the art of facility management, it is necessary to know what a GIS is capable of. GIS is designed to collect, comprehend, analyze, display and provide a mode for querying data in order to extract the patterns and important relationships that the data depicts. Figure 1 shows what a GIS stands on. The five basic concepts of GIS include the following.

1. A GIS has layers.
2. GIS renders seamless scaling.
3. The attribute data for GIS is strictly typed.
4. A GIS consists of various feature classes.
5. GIS data models are based on topologically concentrated data.

1. Layers in GIS

The layers in GIS correspond to features with similar attributes or behavior. For example a residential area being represented by GIS will be divided intelligently into a number of layers. These layers will correspond to a particular feature for example, roads, water pipelines, houses, and public parks. Hence, a GIS deconstructs any given data to arrange the information so that it can be utilized most efficaciously.

2. Scales in GIS

An amazing function of GIS is the diversity of scale that it operates on. A GIS is useful to handle facilities over the globe, even at regional level or inside a campus and even a small room. With this unique ability, a GIS can weigh the geographic worth of any developed facility. It allows companies to venture a whole new perspective of economic gain. Through this, the location of facilities and their expected uses and benefits with respect to the customer base is analyzed. Within a room, GIS is able to guide the regulatory processes and point out the precise location of assets and their proposed position for maintenance.

3. Attribute data in GIS is typed

The attribute data in a GIS is descriptive and coincides strongly with the feature that it represents. This data is typed in a highly structured way to allow for its access through a GIS. Unlike CAD where annotation is loosely attached to a feature as text, GIS is very specific and the attribute data is formatted for the very feature it represents.

4. Feature classes of GIS

Feature class in GIS is a collection of similar data. A feature class comprises of all the objects with similar spatial information. The most common types of feature classes in GIS are point, line, and polygon which are used to represent different types of real world entities.

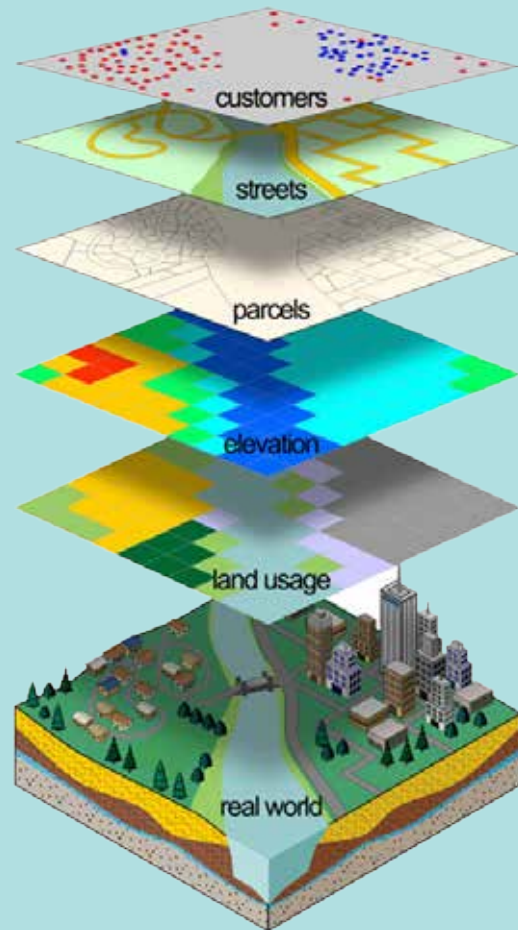


Figure 1 Different GIS information layers, stacked together

5. Topology in GIS

To model any real world entity, it is important to determine the relationships between the features present within or on a feature. The topology of any spatial domain encompasses the location, height, and shape of the features that it hosts. Through topology (Figure 1), GIS formulates the complex relationship among the different feature classes to allow for smooth interpretation of the land with respect to the facility in hand.

The domain of GIS is vast and beneficial in every respect. The data storage and its organization are apt for task-like facility management. The data is stored in the most sophisticated fashion and it can be sought and queried in numerous easy and effective ways. Some of the more commonly applied queries include buffer, which highlights all the features that fall in a specified range of the key feature. The location of features and their distance from any facility can be determined within a second. Using the above mentioned information, line of sight of facilities can also be established and calculations regarding the transport time and cost can be made accurately and cheaply.

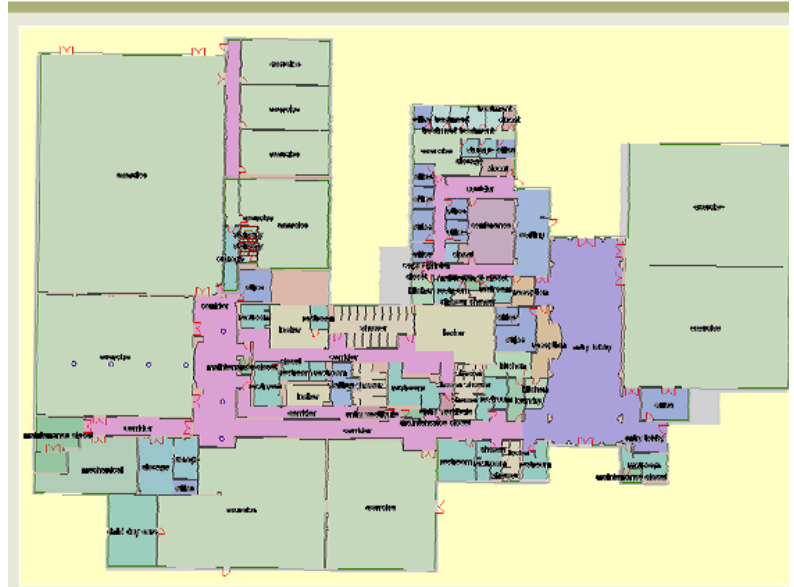
A salient feature of GIS is the diversity of scale that it operates on. A GIS is useful to handle facilities over the global, national, urban, rural and even at the level of facility and buildings. With this unique ability, a GIS can weigh the geographic worth of any information.

FIMS-The Evolution

The evolution of FIMS to a GIS-based technology began many years ago. The nature of GIS was no less than apt for FIMS and the integration of these two systems was inevitable. Some of the very common applications that GIS performed for facility management were the maintenance of the water system, electricity network, and more utility based tasks. The geospatial data available for facility management is generally the aerial photographs taken at varying distances and heights. These photographs reveal information about the outside of the facility, but its interior remains unexploited. For example, an aerial photograph will not contain the picture of the inside of building and its floors, it is only useful for finely presenting the domain of its exterior and objects that are located there. Hence, the GIS data is available only for the landscape level and it does not render capabilities to operate inside the buildings. In modeling and specifically the architecture inside the buildings, CAD and building information model (BIM) are still in place which provide diverse techniques to visualize the inside localized infrastructure. Hence the integration of GIS into the existing technology of FIMS will increase its productivity and output by many factors. Until now, none of these functionalities is offered by any other developed structure, except by GIS. A GIS allows one to sensitively weigh every aspect of an organization with an eye into its geographical dimension.

1. It allows one to determine the cost and expenses with respect to the area occupied by a facility campus and the space it utilizes.
2. It provides a view into the available routes to operate for facility management and with the wide range of perspective it provides, it is easy to choose the best and most feasible pathway.
3. GIS has been polished most at its use for keeping a hold over the energy consumption index. It operates on an electrical and mechanical network from inside of the room to the national level and vigorously analyzes its delivery points.
4. FIMS integrated with GIS, enjoy a special hold over the security and safety of the facility. GIS enables the management of security points both inside and outside the

Much like the use of GIS outside the buildings with its unique way of handling tasks and generating the outcomes, GIS is also being implemented in the inside of buildings. The basic principle remains the same with the features inside buildings; parts are divided and separated in a way similar to the peeling of landscape into layers. The homogenous features are placed into different groups. The inside of the buildings is manifested with different floors presented in distinct layers. The sewage, electricity, IT, safety, and offices



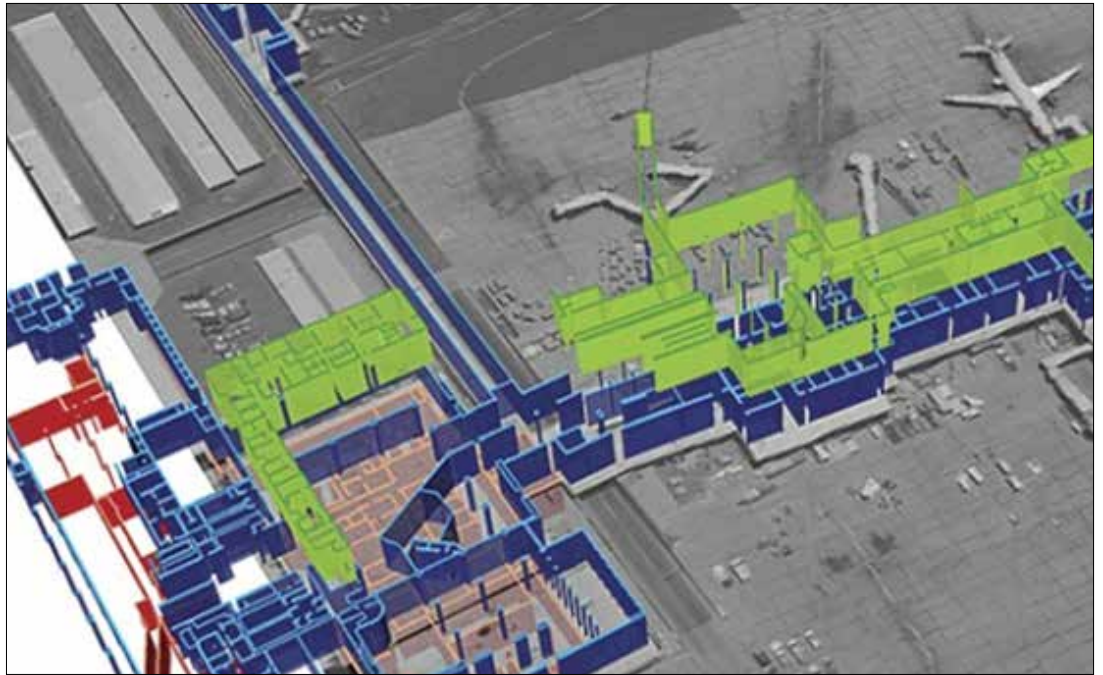
Aerial view of MacDill Airforce Base

are all stored in individual layers. With all this information in hand, civilized observation regarding the transportation patterns within the buildings can be generated. These can be used to point towards the most feasible ways to transfer assets and their relocation. The system assists in analyzing the space availability and tends to allow for optimum use of the facility space. With technologies like global positioning system (GPS), all the assets inside the buildings can be located and accessed without wasting time. This structural representation of the buildings and facilities provides a way to regularly analyze the equipment and accessories placed at different locations and their maintenance. It gives the freedom to venture into new ideas of space utilization and enhancement, and witness the results using GIS before applying them to generate the best outcome. Through GIS, the line of sight from any window and angle of the facility can be established, which may be useful in planning special events. Using GIS decisions regarding the development of new facilities around existing ones can be made very intelligently. This system calculates the impact of buildings and facilities on their nearby features and determines how they may speed up or disrupt an ongoing development. Through this, capital can be invested exactly where an outcome of exceptional stature is promised and expected.

The overwhelming advantages and precious use of integrating GIS with FIMS has been known for years. Many integrated management systems have already been developed that cater to industries and enterprises in ways to maximize their output and minimize losses in every possible way. Below are several well-known integrated FIMS providing service and proving their worth.

1. MacDill Air Force Base, Facility Management Mapping

This is an active military base located in Florida, stretching over 5700 acres, laden with numerous facilities spreading over the area it covers. In late 2008, the civil engineering squadron (CES) proposed the collection of accurate in-building data used for budgeting a contract that required



Aerial view of Sky Harbor International Airport, Phoenix, Arizona

auditing over 100 buildings. This squadron was the geobase; it hosted all the geospatial data that could be used for facility management but the problem was still unsolved. This data was old, deteriorated, and unreliable. The data on hand could not be used for the extraction of the required information. The floor plans did not represent the details of spatial structure and materials. Hence it was decided that a complete in-building data needed to be collected with authentic associated attribute data. This work had to be completed quickly and the authorities were looking for a quick and error free output. CES contacted a GIS company to provide a facility management mapping service. The company surveyed all the buildings in the facility, collecting very accurate and concise data. They launched GIS using a robotic platform and collected data for 1.7 million square feet in just a period of nine days. This data included vectored floor plans with coinciding attribute information. These space models, created in a geo-database, allowed the CES to analyze the area covered by them and operate on it accordingly. Using GIS with robotics, well informed decisions were made concerning the interior activities of the facilities.

2. Sky Harbor International Airport, Phoenix, Arizona, GIS Implementation

A GIS enterprise was installed at the Sky Harbor International Airport. To continue the system's development, all the existing spatial content of any sort must be available through a single point of delivery. The task was not simple since it required all the spatial data from inside the airport, on the airport's surface and its immediate surroundings. This system was not aimed to be comprised of GIS alone; it had to be integrated with enterprise resource planning (ERP) in a number of business experiences like sign management and aerial photo management. When this project

was introduced in 2007, the airport organization lacked a single system to operate on all interior and exterior assets simultaneously. An enterprise class information system had to be developed. As a result, a geo-portal was developed to host all spatial information. This portal proved to be a platform where all the airport staff could interact about the daily processes and fixation of tasks and facilities. It was laid on a three tier architecture (a presentation tier, application tier, and data tier) and was implemented with an attractive graphical interface where the building could be searched from any and every angle. The assets could be zoomed in and information pertaining to every facility would be available in no time. The final task was the integration with the ERP to enhance the possibility of making geographically informed decisions. After integration of these systems, one could locate and retrieve the ERP assets using GIS and vice versa. GIS also helped to strengthen the emergency facility of the airport by generating evacuation maps and highlighting the exits of the airport.


There are numerous other GIS integrated management systems for facility maintenance, an for example is the US Army Corps of Engineers GIS for Spatial Allocation and some introduced by NASA. The fact that is established and must be put into use, is the importance of spatial data. Managing facilities is not an easy task and it requires very accurate location data to allow for geographically informed decision. There are numerous other GIS integrated management systems for facility maintenance. Another example is the US Army Corps of Engineers GIS for Spatial Allocation and others introduced by NASA. The established fact that must be put into use is the importance of spatial data. Managing facilities is not an easy task and it requires very accurate location data to allow for geographically informed decision.

Integrated FIMS Development at AIT Consulting

At the Asian Institute of Technology, Thailand, AIT Consulting recognizes FIMS as the fundamental block for infrastructure management and developed integrated FIMS (iFIMS). This system primarily serves real estate management and academic facilities management. The underlying architecture is highly customizable to the needs of the client.

iFIMS facilitates the decision making hierarchy, as shown in

Figure 2, by equipping the users with knowledge maps as shown in Figures 3, 4, and 5.

Using iFIMS has introduced a whole new dimension for a potential business environment. In a way, it has provided an alternative for accounting various factors that can contribute to the advancement and productivity of any business company or industry. 

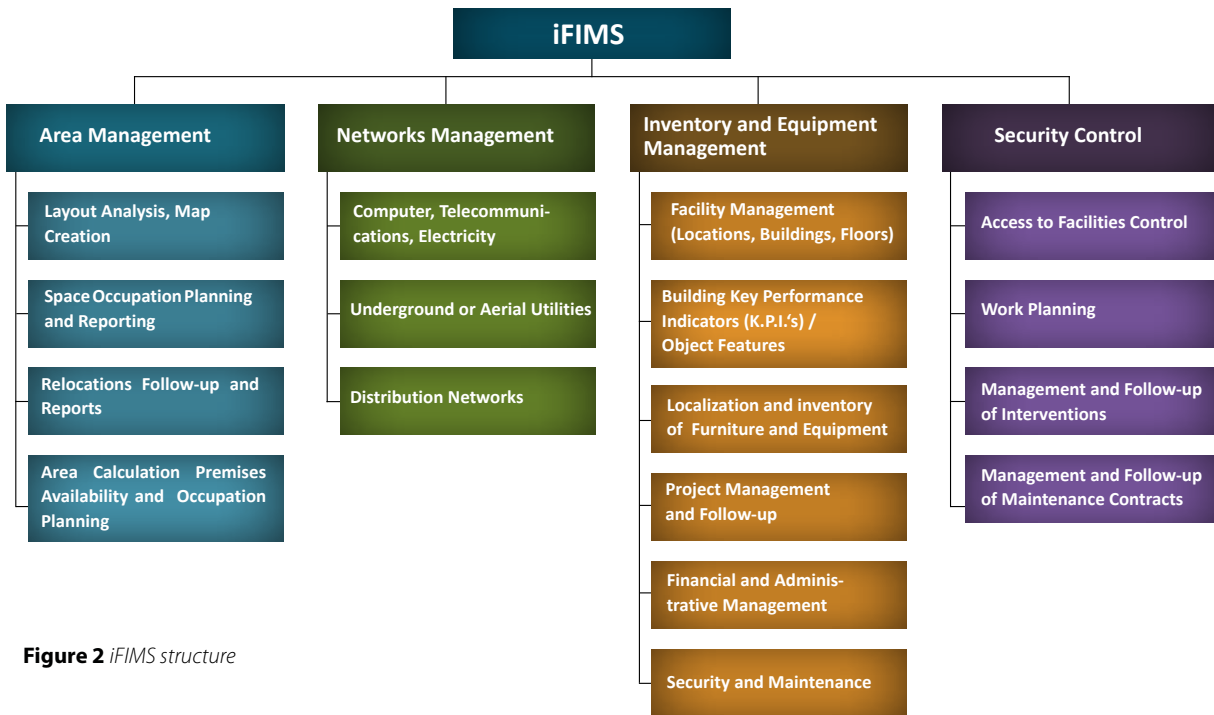


Figure 2 iFIMS structure

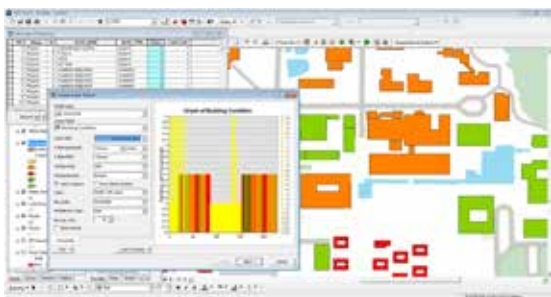


Figure 3 Infrastructure information and analysis module



Figure 4 Energy consumption analysis

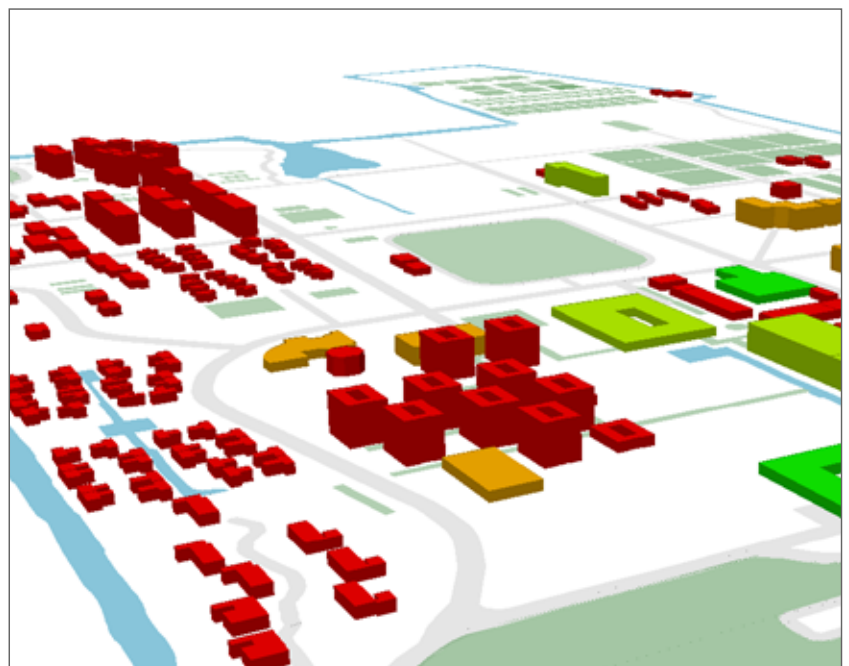


Figure 5 3D thematic maps

Research & Consultancy Projects



AIT Consulting in coordination with ACECOMS provides expertise and services over a broad spectrum of areas covering Technology, Engineering, Environment, Development and Management. Some current and completed projects in structural engineering focusing on performance-based design reviews, structural design and evaluation, and peer review are summarized below.

Structural Peer Review of the 32m-high Buddha Statue in Kanchanaburi, Thailand

Client	The Crown Property Bureau, Government of Thailand
Location	Kanchanaburi, Thailand
Project Description:	32-meter steel Buddha statue on a 13-meter high pedestal

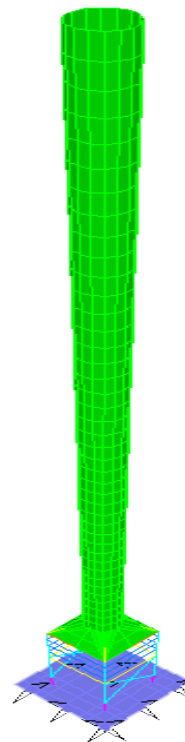


In remembrance of two of the world's tallest Buddha statues destroyed over a decade ago by the Taliban in Bamiyan province, Afghanistan, Her Majesty the Queen of Thailand Sirikit, outlined plans to build a 32-meter Buddha in Kanchanaburi province, about 100 kilometers west of Bangkok. The Buddha statue, called Phra Phuttha Metta Prachathai Trailokkanart Khanthararat Anusorn will be installed on a 13-meter-high pedestal and will be housed inside the Thip Sukhontharam Temple's 300 rai grounds. The Buddha statue will be made up of a steel frame skeleton and covered by gold-plated sheets. The whole project will take about four years to complete and will eventually be publicly open for Buddhist worship and a tourist attraction.

The Crown Property Bureau of the Government of Thailand awarded AIT Consulting a structural peer review project for the Buddha Statue, with Dr. Pennung Wanitchai, Associate Professor, Structural Engineering, AIT, as the main expert for the project. The main objectives of the work carried out was to review the structural system and design of the steel skeleton in terms of safety and stability of the structural system and its foundation against various temperatures, extreme wind, and earthquakes. The scope included wind tunnel tests, structural analysis, and design review which were carried out using the current state-of-the-art in terms of methodologies, techniques, technologies, and tools.

Structural Analysis and Design for Extension of PATKOL Stack

Client	PATKOL Public Company Limited
Location	Bangkok, Thailand
Project Description:	Extension of 20-meter steel stack



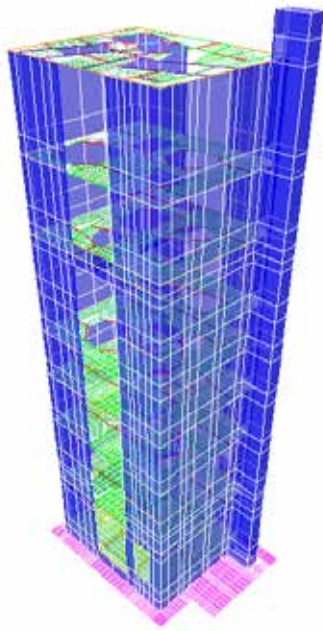
PATKOL Public Company Limited, founded as Patanakolkarn Company Limited in 1965, is an engineering company dedicated to providing the best possible products and services and is a leader in manufacturing of a wide range of industrial equipment and machinery in Thailand.

PATKOL's Petrochemical Project Business Unit (PP) was established in 2009, to design, construct, and install engineering procurement construction works. PATKOL is well-known for the construction and installation of PTT's 135 meter stand-alone steel stack located at PTT Maptaphut Rayong. PATKOL's other products provided in its PP Business Unit include pressure vessels (stainless, special metal, and steel), heat exchangers (shell & tube), storage tanks, steel stacks, as well as installation and piping including maintenance or modification.

ACECOMS was engaged by PATKOL Public Company Limited to carry out the analysis and design of one of PTT's existing steel stack structures located at PTT Maptaphut Rayong. The plan was to extend the existing 20m steel stack by a total length of 30m. During the analysis, it was found that the steel stack could be at possible risk for across wind vibration due to the vortex shedding effect. For this reason, helical vanes were included in the design and construction of the steel stack to reduce the any possible adverse effects caused by across wind vibration.

Structural Evaluation and Design of Preheater Building for Installation of New Machines

Client	Siam City Cement Public Co. Limited and Unity Engineering Consultants Co. Limited
Location	Saraburi Thailand
Project Description:	70-meter RC Building with perimeter shear wall



Siam City Cement, a listed Thai company producing cement, concrete and related products in Thailand is part of the Holcim Group, one of the world's largest cement producers. The Siam City Cement Plant, located in Saraburi, Thailand is one of the largest cement manufacturing plants in the world, which has been in operation for more than 20 years.

Due to increasing demand of cement, the company is working on increasing the production capacity of its cement manufacturing plant.

To realize this plan, the existing machines needed to be replaced with a new system containing many cyclones throughout the height of its structure. For the purpose of installing new machines, several structural components needed to be demolished and a steel structure needed to be added at some locations.

Siam City Cement Public Company Limited and Unity Engineering Consultants Company Limited, a Bangkok-based Civil Engineering Consulting firm, which designed the major structures of the plant, engaged the services of ACECOMS to conduct a Structural Evaluation and Design of the Pre-heater Building prior to installing the new machines. The Pre-heater Building houses the Pre-heater unit which is utilized for heating the incoming raw material with hot air at a high temperature ignition of 1500 degrees, before it enters into the kiln.

ACECOMS conducted structural system evaluation for the new machine installation in terms of suitability, safety, performance, conformance to the relevant codes and standards, cost effectiveness and adherence to the established engineering practices. The scope included a review of the original drawing and construction documents of the structure, study of the new machine drawings and details, evaluation of the structure and its components for all the structural design requirements, and preparation of a detailed technical report and design drawings of the study.

A site visit for structural design verification was carried out to ensure that construction was carried out in accordance with structural design objectives and drawing.

Performance-Based Design of Shangri-La at the Fort, Manila

Client	Sy^2 + Associates Inc.
Location	Manila, Philippines
Project Description	62-story building with 8-level podium and 4 basements



Inspired by the legendary land featured in James Hilton's 1933 novel, *Lost Horizon*, the name Shangri-La signifies the serenity and service for which Shangri-La hotels and resorts are renowned worldwide. Today, Hong Kong-based Shangri-La Hotels and Resorts is Asia Pacific's leading luxury hotel group and is also regarded as one of the world's finest hotel ownership and management companies. With 72 hotels and resorts throughout Asia Pacific, North America, the Middle East, and Europe, the Shangri-La group has a room inventory of over 30,000.

Complementing the company's five existing properties in the Philippines, Shangri-La Hotels and Resorts is planning to open another upscale property, the Shangri-La at the Fort in Manila. The newly planned mixed-use business, residential and retail tower, located along Fifth Avenue and 30th, within Fort Bonifacio, the former military base and city centre in Taguig's business district is planned to open in mid to late 2014. The hotel building, destined to become a Manila landmark, will feature 62 stories, 8-level podiums, 4 basements, 577 hotel guestrooms, 97 hotel residences, and 96 exclusive Horizon Homes.

US-based HANDEL Architects LLP and Hirsch Bedner Associates were selected as architects and interior designers, respectively, for the hotels guestrooms, hotel residences and the main public spaces. Sy^2 + Associates Inc. will handle the structural aspects. Assisting Sy^2 + Associates Inc., AIT Consulting will be conducting the performance-based design review of the 229.3 meter building through the use of state-of-the-art analyses tools and procedures with special emphasis on the effects of earthquakes. This is the second Shangri-La project for AIT Consulting. The first was for a performance based design review of One Shangri-La Place in Ortigas, Manila.

Structural Performance-Based Evaluation of Lattice Towers

Client	Sy ² + Associates Inc.
Location	Manila, Philippines
Project Description	2 Towers, 58 and 54 stories



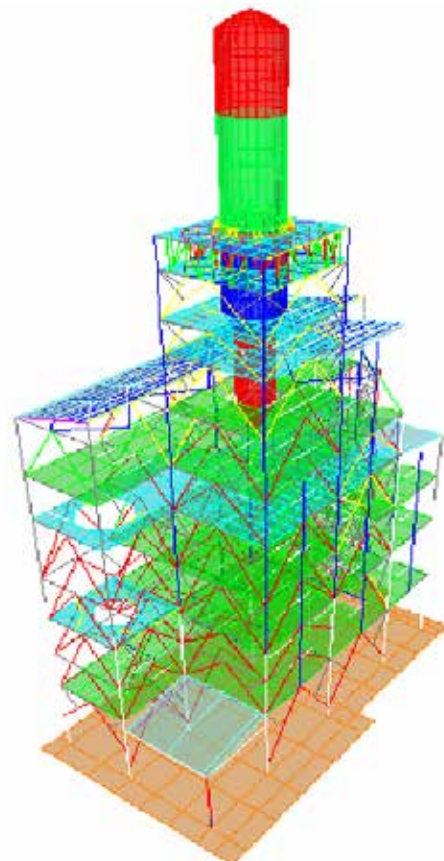
Sy² + Associates, Inc. engaged the services of AIT Consulting, to carry out the Structural Performance-Based Evaluation of Lattice Towers. Ayala Land's Lattice Towers are located in Makati City, Philippines covering a total construction floor area of 66,200 sqm. The project is divided into 2 stages. Stage 1 will consist of a tower that is 58 stories high, while Stage 2 will focus on evaluating a 54-storey. The project also includes the evaluation of a 4-story podium. The main objective of the project is to evaluate the structural performance of the two towers to determine whether the overall performance and reliability of the building under the effects of gravity and lateral loadings will satisfy public safety requirements.

Structural Design Review of Pelletizer Structure, Philippines

Client	Toyo-Thai Corporation Public Company Limited
Location	Batangas, Philippines
Project Description	Pelletizer structure, 56m high

Toyo-Thai Corporation Public Company Limited (TTCL), the first all-around engineering company in Thailand, was incorporated in 1985 by the joint venture of Italian-Thai Development Public Company Limited, one of the biggest contractors in Thailand, and Toyo Engineering Corporation, a leading international engineering company in Japan. TTCL is an integrated contractor, providing integrated design and engineering, procurement of equipment and materials, and construction (integrated EPC) services for turnkey projects, mainly to petrochemical, chemical, and petroleum industries. With twenty-six years of engineering service leadership, TTCL has undertaken more than 160 projects such as the construction of the process plants and facilities and earned solid reputation for quality, safety, and on-time delivery.

AIT Consulting was invited by Toyo-Thai Corporation Public Co. Limited to conduct a structural design review of a Pelletizer structure located in Batangas, Philippines. The main objectives include a review on the structural system and design of the pelletizer structure in terms of safety and stability as well as conformance to the acceptable codes, standards and established engineering practices, with special emphasis on the effects due to strong earthquakes, winds and other applicable demands. The structural design review will be carried out using National Structural Code of the Philippines (NSCP-2010), relevant international codes and standards and methodologies.



Performance-Based Evaluation of Acqua Livingstone Tower

Client	Sy ² + Associates Inc.
Location	Manila, Philippines
Project Description	53-story reinforced concrete building, comprised of shear walls with a special moment-resisting frame



Sy² + Associates, one of the leading groups of Structural Engineers in the Philippines awarded its fourth Structural Performance-Based Evaluation project for Acqua Private Residences Livingstone Tower to AIT Consulting.

The Acqua Livingstone Tower, similar to the first three towers (Niagara, Sutherland, Detifoss), is a reinforced concrete building supported by a pile foundation. The structural system of the building is a dual system, comprised of shear walls with a special moment-resisting frame.

The main objective of the evaluation is to determine the structural performance of the building and define whether the overall performance and reliability of the building under the effects of gravity and lateral loadings will satisfy public safety requirements.

Sy² + Associates, Inc. began engaging AITC to carry out the Structural Performance-Based Evaluations of the Acqua Private Residences in 2010. Acqua Livingstone, the newest tower, is part of the six-tower master planned development on the 2.4-hectare property directly across Rockwell building and accessible via a new bridge over the Pasig River in Manila. 🌐

Seismic Performance Evaluation of Lal Durbar Convention Center for Yak and Yeti Hotel, Nepal

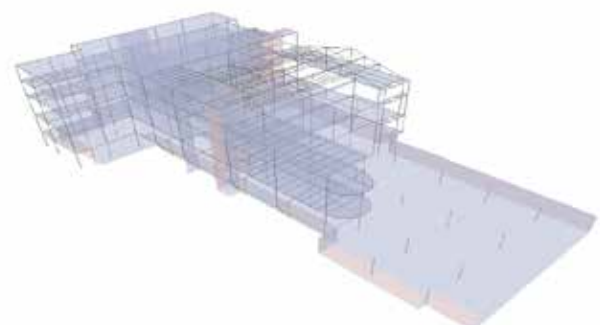
Client	Yak & Yeti Hotel Ltd.
Location	Kathmandu, Nepal
Project Description	4-story structure with a basement and 7 halls



Hotel Yak and Yeti is a luxury 5-star deluxe hotel in the heart of Kathmandu, Nepal. The 120-room facility started its operation in 1977 and after a successful run of 12 years, the hotel expanded by constructing the new Durbar wing featuring an additional 150 deluxe rooms, a brand new porte-cochere, lobby, a new lobby bar, shopping arcade, an atrium, a second swimming pool, and two tennis courts.

The hotel further expanded with the construction of its Lal Durbar Convention Centre (LDCC) in 1999, a four-story structure with a basement, featuring 7 halls to accommodate anything from board meetings to full-scale banquets. The LDCC structural floor system is mainly composed of flat slabs with edge beams while the structural system for resisting seismic loads is a dual system combination of column-beam frames and shear walls. LDCC design was based on the relevant IS 1893 code prevalent at the time, and since this code on "Criteria for Earthquake Resistant Design of Structures" was revised in 2002, the owners of Yak and Yeti Hotel were interested in evaluating the safety of the structure with respect to the provision of the IS 1893-2002 code.

Hotel Yak and Yeti, Kathmandu, Nepal invited AIT Consulting to conduct the seismic evaluation of Lal Durbar Convention Center (LDCC) in coordination with engineers from Optimal Consultancy Services Private Company Limited, India and representatives from Hotel Yak and Yeti. The overall work carried out included 1. Performance of seismic evaluation using nonlinear analysis procedures, 2. Identification of the required retrofit strategies and locations, 3. Preparation of a seismic evaluation report for Hotel Yak and Yeti, Kathmandu, Nepal. 🌐



Modal Separation of Response Spectrum Analysis Results from ETABS

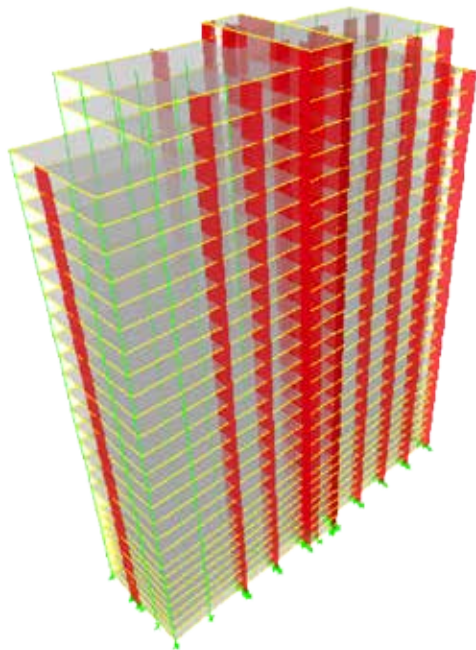
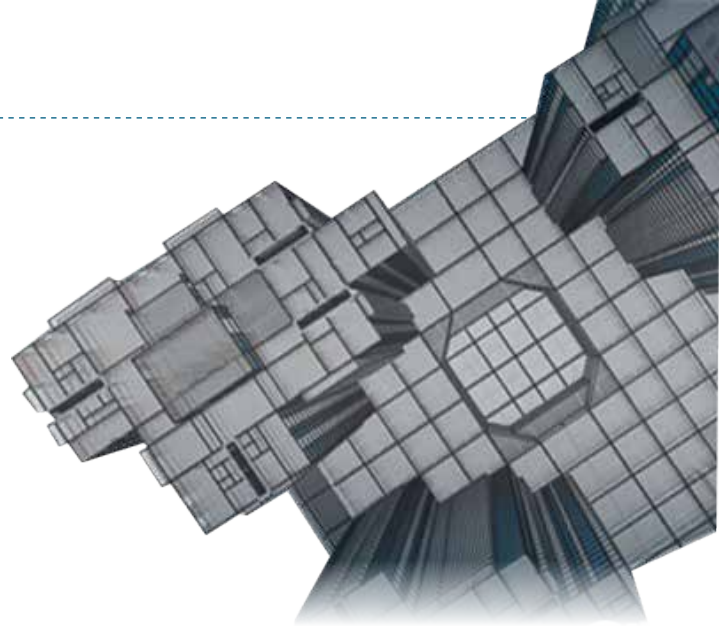


Figure 1 A finite element model of 28-story building

In seismic design, a response spectrum analysis is considered a routine in engineering practice to analyze irregular or dynamically complex buildings. Dynamic complexity is common in flexible structural systems, especially in tall buildings. Flexibility is greatly influenced by the selection of structural system and building height. During the stage of structural system development, analytical models are created to study the performance of the selected structural system. Dynamic and lateral load response parameters, such as mode shapes, natural periods, modal participating mass ratios, base shear, lateral displacement, and story drifts are checked in terms of stiffness requirement and preferable dynamic response. In tall buildings,

the higher mode effects are greatly influenced in response of the building under earthquakes. Typically, the first two mode shapes are in translation and the third mode shape is in torsion. The main lateral load resisting system should be proportioned properly, considering the potential effects of higher-mode response to achieve the optimal dynamic and lateral load response prior to the detailed member design.

Although the modal participating mass ratios can be obtained directly from analysis software, the contribution of each mode on the design forces cannot be judged directly. In spite of smaller modal participating mass ratio in higher mode when compared to the first fundamental modes, the response might be relatively large due to the higher spectral values at lower natural periods in the response spectrum. Additionally, analysis software normally provides the final response after the combination of responses from all

modes according to specified modal combination procedures in response spectrum analysis. To determine the contribution of higher modes on responses, a modal separation needs to be performed for the response spectrum analysis results.

Off the ETABS results, a response for each mode can be calculated by multiplying the response spectrum modal amplitudes with the modal response in each mode of any response quantity such as displacement, force, and stress. The following post-processing procedure is used to separate the response of each mode from the response spectrum analysis of 28-story building.

Step 1

Define the load combinations for each mode to extract the modal responses.

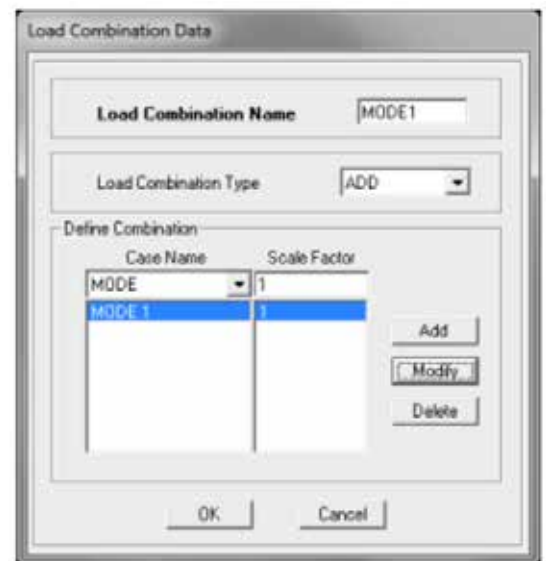


Figure 2 Define Load Combination for each Mode

Author:



Engr. Thaug Htut Aung

Project Coordinator,
AIT Consulting
M. Eng., Structural
Engineering, AIT,
Bangkok, Thailand

Step 2

Extract the response spectrum modal amplitudes of the response spectrum analysis case.

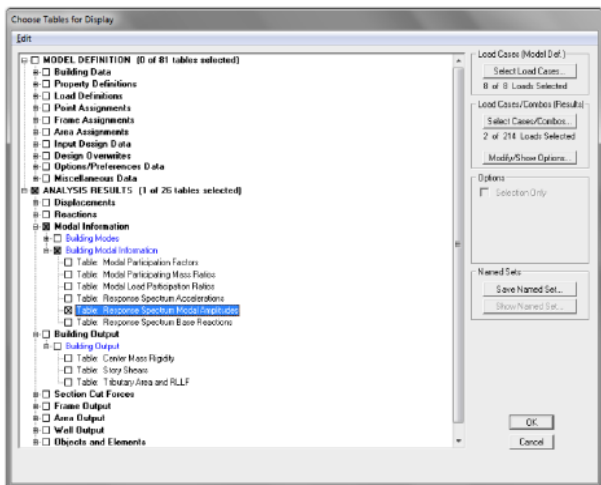


Figure 3 Display Response Spectrum Modal Amplitudes in ETABS

Table 1 Response Spectrum Modal Amplitudes

Spec	Mode	Period	U1	U2	U3
SPECX	1	4.09	-29.84	0.00	0.00
SPECX	2	3.69	210.22	0.00	0.00
SPECX	3	3.16	74.82	0.00	0.00
SPECX	4	1.14	-30.11	0.00	0.00
SPECX	5	1.04	-2.31	0.00	0.00
SPECX	6	0.97	9.53	0.00	0.00
SPECX	7	0.64	14.20	0.00	0.00
SPECX	8	0.53	3.12	0.00	0.00
SPECX	9	0.48	-0.29	0.00	0.00
SPECX	10	0.43	5.53	0.00	0.00
SPECX	11	0.35	1.04	0.00	0.00
SPECX	12	0.31	-1.83	0.00	0.00
SPECX	13	0.29	0.04	0.00	0.00
SPECX	14	0.25	0.45	0.00	0.00
SPECX	15	0.23	-0.75	0.00	0.00

Step 3

Extract the modal response of interest for all modes from load combinations defined in Step 1.

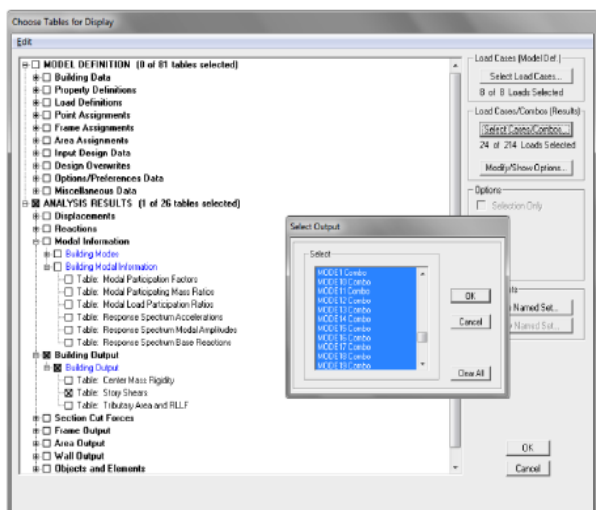


Figure 4 Display Story Shear for all Modes

Table 2 Modal Base Shear

Story	Story	VX
1FL	MODE1	20
1FL	MODE2	-186
1FL	MODE3	-106
1FL	MODE4	894
1FL	MODE5	91
1FL	MODE6	-465
1FL	MODE7	-2,318
1FL	MODE8	-1,016
1FL	MODE9	143
1FL	MODE10	-3,982
1FL	MODE11	-1,767
1FL	MODE12	5,148
1FL	MODE13	-145
1FL	MODE14	-3,135
1FL	MODE15	6,716

Step 4

Multiply the modal amplitude and modal response for each mode.

Figure 5 compares the modal participating mass ratios of each mode while Figure 6 presents the comparison of base shear contribution of each mode from response spectrum analysis cases in both X and Y directions. In this case, the modal participation mass ratios are lower in the higher modes than the first translation modes. In comparison, the base shear contributing from higher modes are relatively higher than the first fundamental modes.

In conclusion, the individual seismic response of each mode influenced on the overall response the building should be checked in the structural system development stage and the dynamic response of the system should be tuned properly to achieve the optimal structural performance. 🏗️

Table 3 Base Shear from Modal Separation

Story	Load	Modal Shear (V)	Modal Amplitude (A)	Base Shear Abs (V x A)
1FL	MODE1	20	-29.84	582
1FL	MODE2	-186	210.22	39,191
1FL	MODE3	-106	74.82	7,904
1FL	MODE4	894	-30.11	26,920
1FL	MODE5	91	-2.31	210
1FL	MODE6	-465	9.53	4,428
1FL	MODE7	-2,318	14.20	32,924
1FL	MODE8	-1,016	3.12	3,171
1FL	MODE9	143	-0.29	42
1FL	MODE10	-3,982	5.53	22,008
1FL	MODE11	-1,767	1.04	1,838
1FL	MODE12	5,148	-1.83	9,445
1FL	MODE13	-145	0.04	6
1FL	MODE14	-3,135	0.45	1,401
1FL	MODE15	6,716	-0.75	5,038

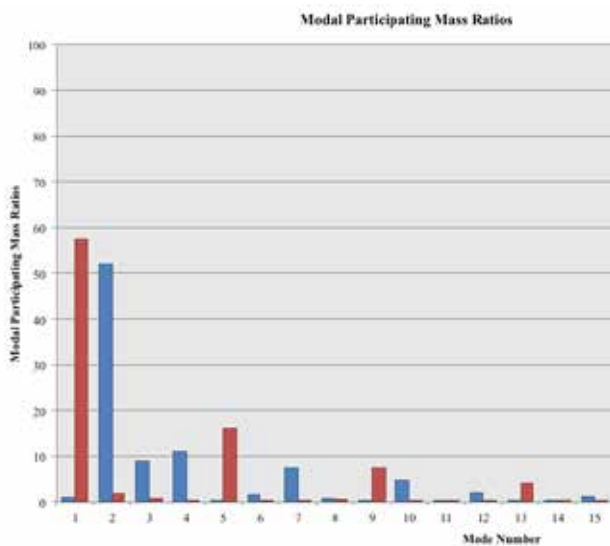


Figure 5 Comparison of Modal Participating Mass Ratios

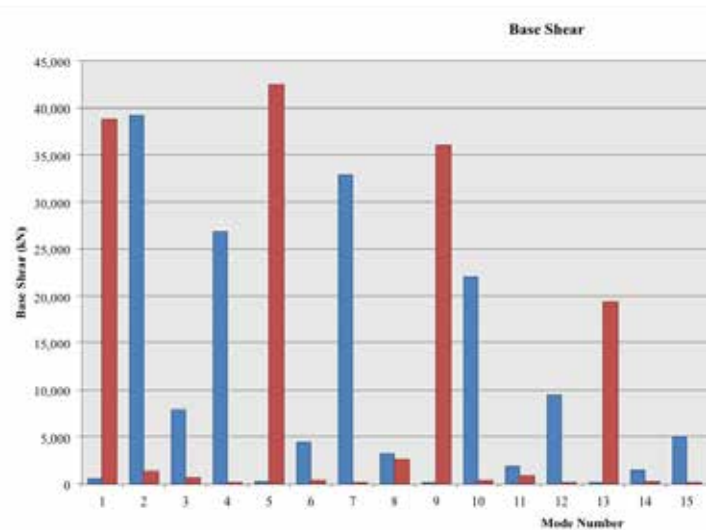
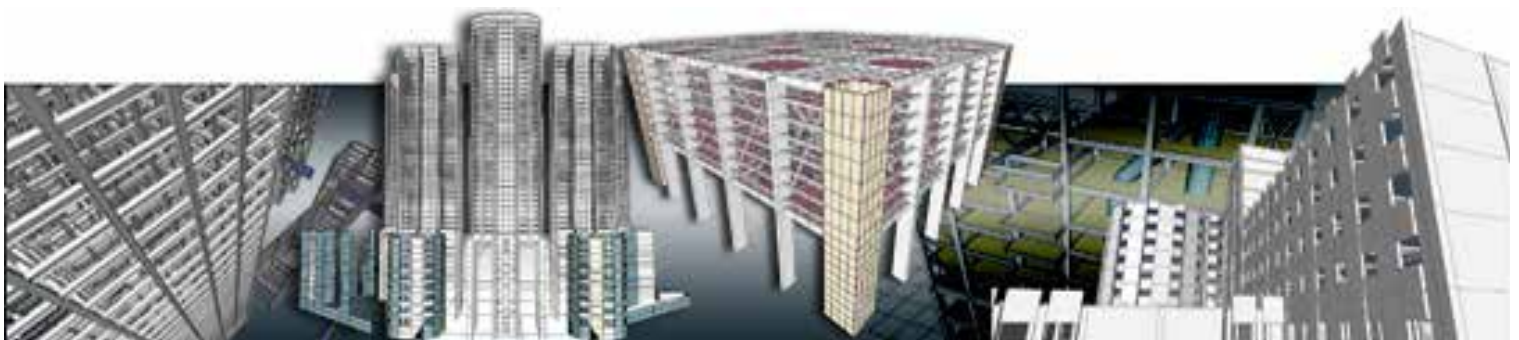


Figure 6 Comparison of Base Shear from Modal Separation



Software from CSI



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Founded in 1975, Computers and Structures, Inc. (CSI) is recognized globally as the pioneering leader in software tools for structural and earthquake engineering. Software from CSI is used by thousands of engineering firms in over 160 countries for the design of major projects, including the Taipei 101 Tower in Taiwan, One World Trade Center in New York, the 2008 Olympics Birds Nest Stadium in Beijing and the cable-stayed Centenario Bridge over the Panama Canal.

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AIT Consulting and ACECOMS are providing support to CSI for development of design tools, particularly for the ETABS software package. These modules include section designer, wall designer, column designer, footings and steel connection. The developed ETABS modules will be used by engineers in building and structure design of multi-story commercial and residential structures.

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