

# TECHNOLOGY

Asian Outlook on Engineering and Technology

Trends in Innovation

Institutions Nurturing Innovators and  
Entrepreneurs:  
Contribution in Innovation Ecosystem

From Prescription to Resilience:  
Innovations in Seismic Design Philosophy

Replicating Wildlife Enforcement Monitoring  
System (WEMS) Model in Asia

Smart Systems for Smart Structures

Innovative Engineering Technologies:  
A Glance at the Most Famous Bridges in Japan



## [ Collaborative Innovation ]

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December 2016

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### About the Cover

*The cover image represents 15 of the greatest innovators and inventors the world has seen from past to present. This issue of Technology magazine pays tribute to these men and women for their valuable contribution to humanity and to also encourage us that it's never too late to innovate.*

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## Editor's Note

Innovation is an essential component of sustaining economic growth, and this renewed understanding by government and private sectors is leading to policy formulation directed towards creating a more inclusive and collaborative innovative growth model. This collaboration in innovation is leading various private and public sector organizations to pool-in ideas and resources and construct a more holistic solution that is not only financially sustainable but also aims at meeting societal demands.

Here at AIT, we are nurturing the entrepreneurial and innovative spirit required of our researchers and students, through competitions, collaborative events, inspirational talks, hack-days, and forming partnerships to push forward this agenda.

This issue of Technology magazine aims at providing the readers a glimpse into the multifaceted world of innovations and collaborative efforts. The magazine, besides highlighting innovations in various sectors, also provides information on the empowerment that a community can attain through technological innovations. This issue also discusses consideration for innovators to innovators regarding and their intellectual property rights.

We hope the ideas and solutions shared in this magazine would be of substantial immense value to the readers, and also invigorate critical, innovative, and collaborative thinking and discussions, and actions.

This magazine is made possible through the valuable contributions from our expert and dedicated authors, as well as our editorial team, making this issue both informative and useful.

I would like to extend my sincerest invitation to all our readers to join our team in developing the next issue of Technology magazine by sending us your feedback, articles, achievements, and opinions on matters relevant to sustainable development.



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# Trends in Innovation

Innovations can be the result of focused research aiming to find solutions for a particular problem or they can emerge from sheer creativity. They can be state-of-the-art comprising of the most advanced and complex technologies or a simple readjustment and unique way of using existing tools. Either way they offer the potential to address our most pressing social and environmental challenges, while providing a sustainable business model.



From the world's tallest green building to salt-powered lamp, we sum up some of the promising and sustainable innovative technologies in recent years that are creating an impact in the society.

## AUSTRALIA

### ONE CENTRAL PARK, SYDNEY

Best tall building worldwide (Council for Tall Buildings and Urban Habitat)

Innovator/ Designer: **Ateliers Jean Nouvel; Urbis Pty Ltd**

The 117 meter One Central Park (OCP) in Sydney, Australia, is an innovative and sustainable structure that incorporates two unique technologies: a hydroponic garden made up of 383 species that hugs the building's exterior, and 42 heliostats, mirrors that passively direct solar energy away from apartment windows and onto shaded spaces. The overall planning aims to adhere to the highest standards of

sustainable residential design under the Australian Green Star rating system and support the vision of an environmentally responsible future for the city. The skyscraper also features a hovering cantilever that cleverly reflects light onto the gardens below and at night doubles up as another bright and colourful LED display.

#### Sources:

<http://bestofwhatsnew.popsi.com/one-central-park-sydney>  
<http://skyscrapercenter.com/building/one-central-park/10710>



One Central Park by Ateliers Jean Nouvel  
(Copyrights Murray Fredericks)

## BANGLADESH

### ECO-COOLER

Low-cost eco-friendly air conditioner

Innovator/ Designer: **Ashis Paul (Grey Dhaka)**



Source: inhabitat.com

In Bangladesh, over 70% of the population lives in corrugated tin huts across the countryside. Living in these huts is unbearable especially during the summer months, when temperatures reach up to 45° Celsius. The inventor of Eco-cooler, Ashis Paul, who works for an advertising house Grey came up with an innovative way to draw cool air into homes using plastic bottles by cutting a board to fit the desired window, and cut bottleneck-sized holes in a grid pattern. The bottoms of empty plastic bottles are cut off and discarded, leaving funnel-shaped bottlenecks that are placed on the grid. This 'zero electricity' air conditioner is one excellent example of a simple innovation that makes life a little better.

Source: <http://inhabitat.com/this-amazing-bangladeshi-air-cooler-is-made-from-plastic-bottles-and-uses-no-electricity/>

## JAPAN

### FLOATING SOLAR PANELS

World's largest floating solar power plant

Innovator: **Kyocera TCL Solar and joint-venture partner Century Tokyo Leasing Corp.**

What is a smart way to build and set up solar power plants without consuming precious agricultural land? Build the plants on freshwater dams and lakes.

Kyocera Corp. and joint venture partner Century Tokyo Leasing Corp has come up with an innovative solution to construct

the world's largest floating solar power generation system that could produce some 13.7 megawatts of power annually. That capacity is sufficient to offset 8,170 tons of carbon dioxide emissions a year, the amount put into the atmosphere by consuming 19,000 barrels of oil. The two companies plan to build the floating

Source: <http://www.architecturaldigest.com/story/floating-solar-panels-could-power-thousands-households-japan-2018>



Source: www.steelguru.com

module made up of 51,000 solar panels on the surface of the Yamakura Dam reservoir, roughly 43 miles southeast of Tokyo.

## ECUADOR

### DRONES or UAV (Unmanned Aerial Vehicles)

Drone for humanitarian efforts

Innovator: **GlobalMedic**



Source: globalmedic.ca

Though associated with war and violence. The move towards using this technology as a humanitarian tool is gaining a momentum, with several pilot projects on the go. The goal is to use drones in disaster struck areas with dangerous and limited road access, for humanitarian workers and serve during damage assessment and even as a tool for survivor detection.

This technology is currently being utilized for disaster mapping process in Ecuador by GlobalMedic after an earthquake of a magnitude 7.8 hit the country to generate 2D and 3D maps to identify areas that need the most support. Researchers are working on installing IntelliNet sensors that will be able to pick up on heartbeats and breathing in areas of detection.

Source: <http://globalmedic.ca/programs/view/globalmedic-ecuador-earthquake-response-2016>

## INDIA

### SMART GARBAGE

Trash can that gives free wifi

Innovator: [ThinkScream](#)



Source: [www.dailymotion.com](http://www.dailymotion.com)

New age media startup ThinkScream invented a trash can that gives 15 minutes of Internet connection whenever garbage are thrown inside it. to people who throw rubbish. This smart garbage plastic bins have light-up LED screens and a radius that reaches 50 yards that can reward people who choose not to litter access to free wifi Internet.

This venture has attracted a lot of attention from other companies who are also interested in the branding opportunities from the \$1500 USD smart garbage vessels.

Source: <http://money.cnn.com/2016/02/23/smallbusiness/india-trash-bin-wifi-thinkscream/>

### WORLDHAUS (Affordable Housing in India)

Fast, sustainable, affordable

Innovator: [WorldHaus](#)



Source: [www.businessinsider.com](http://www.businessinsider.com)

The Worldhaus projects are providing affordable housing in low-income areas in India for under \$2000. The pilot project was launched in 2012 and the organization aims to build a total of 1,000,000 new houses by 2020.

The houses built are constructed with reinforced concrete that uses 20% less cement and sand and 80% less construction steel and can be built in about 10 days.

#### Sources:

<http://bigthink.com/endless-innovation/is-the-world-ready-for-a-radical-low-cost-housing-boom>

<http://nextbillion.net/an-entrepreneur-view-worldhaus/>

## THE PHILIPPINES

### SALT (Sustainable Alternative Lighting) LAMP

Green and safe alternative to traditional lamps

Innovator: [Aisa Mijeno](#)

Filipina scientist Aisa Mijeno mission in inventing the SALt lamp is to change the habit of Filipinos living in remote communities of using kerosene lamps and candles. has no intention of competing with other inventors of sustainable alternative light sources. SALt lamp utilizes the scientific process behind the Galvanic

cell, but instead of electrolytes, the SALt lamp uses saline solution, making it harmless and non-toxic. Compared with kerosene lamp, the SALt lamp is also a lot safer since it does not have components and compounds that may spark fire. Moreover, it does not emit toxic gases and leaves minimal carbon footprint. It also has



Source: [www.changemakers.com](http://www.changemakers.com)

a USB port to charge low-power mobile devices such as cellphones, smartphones, and mp3 players.

Source: <http://filipinoinventionsanddiscoveries.blogspot.com/>

### LOW-COST SENSOR FOR LANDSLIDES

An alternative to expensive early warning systems

Innovator: [National Institute of Geological Studies \(NIGS\) and the Electrical and Electronics Engineering Institute \(both from University of the Philippines\)](#)

A low-cost sensor that can detect landslides has been developed in the Philippines through a collaboration between the National Institute of Geological Studies (NIGS) and the Electrical and Electronics Engineering Institute, both part of the University of the Philippines.

The sensor costs less than US\$1,000, in contrast to standard commercially available landslide sensors that can cost up to

US\$60,000 excluding installation costs. The sensor uses power available from an electric grid, but has a back-up battery in case of power failure.

The sensor is buried vertically in the bedrock of the areas that are being monitored for possible landslides. It then logs ground movement electronically and transmits a report every ten seconds to the NIGS, which serves as a central base station. Geologists

then process and analyse the data, measuring various parameters that affect the sturdiness of slopes, such as rainfall intensity and moisture content.

The project was initiated following a landslide in Southern Leyte in 2006 that buried the village of Guinsaunon, killing more than 1,100 people.

Source: <http://www.scidev.net/global/earth-science/news/low-cost-landslide-sensor-tested-in-philippines.html>

## SOUTH AFRICA

### MELLOWCABS

High-tech electric pedicabs

Innovator: [Neil du Preez](#)

Manufactured from recycled materials, Mellowcabs are a fully electric minicab designed to provide an efficient on-demand taxi service in urban areas. Mellowcabs have the ability to provide more than 100km of transport per day for commuters who need micro transport within three-mile radius, and can easily be hailed via the Mellowcabs app or website.

Source: [www.mellowcabs.com](http://www.mellowcabs.com)



## SWITZERLAND

### LIFESTRAW

Award-winning technology to filter water contaminated following natural disasters

Innovator: [Vestergaard Frandsen](#)

The earth's surface is covered by about 71 percent water yet more than a billion people don't have reliable access to clean drinking water. Many of the poor worldwide simply drink dirty water which can result to diarrhea, one of the major causes of death particularly for children.

A new generation of low-cost and effective water purifiers like Lifestraw, which can

remove nearly all water-borne pathogens without electricity, was designed for the poorest of the poor. The personal version works like a chunky drinking straw and can filter about 1,000 liters, enough to keep a person hydrated for a year. There is also a family version can purify 18,000 liters, serving a typical family for about three years.

Source: <http://lifestraw.com/>



Source: [www.eartheasy.com](http://www.eartheasy.com)

## UNITED STATES

### SOLAR ROADWAYS

Pavement that produces power

Innovator: [Solar Roadways](#)



Source: [www.solarroadways.com](http://www.solarroadways.com)

The future of roadways is looking bright with the little help from the sun. A smart road was developed by Solar Roadways that uses tempered glass and photovoltaic cells to create intelligent, energy-harvesting pavement, complete with built-in heating elements for melting ice and LEDs for signage. Solar Roadways asserted that the glass surface has been tested for traction, load testing, and impact resistance testing in civil engineering laboratories around the United States and exceeded all requirements.

The technology is still in its infancy, but it already received funding from the Federal Highway Administration and an Indiegogo campaign. Solar Roadways was selected by their peers as a Finalist in the World Technology Award for Energy, presented in association with TIME, Fortune, CNN, and Science.

Source: <http://www.solarroadways.com/>

### C-MAX SOLAR ENERGI CONCEPT

Solar-powered car

Innovator: [Ford](#), [SunPower Corp.](#), [Georgia Institute of Technology](#)

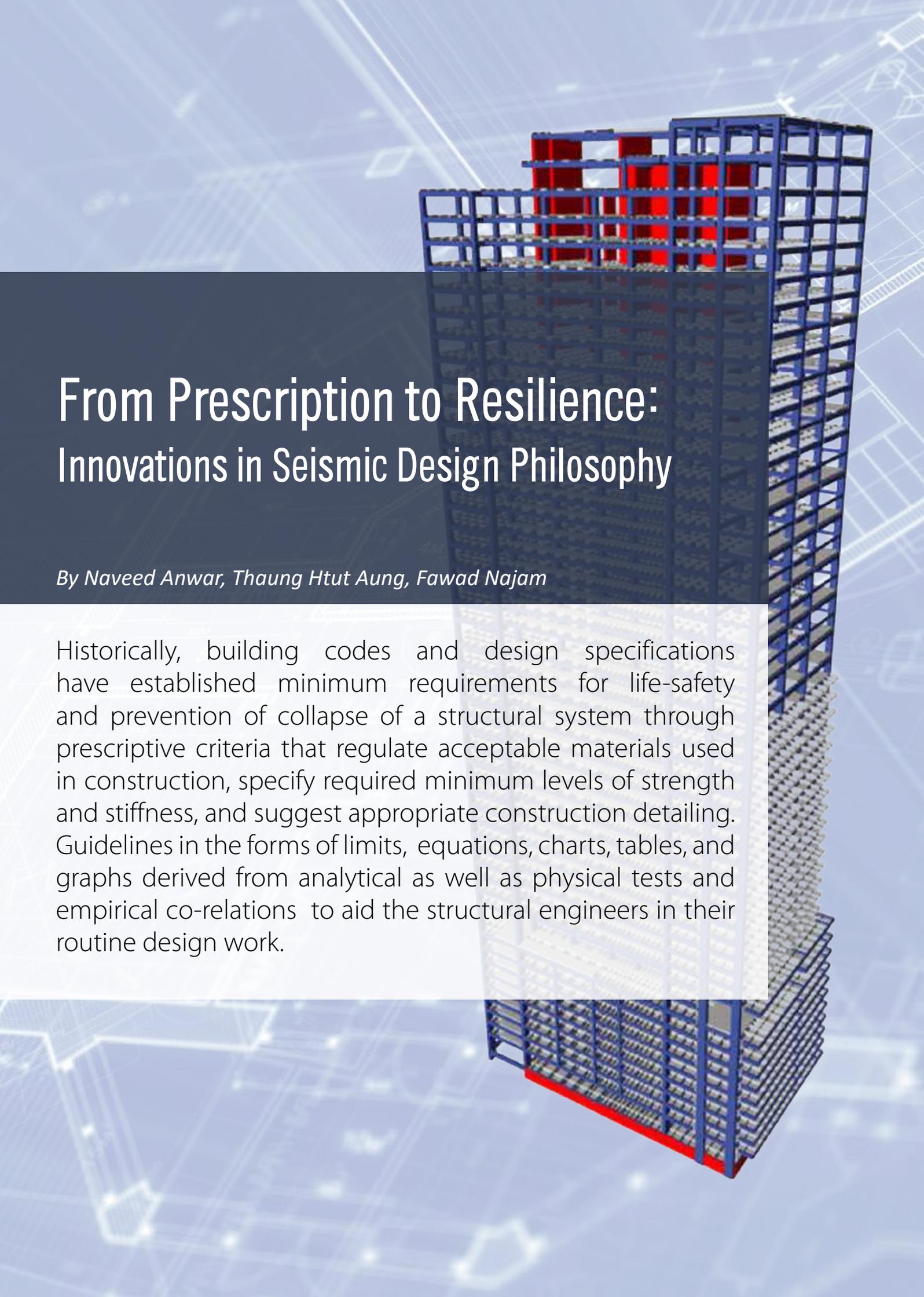


Source: [www.media.ford.com](http://www.media.ford.com)

What's the next best thing to having solar roadways? A solar-powered car? Ford has developed a concept model that runs primarily on solar power and not dependent on traditional energy sources.

A collaboration between Ford, SunPower Corp. and the Georgia Institute of Technology, the C-MAX Solar Energi Concept is a concept car that will be powered by energy it collects using a special concentrator that acts like a magnifying glass. The concentrator would take energy from sun light and direct intense rays to panels on the vehicle's roof.

Source: <http://www.cnbc.com/2014/01/02/ford-develops-solar-powered-car-for-everyday-use.html>



# From Prescription to Resilience: Innovations in Seismic Design Philosophy

*By Naveed Anwar, Thaung Htut Aung, Fawad Najam*

Historically, building codes and design specifications have established minimum requirements for life-safety and prevention of collapse of a structural system through prescriptive criteria that regulate acceptable materials used in construction, specify required minimum levels of strength and stiffness, and suggest appropriate construction detailing. Guidelines in the forms of limits, equations, charts, tables, and graphs derived from analytical as well as physical tests and empirical co-relations to aid the structural engineers in their routine design work.

# From Prescription to Resilience: Innovations in Seismic Design Philosophy

Traditionally, the design procedure recommended by codes and standards was always force-based, owing to the idea that design is a systematic investigation of the stability, strength and rigidity of structures.

Although the prescriptive criteria given in the building codes are intended to result in buildings capable of providing acceptable performance with regard to life-safety, they provide little guidance to the structural engineer with regard to reducing the potential of damage to non-structural components and systems, or excessively large initial construction cost.

In addition, the performance of buildings designed using prescriptive criteria can have high levels of variability during the seismic events. Although the basic objective was always to produce systems capable of resisting all applied loads without failure and excessive deformations during its anticipated life, no special considerations about the role of displacements in design process were invoked prior to mid-1980s.

Various studies in the late 1980 and 1990s highlighted the importance of displacements and their potential role in structural design procedure. The acceptance of key role of displacements in not only performance, but also the design of structures, led to a number of alternate design philosophies.

With the advent of innovative structural systems, complex geometries and advanced construction techniques, the requirement from building codes to handle various new aspects also increased. Currently the traditional codes govern the design of general, low- to medium-rise and relatively regular buildings built with traditional construction materials. They are not specifically developed for tall buildings (having total height > 50 m).

Moreover, they are prescriptive in nature with no explicit check on intended outcome. They are also not expected to cover new structural systems and shapes. Mostly, the prescribed analysis and design procedures are based on elastic theory neglecting some of the key aspects of nonlinearity e.g. realistic demand redistribution etc. The intention to propose simplest and cook-book type procedures does not provide the opportunity to exploit the potentials of recent computing tools. An important shortcoming of traditional building codes (for seismic design) is that the performance objectives are considered implicitly. The structure is expected to resist minor earthquake without damage, which is anticipated to occur several times during the life of a building, without damage to structural and non-structural components.

For design level earthquake, some damage is allowed without causing loss of life and for strongest earthquake, substantial damage is allowed with a very low probability of collapse. There is no explicit verification specified or required in traditional building codes whether these performance objectives are achieved or not. It should be noted that satisfying one design level does not ensure that other design levels will be satisfied as well. Serviceability design



Figure 1: Seismic Design Approaches

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Performance-based seismic design explicitly evaluates how a building is likely to perform, given the potential hazard it is likely to experience, considering uncertainties inherent in the quantification of potential hazard and uncertainties in assessment of the actual building response.

Reference: FEMA 445

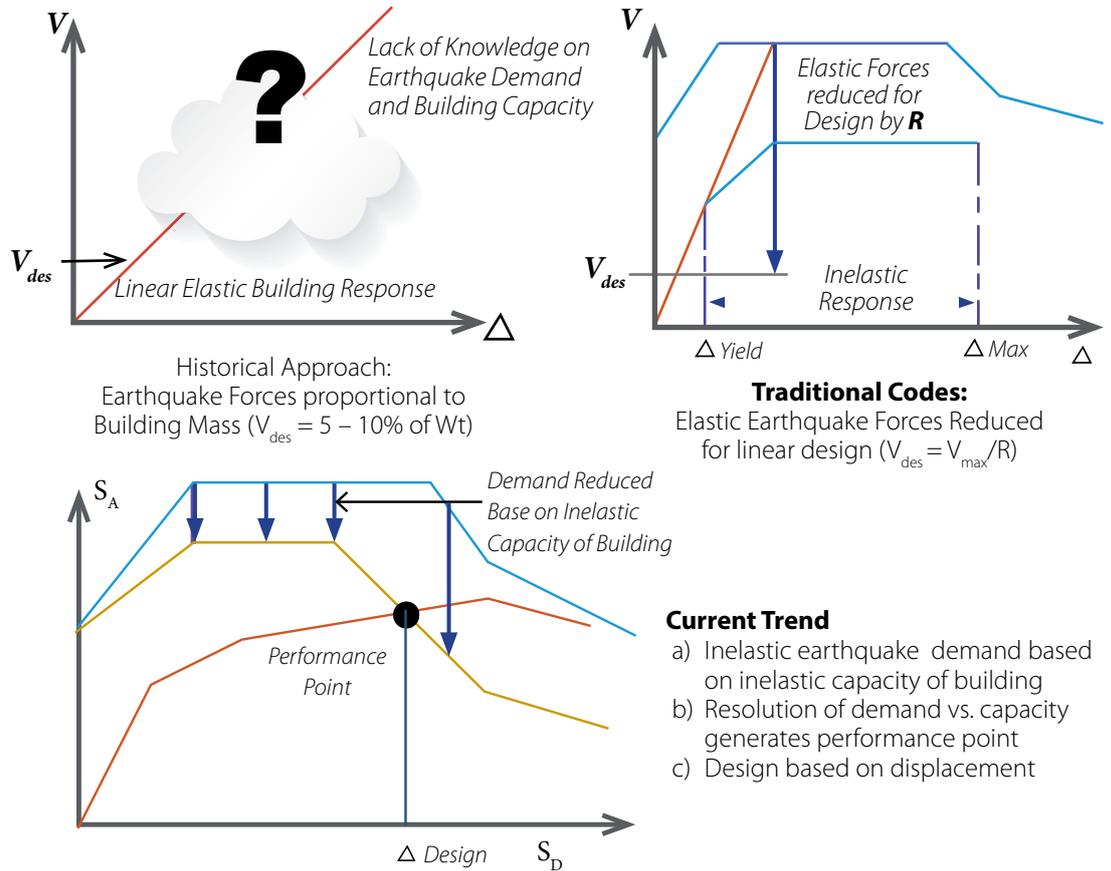


Figure 2: The progression of seismic design approach

only ensures that deflections and vibrations for service loads are within limits but provides no information whatsoever about strength. Similarly, the most commonly used strength design ensures that a certain factor of safety against overload is available within a member or a cross-section but tells nothing about what will happen if load exceeds the design level.

These limitations resulted in strong realizations among researchers and practicing engineers that a new design approach is required, focusing rigorously on achieving the intended performance instead of fulfilling definite rules to implicitly account for desired functionality. These realizations have led to a relatively recent paradigm shift in current approach towards analysis and

design of building structures, termed in latest guidelines and standards as "Performance-based Design (PBD)". It refers to the methodology in which structural design criteria are expressed in terms of achieving a set of performance objectives or levels. It ensures that the structure as a whole reaches a specified demand level including both service and strength design levels. It is the practice

of thinking and working in terms of ends rather than means. Here, owners and engineers can work together to achieve the best possible balance between construction costs and structure's ultimate performance.

### SHORTCOMING OF CODES

- Govern the design of general, low- to mid-rise and relatively regular buildings
- No explicit check on intended performance
- Limited coverage on structural systems and shapes
- Enforce uniform detailing rules on all members
- Neglecting some key aspects in seismic design, eg. realistic demand redistribution, dynamic amplification effect

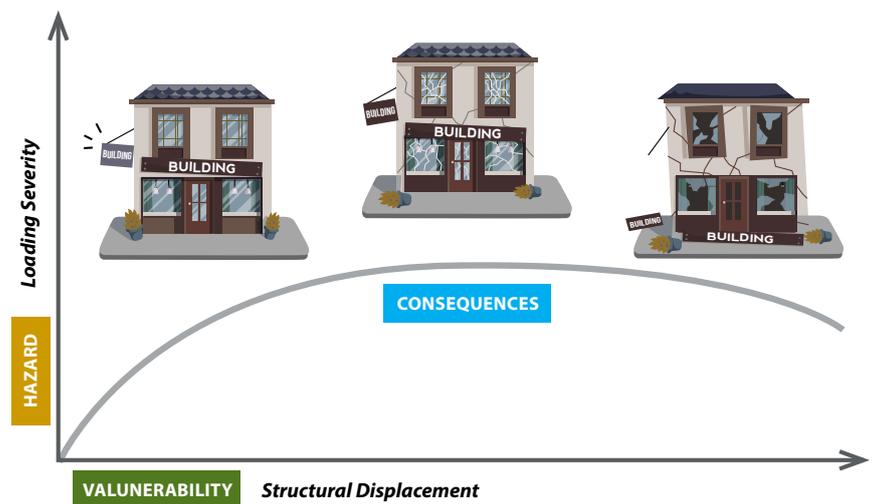
The basic idea is to relate the level of structure's damage to measurable engineering demand parameters (figures 2). It is similar to associating "numbers, which can be crunched" with "physical extent of damage". For example, the performance objectives set for a building can be related to the level of its damage, which in turn, can be related to its displacements and drift values.

Usually the design process starts with analyzing a linear elastic model for code-based design loadings. The structure is initially designed to remain elastic under a lower level of intended loading termed as design-basis load. Then a nonlinear computer model is prepared representing a real building capable of going in to nonlinear range depending upon given inelastic behavior. With

recent developments in information technology and exponential increase in computational power, advance software tools are allowing practicing engineers to simulate the structural behavior as close as the actual. A nonlinear finite element model requires far more expertise, engineering judgment and skills compared to linear elastic model. A full nonlinear response history analysis (NLRHA) is performed for a suit of 7 ground motions and an average of peak response quantities from all ground motions are extracted. The last stage of the process is results interpretation i.e. converting “numbers we have already crunched” in to “meaningful outcome for decision-making”. Since each of these performance levels are associated with a physical description of damage, obtained results are compared and evaluated based on this criterion to get performance insight.

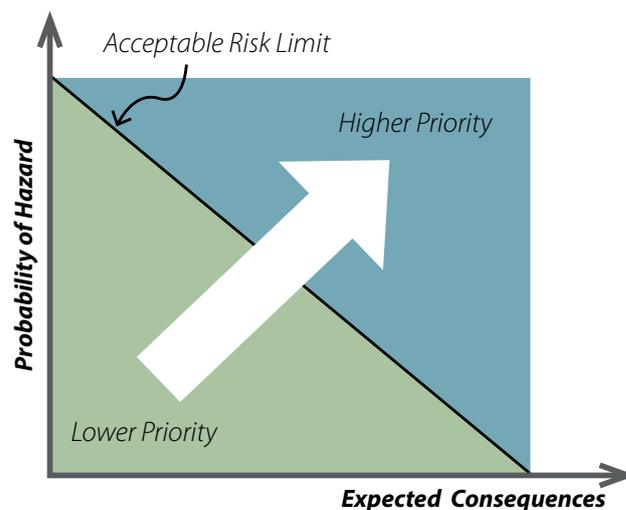
Consequence-based design is nowadays gaining popularity and is being seen as a natural extension of the performance-based design approach. It has been applied in engineering design in different contexts. There are few other types of consequences which result from the inherent function of a structure. The term “consequence” for structural engineers refers to “structural consequence” determined entirely from the analysis of structural member as well as overall system behavior. The consequence-based structural design approach represents another paradigm shift, from the code specified uniform reliability for different members (Nafday 2011). It proceeds through the analysis of expected system consequences, irrespective of the event triggering these consequences. Contrary to the general code-based design in which members are designed for uniform reliabilities, this philosophy requires the structural members to be designed for variable reliability levels, depending upon their contribution in causing adverse system consequences. The aim is to ensure general system integrity and prevent structural collapse in case of any unforeseen causal event. The consequence factors ranging between 0 and 1 are used for determining a member’s contribution towards adverse system response.

Although better design considerations, introduction of sustainability concepts and lessons learnt from past earthquakes, have resulted in improving the resilience of new structures against earthquakes, highly vulnerable older structures (designed based on older codes) still pose a real threat to life safety. These

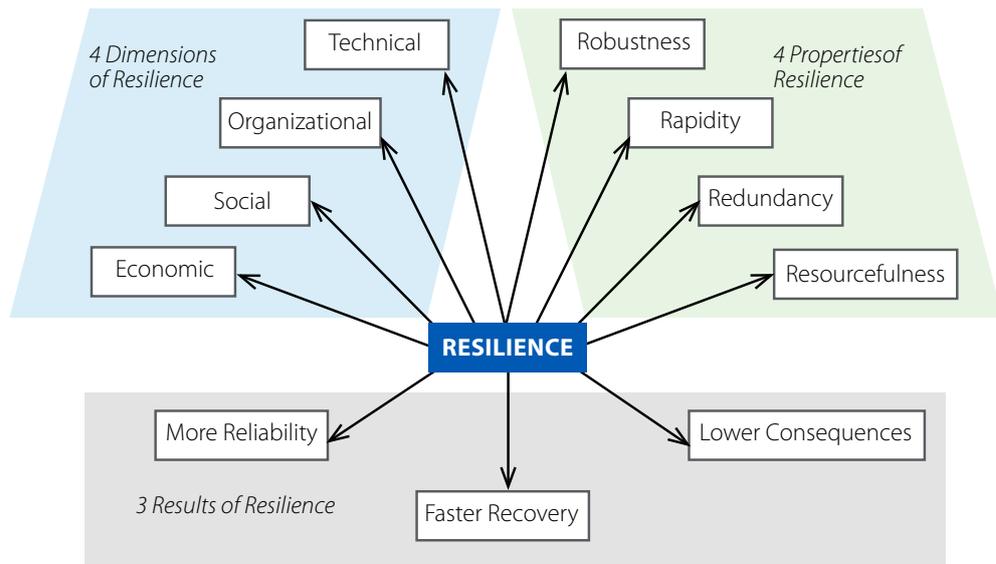


**Figure 3:** Linking the damage to various performance levels in PBD (based on FEMA 451 B)

existing buildings are required to be accessed and rehabilitated to improve their performance against future earthquakes. Owing to their huge number, applying a constant retrofitting strategy to all, is not an economically feasible option. In such scenarios, a risk-based seismic assessment approach is required for prioritization of seismic rehabilitation and retrofitting. Risk analysis can be defined as the estimation of the frequency and physical consequences of undesirable events, which can produce harm (Ricci et al. 1981). A risk-based seismic assessment can be carried out by integrating three important parameters, which include site seismic hazard, likelihood of failure (vulnerability of structure), and consequence of failure (defined in terms of importance/exposure factor). For risk assessment of existing structures, various vulnerability assessment techniques



**Figure 4:** A typical risk plot showing high and low priorities. The components with risk greater than acceptable limit receive inspection priority (Based on McCann et al., 2012)



**Figure 5:** Aspects of resilience considered in the definition by Bruneau et al. 2003 (Based on Bocchini et al., 2013)

*Resilience-based earthquake design is a holistic approach which seeks to identify all earthquake-induced risks (including those outside the building envelope) and mitigate them using integrated multi-disciplinary design and contingency planning to achieve swift recovery objectives in the aftermath of a major earthquake.*

have been proposed in last two decades dealing with different levels of complexity, ranging from simple scoring to more detailed procedures of nonlinear structural analysis. The intended use of information and economic considerations (for any retrofit strategy) heavily affect the level of complexity required for such assessments.

Earthquake engineering practitioners and academics have largely focused on developing ductile structural systems which can sustain high levels of damage before collapsing in order to achieve the life-safety objective more economically. It is therefore not surprising that when a major earthquake strikes an urban region the losses due to damaged buildings and infrastructure are immense. Typically, losses are measured in terms of repair or rebuilding costs, but the indirect losses due to downtime, the inability of people to return to their homes or their jobs (including loss of economic activity), and quality of life may be even greater. These losses are harder to quantify but typically impact communities for years and even decades after an earthquake (REDi™, 2013).

The achievement of “life-safe” buildings is a major accomplishment of huge research efforts and code development. However, with the availability of reliable proven seismic protection devices, and through the use of computer simulation (based upon improved knowledge of structural behavior), it is now possible to design resilient buildings that will suffer little damage

in major earthquakes at minimal cost premium. Small changes to conventional non-structural details can greatly reduce their susceptibility to damage. The consequences of damage in terms of financial loss and repair time can ultimately be used to benchmark performance. Components that contribute significantly to the losses can be re-designed to improve performance and in combination with contingency planning, allows designers to protect owners’ assets and business continuity in addition to providing life safety. These concepts gave rise to a new holistic approach towards earthquake design, termed as resilience-based design (REDi™, 2013). Although the term “resilience” has been used in various contexts and defined by various studies, figure 4 presents the most common aspects of resilience based on Bruneau et al. (2003).

Resilience-based earthquake design is a holistic approach which seeks to identify all earthquake-induced risks (including those outside the building envelope) and mitigate them using integrated multi-disciplinary design and contingency planning to achieve swift recovery objectives in the aftermath of a major earthquake. With the support of a group of stakeholders and multi-disciplinary design professionals, recently a REDi™ (resilience-based earthquake design initiative) rating system has been developed to provide owners, architects and engineers with a framework for implementing resilience-based earthquake design for achieving beyond-code seismic resilience. This framework establishes three rating tiers, each with resilience

**Table 1:** Baseline resilience objectives for design level earthquake (REDi™, 2013)

Rating	Downtime	Direct Financial Loss	Occupant Safety
<b>Platinum</b>	Immediate Re-Occupancy (Green Tag expected) and Functional Recovery <72 hours	Scenario Expected Loss < 2.5%	Physical injury due to failure of building components unlikely
<b>Gold</b>	Immediate Re-Occupancy (Green Tag expected) and Functional Recovery < 1 month	Scenario Expected Loss < 5%	Physical injury due to failure of building components unlikely
<b>Silver</b>	Re-Occupancy < 6 months (Yellow Tag possible) and Functional Recovery < 6 months	Scenario Expected Loss < 10%	Physical injury may occur from falling components (but not structural collapse), fatalities are unlikely

objectives which aim to substantially reduce earthquake risks relative to the code objectives for ordinary buildings. These three rating tiers are denoted as Platinum, Gold, and Silver and their details are listed in table 1.

Since the start of the formal approaches and procedures for carrying out the structural design, there have been many developments in the underlying principles, and the implicit and explicit design objectives. Starting with putting limits in the allowable, working stresses in various materials to achieve in-direct safety factors, to more explicit consideration of different load and capacity factors, to the limit state design principles,

to the formulation of ultimate strength concepts, based on strain and deformation limits. Then the recognition of the difference between brittle and ductile failure, and the introduction of capacity based design approaches, leading to the more comprehensive performance design using high level of analysis sophistication, and more explicit linkage between demand and performance. The recent emphasis on risk based design, and a more integrated approach towards consequence based engineering, also results in increased seismic resilience of structures. 🌐

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# CALL FOR MAGAZINE ARTICLES

We invite all professionals, engineers, architects, developers, academics, and post-graduate students in the field of tall buildings to write for the next issue of Technology magazine with the theme [Tall Buildings]. Please send us your article no later than 15 February 2017.

This issue will cover the following themes:

- *Trends and Advancements in Tall Buildings*
- *Structural Engineering Solutions to Architectural Challenges*
- *Architectural Innovation and Challenges in Tall Buildings*
- *How Cities Can Benefit for Going Tall?*

We also welcome submissions that describe research projects in this area. Feel free to choose another related area.

## GUIDELINES:

- Articles should be between 500-1000 words
- Long articles should be subdivided into smaller sections with sub-headings into several sections with sub-headings
- We also gladly accept alternative submissions such as photo-essays, travel writing, opinion pieces and other relevant content
- Please always put your name, designation, organization, and email in the header of the document
- Please send high resolution photos and graphs, and figures along with your text submission, if possible. Please do not send us images for which you do not have the copyright

## SUBMISSION:

Please submit your article (and photo) to [solutions@ait.asia](mailto:solutions@ait.asia) not later than **15 February 2017**.

For further inquiries, please email [aitsolutions@ait.asia](mailto:aitsolutions@ait.asia)



## WHY TALL BUILDINGS?

World population is projected to reach 8.5 billion by 2030, 9.7 billion in 2050, and 11.2 billion in 2100. This estimation is based on the UN DESA Report "World Population Prospects: The 2015 Revision (Source: [www.un.org](http://www.un.org)).

As population increases cities become denser. Cities with limited space like Singapore and Hong Kong and the Central Business Districts (CBD) of almost all megacities in Asia are utilizing the advantage of tall buildings to accommodate more city dwellers and the influx of tourists. Tall buildings not only provide solutions to expansion of cities but also serve as an important iconic symbol of a city. This trend is only going to increase in the future.



Visit [www.solutions.ait.asia](http://www.solutions.ait.asia)

## Book on Structural Engineering by AIT Authors

A book on "Structural Cross-sections: Analysis and Design" authored by Dr. Naveed Anwar and Fawad A. Najam of the Asian Institute of Technology (AIT), has been published by Elsevier. Released on 11 November 2016, the book focuses on

basic tools and computation methods for structural design and analysis of beam and column cross-sections. To get 30% discount with authors signature, please order at [solutions@ait.asia](mailto:solutions@ait.asia)



## Seminar and Workshop: Tall Buildings Design Trends and Advancements for Structural Performance



More than 100 professionals, engineers, architects, developers, researchers, and students joined the seminar and hands-on workshop on *Design of Tall Buildings: Trends and Advancements for Structural Performance* held on 7-12 November in Bangkok Thailand. The issues and challenges for engineers and architects working on tall buildings were some of the key themes deliberated in the

seminar organized by the Asian Institute of Technology (AIT) in collaboration with Computers and Structures, Inc., USA, and supported by the Council on Tall Buildings and Urban Habitat (CTBUH) with thyssenkrupp as technology exhibitor.

Keynote speakers included Joel Luna, Vice President, Chief Architect, Innovation and Design Group, Ayala Land, Philippines; Jose

A. Sy, President and CEO, Sy<sup>2</sup> + Associates Inc., Philippines; Winyou Wanichsiriroj, Executive Vice President, Design 103 International Ltd.; Maythin Chantra-ou-rai, Executive Director, Architects 49 Limited Thailand; Guest speakers including Dr. Karoon Chandrangu, President, K.C.S & Associates Co.,Ltd.; Dr. Teraphan Ornthammarath, Lecturer, Mahidol University; Apichai Siridumrongphun, Project Development Director, Siam Sindhorn; Rex Sirilan Head of R&D Department, Sy<sup>2</sup>+ Associates Inc. and Earl P. Bonita Head of PBD Department, Sy<sup>2</sup>+ Associates Inc. **More on this event in the next issue of Technology magazine with the theme [Tall Buildings].**

## Talk on Innovation Challenges by Swedish Innovation Expert

A talk on "Innovation Challenges – How to Become Better in Research-based Innovation and Commercialization" - A Swedish Perspective was delivered by Mr. Kjell-Håkan Närfelt, Chief Strategy Officer, VINNOVA (Swedish Governmental Agency for Innovation Systems) at AIT on 15 November 2016.



## Conference in Singapore on Construction Excellence



AIT Solutions Executive Director Dr. Naveed Anwar, one of the speakers in "Construction Excellence: Prefab & Modular Buildings" a marcusevans event held on 14-16 November 2016 at Pan Pacific Hotel, Singapore.

 International Seminar on Affordable Housing



**The International Seminar on Affordable Housing** was held on 3 October 2016 at MiCasa Hotel, Yangon Myanmar organized by Ministry of Construction (MOC) Myanmar, UN-Habitat Myanmar and AIT Solutions, Asian Institute of Technology. The UN-HABITAT, Myanmar discussed the topic *“Issue of Housing Affordability in an International Perspective.”* Mr. Kitti Patpongpijul, Chairman of Housing Finance Association, Thailand presented the topic on *“Housing Finance, Housing and Real Estate.”* A presentation by Ms. Suchada Sirorangsee, Expert in Housing Development Studies, Thailand covered the *“Housing Industry: Policies and Governance Issues.”* The Ministry of Construction (MOC) Myanmar tackled the *“Needs, Issues, and Current Trends in Myanmar Housing Industry.”* Dr. Naveed Anwar, Executive Director, AIT Solutions presented *“AIT’s Technology and Innovation in Affordable Housing and Disaster and Environmental Considerations.”* SCG Representative Mr. Dayin Kiatwankul, Manager of New Business Development, presented *“Building Materials and Technology for Affordable Housing.”*

September 2016

 6<sup>th</sup> Asia Conference on Earthquake Engineering, Hosted by ASEP



AIT’s Prof. Pennung Warnitchai and Dr. Naveed Anwar with some officials from the Association of Structural Engineers of the Philippines, Inc. (ASEP)

The 6th Asia Conference on Earthquake Engineering (6ACEE) with the theme **“Bridging Theory and Practice in Earthquake Engineering for Enhancing Community Earthquake Resilience”** hosted by the Association of Structural Engineers of the Philippines, Inc. (ASEP) was held on 22-24 September 2016 in Cebu City, Philippines. The next conference in this series will be held in Bangkok in 2018 to be organized by AIT Solutions.

Engr. Thaung Htut Aung, Deputy Projects Director, AIT Solutions, presented a case study on *“Performance-based Seismic Design of Reinforced Concrete Dual System Building”* which he co-authored with Dr. Naveed Anwar, Dr. Pramin Norachan, and Engr. Ahmad Muneeb Badar.

## Presidential Estate Project in India Utilizes Technologies Developed at AIT



The President of India H.E. Mr. Pranab Mukherjee attended and laid the foundation stone of the 12 dwelling units during the inauguration of Presidential Ashiana Estate Project by Habitech and the Naturally Acceptable and Technologically Sustainable (NATS), Asian Institute of Technology (AIT) in partnership with Pune-based Prashak Techno Enterprises.

The technologies developed at AIT that will be the basis of the renovation including the interlocking bricks based on AIT-Habitech Technology, and two innovative sanitation technologies developed under NATS Program. Work at the dwelling units is scheduled to begin soon, and it will be formally handed over to the Government of India before the middle of next year.

*“This is just a beginning. The success of this project will open the door to our Habitech Building Technology which is environmental*

*friendly, disaster resilient, cost effective and user friendly to a large country like India. I believe, in few years, there will be large number of projects initiated with Habitech Building Technology all over India which besides being beneficial to the people will also help the Government in its mission to provide Housing for All,”* says Mr. Gyanendra Sthapit, Director of Habitech Center. He will be visiting the site soon for a preliminary survey.

The sanitation component of the project involves two NATS technologies — Anaerobic Buffer Reactor (ABR) and Constructed Wetlands. *“While the ABR technology will be used for pretreatment and degradation of organic waste, the lotus-shaped wetland will serve to kill pathogens and remove pollutants enabling the effluent to be reused in green areas,”* says Dr. Thammarat Kootatep, who has spearheaded NATS research at AIT. 

Reference: AIT News

## AIT and UNU Sign WEMS License Agreement



The United Nations University (UNU) and the Asian Institute of Technology (AIT) signed a License Agreement to implement the Wildlife Enforcement Monitoring System (WEMS) through AIT.

UNU granted AIT license for the deployment of WEMS that empowers governments to monitor trafficking and illegal wildlife crime by bringing together national enforcement institutions to a common data collection

and reporting mechanism. Under the agreement, AIT will execute the programme in the region and beyond through the WEMS Secretariat established under AIT Solutions headed by Dr. Naveed Anwar.

Developed by UNU, WEMS is an environmental governance initiative and policy tool that aims to monitor and protect wild fauna and flora from illegal wildlife trade. WEMS has been successfully implemented in four African countries in a joint effort led by UNU, the Faculty of Geo-Information Science and Earth Observation (ITC) at the University of

Twente, and the Lusaka Agreement Task Force (LATF).

WEMS Secretariat will build upon the model operational in Africa to initially implement in Thailand and eventually promote it in the region while advancing in Africa, and establish an international community of practice to facilitate capacity building and knowledge transfer at transnational and transcontinental level. WEMS will strive to forge partnerships among African, Asian, and European countries in an effort to eradicate wildlife crimes. 

## Mini-Hackathon: Build the Next Killer Mobile App Challenge



The first of a series of Mini-Hackathons was organized on 23 August 2016 at AIT Conference Center by AIT Solutions as a platform for both AIT and non-AIT students and professionals to brainstorm on different ideas that can be converted into a Mobile or Software App. Fourteen ideas ranging from global disaster alert system to personal trekking guide were presented from 11 teams and 4 individual participants. Out of these 14 ideas, three concepts emerged as the most viable industry solution. First Prize was awarded to AIT Team: Fawad Ahmed Najam, Hassan Fazliani, Adnan Nawaz for the "Con MiD" (Concrete Mix Designer) idea. Second Prize went to "Visual Vibometer" by another AIT Team: Fawad Ahmed Najam, Hassan Fazliani, Faisal Rasool. The third prize winner was the Team Mahidol: Dilok Puanhvuan, Piyawat Kengthada,

Saowalak Manakitpaiboon, Warangkhan Phanwanich with Mobile Application for Wheel Chair Structure design. The cash prizes were 10,000, 7,000, and 5,000 baht respectively. Invited guest speakers Bjorn Harvold, Chief Technology Officer & Co-Founder of Traveliko and Zack Siri, CEO / Founder of Codemy shared their experiences on building their own startups and talked about the importance of having the knowledge in coding in this day and age.

Hackathon is an initiative of the Innovation Center at AIT Solutions, a hub for students, researchers, innovators, entrepreneurs to share their promising ideas, collaborate, and develop sustainable and scalable solutions for the benefit of the industry and society. 🌐

## AIT GIC Director among Authors Published in the Science Magazine

An article **“Global Trends in Satellite-based Emergency Mapping,”** was published in the July 15 issue of the prestigious Science Journal that features a review of global trends in satellite rapid response and emergency mapping from 2000 to 2014, analyzing more than 1000 incidents in which satellite monitoring was used for assessing major disaster situations.

One of the authors is an expert from the Asian Institute of Technology (AIT), Dr. Manzul Kumar Hazarika, who is currently the Director (Project Operations) at AIT’s Geoinformatics Center (GIC). According to Dr. Hazarika, they have *“provided a synthesis of spatial patterns and temporal trends in global satellite emergency mapping, and the results indicate that satellite-based emergency mapping is most intensively deployed in Asia and Europe.”*

He added that *“AIT has also been very active in using satellite data for disaster mapping with the Geoinformatics Centre acting as the Principal Data Analysis Node (P-DAN) of*

*Sentinel Asia, and it was only natural that they were asked to collaborate in this activity.”*

Top scientists and specialists from leading space organizations and research institutions from all over the world contributed to this paper including: DLR Earth Observation Center, Information Technology for Humanitarian Assistance; Cooperation and Action (Italy); Human Rights Watch (Switzerland); European Commission - Joint Research Centre (Italy); U.S. Geological Survey (USA); Gulich Institute - Córdoba National University/CONAE (Argentina); Japan Aerospace Exploration Agency (Japan); Asian Institute of Technology (Thailand); UN Office for Outer Space Affairs (Austria); National Disaster Reduction Center of China (China); Geneva International Centre for Humanitarian Demining (Switzerland); National Space Research and Development Agency (Nigeria); Centre National d’Études Spatiales (France); Regional Centre for Mapping of Resources for Development (Kenya); European Space Agency (Belgium); and Université Catholique de Louvain (Belgium). 🌐



Reference: AIT News

## NSTDA and AIT Sign Landmark Agreement

An agreement was signed between AIT and the National Science and Technology Development Agency (NSTDA) to cooperate in the field of research and education, and work towards creating a premier technology and knowledge hub in Thailand. The agreement also includes NSTDA providing 11 experts and researchers to work at AIT as Special Adjunct Faculty members, while AIT gets access to NSTDA research facilities.

Dr. Thaweesak Koanantakool, President, NSTDA, and Prof. Worsak Kanok-Nukulchai, President AIT signed the agreement in the presence of H.E. Dr. Subin Pinkayan, Chairman of the AIT Board of Trustees; H.E. Prof. Yongyuth Yuthavong, Former Deputy Prime Minister and Minister of Science

and Technology, Royal Thai Government; and H.E. Dr. Sahas Bunditkul, Former Deputy Prime Minister and Chairman of AIT Executive Committee.

Dr. Thaweesak stressed upon the importance of working with partners to move towards creating a knowledge-based economy in Thailand. NSTDA has almost 500 doctorates working as researchers who can serve as mentors for AIT students, he said. The NSTDA President added that AIT students are welcome to utilize their science facilities and laboratories. Dr. Thaweesak also signaled towards the proposed Food Innopolis stating that this would be another stellar opportunity for both NSTDA and AIT to work together.



Prof. Worsak Kanok-Nukulchai, in his welcome speech, shared a piece of history recalling that Dr. Puey Ungphakorn, the Founding Chairman of the AIT Board of Trustees, had been assigned by the Royal Thai Government to identify a piece of state land befitting AIT’s new campus. Dr. Puey hand-picked 2,000 Rais (800 Acres) of land in Rangsit that was originally assigned to the Ministry of Industry envisioning that this region would emerge a “Modern Knowledge Hub.” 🌐

Reference: AIT News

## AIT Distinguished Researcher Awards 2015

Dr. Thammarat Koottatep from Environmental Engineering and Management (EEM) at School of Environment, Resources and Development (SERD) and Dr. Kunawee Kanitpong from Transportation Engineering at School of Engineering and Technology (SET) were selected

for the "AIT Distinguished Researcher Awards 2015" in the categories of Senior Research Leader and Junior Research Leader respectively. Both awardees received a full doctoral scholarship for one student each, and a certificate of recognition presented during the May 2016 AIT Graduation Ceremony. 🌐



Reference: AIT News

June 2016

## Director General of RDA Sri Lanka Visits Thailand, Boosts Relations between AIT and RDA



On the right: Dr. Naveed Anwar, Executive Director, AIT Solutions with students from AIT. On the Left: Mr. M.M.P.K Gunaranthe, Director General, RDA, Sri Lanka.

Mr. M.M.P.K Gunaratne, Director General, Road Development Authority Sri Lanka (RDA) visited the Asian Institute of Technology (AIT) on 22 June 2016 as part of his Bridge and Highway Technology Exposure visit. As Sri Lanka aims to improve and expand its road and highway

infrastructure, the country is seeking support from Thailand and AIT to learn good practices and equip its engineers with the right skills and expertise for this effort

During his visit, a meeting between the Director General, Dr. Naveed Anwar, Executive Director AIT Solutions, and AIT students working on creative structural engineering research took place. AIT Solutions facilitated Mr. Gunaratne and arranged introductory meetings with Mr. Thanin Somboon, Director General, Department of Highways, Thailand and representatives from Eight- Japan Engineering Consultants Inc. (EJEC) as well as site-visit to the Red Line Industrial Ring Road Project. This meeting is a continuation of one of the many efforts to solidify collaborative opportunities between AIT and RDA and builds on the several ongoing projects carried out by AIT in Sri Lanka. 🌐

## AITS Hosts Delegates from RDA Sri Lanka for Infrastructure Exposure Visit



As part of the RDA-AIT exchange program, nine engineers from Sri Lanka visited the Mass Transit System, Red Line Project led by Engr. Keerati Thunthasawatana, Deputy Director of ACECOMS at AIT Solutions.

This was preceded by another site-visit in coordination with the Bureau of Bridges, Ministry of Transport (Thailand) to the



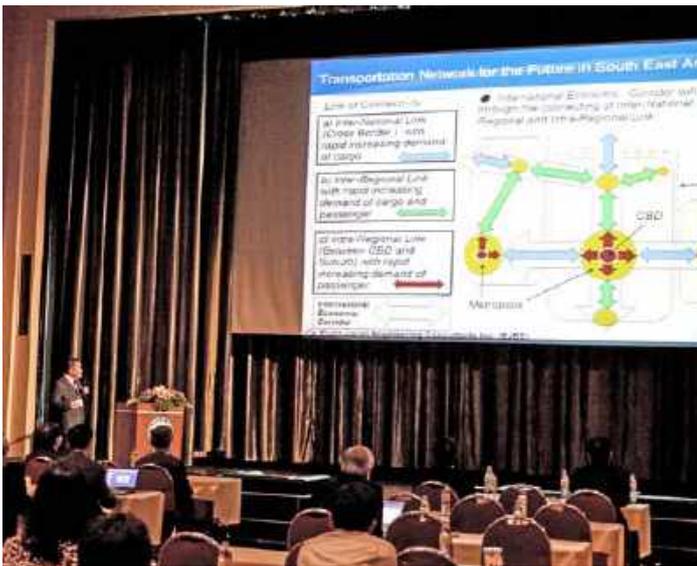
Industrial Ring Road Project, the engineers received presentations outlining the history of the Bhumibol I & II Bridges, and had the opportunity to visit the museum and inspect the bridges.

The engineers also took part in a series of capacity-building activities including the Technical Seminar on Road Infrastructure

for ASEAN Integration, and learned about the transport and infrastructure challenges faced and techniques used by their ASEAN counterparts. In addition, AITS experts held an interactive training session on design check, model analysis, and post processing followed by a thorough Q&A session. 🌐



## AIT and EJEC Collaborate on Technical Seminar on Road Transportation Infrastructure for ASEAN Integration



**From left:** Dr. Naveed Anwar, Mr. Moriyasu Furuki, Mr. Yasukazu Furukawa, Mr. Atsuyuki Nakaseko and Prof. Mitsutaka Sugimoto

The Asian Institute of Technology (AIT) and Eight-Japan Engineering Consultants Inc. (EJEC) collaborated on a technical seminar exploring the current state of infrastructure development in ASEAN held from 13-14 June 2016 at the AIT Conference Center.

A total of 82 participants including over 11 experts from EJEC and 9 experts from ASEAN member countries attended and presented at the seminar. Expert presentations from AIT and lessons learned were shared by representatives from Vietnam, Cambodia, Nepal, Lao PDR, and

Indonesia. The guests included relevant authorities from the national Ministries of Road, Transport, and Infrastructure from the above countries as well.

The first day highlighted the future trends expected to emerge from the region and the challenges faced by member countries in regards to transport infrastructure with participants sharing their experiences. Day 2 focused on in-depth case studies examining tunnel construction, bridge construction, good practices and valuable lessons gained from this.

In his introduction, Dr. Naveed Anwar, Executive Director, AIT Solutions noted the flourishing two-year association between EJEC and AIT, and reiterated AIT's support for EJEC's operations. Following his remarks, EJEC Vice President, Mr. Yasukazu Furukawa, expressed EJEC's determination to continue contributing to the connectivity and resilience of road infrastructure development in ASEAN similarly to the successfully completed projects EJEC has led in Africa and Asia. He also expressed his appreciation for the support and expertise that AIT provides EJEC on its many endeavors. 🌐

May 2016



## ASEP Conference Focuses on Smart and Robust Concrete Structures



Dr. Naveed Anwar, Executive Director, AIT Solutions presented two topics "From Performance to Resilience – A Recent Account of Seismic Design Philosophy" and "Smart Systems for Structural Response Control and Health Monitoring – A Review."

The fifth Convention on Concrete Engineering, Practice, and Technology also known as a.concept'16 focused on the theme "Smart and Robust Concrete Structures" was hosted by the Association of Structural Engineers of the Philippines, Inc. (ASEP) and held on 19-21 May 2016 at the Century Park Hotel, Manila, Philippines.

Keynote speakers included Prof. Sohichi Hirose, Department of Mechanical and Environmental Informatics, Department of Civil Engineering, Tokyo Institute of Technology; Prof. Hikaru Nakamura, Graduate School of Engineering, Department of Civil Engineering, Nagoya University; Prof. Akira Wada, Professor Emeritus, Tokyo Institute of Technology;

and Dr. Naveed Anwar, Executive Director, AIT Solutions and Affiliated Faculty, School of Engineering and Technology, Asian Institute of Technology (AIT).

AIT Solutions and ASEP have long-standing relationship that has been solidified since July 2000. The organizations have collaborated in several focused training programs for structural engineers; the most recent was the Theory and Practice of Performance-based Design: The Future of Earthquake Engineering co-organized by Computer and Structures Inc. (CSI) USA. Dr. Naveed Anwar is a frequent participant and a prominent keynote speaker in ASEP conferences. 🌐

## Vietnam Promotes Non-Fired Brick (NFB) Production and Utilization



The Ministry of Science and Technology (MOST), Vietnam has implemented a project entitled "Promotion of Non-Fired Brick (NFB) Production and Utilization in Vietnam", funded by Global Environment Facility (GEF) United Nations Development Programme (UNDP) and by relevant government institutions.

The Project's objective is to reduce the annual growth rate of GHG emissions by displacing the use of fossil fuels and the usage of good quality soil for brick making through the increased production, sale and utilization of non-fired bricks in Vietnam. The Project will be implemented over a 5-year period and is expected to generate GHG emission reductions estimated at 383 kilotonnes of CO<sub>2</sub> through the displacement of coal-fired clay brick kilns.

UNDP engaged Mr. Gyanendra Sthapit, Director, Habitech at AIT Solutions as an International Building Material Specialist who will assist the National Project Director to effectively deliver project outputs with specific focus on technical capacity building and demonstration of NFB technology.

Mr. Sthapit travelled to Vietnam from 15 -20 May 2016. During his mission, he visited equipment manufacturing factory and also building materials producing factory together with technical advisor Mr. Nguyen Ba Vinh, Vice Chairman cum Secretary General of Vietnam Energy Conservation and Energy Association and also Technical Advisor to Project Monitoring Unit of Ministry of Science

and Technology. In his mission, he had a meeting with national experts on building materials led by Assoc. Prof. Dr. Nguyen Van Tuan, Vice Dean of Building Materials Faculty and Head of Building Materials Division; Dr. Danh Dai Bui, Head of Lab, National University of Civil Engineering and Mr. Do Giao Tien, Project Manager, GKN. Similarly, he also met the task force group of national experts on standards and codes on building materials led by Mr. Tran Quang Hao, Senior Expert, Ministry of Construction; Dr. Thai Duy Sam, Vice Chairman and General Director, Vietnam Association for Building Materials. The mission concluded with the meeting with Ms. Vu Thi Thu Hang, Programme Analyst, Climate Change Mitigation, UNDP and Mr. Nguyen Ba Vinh. 🌐

## Site Visit: Mass Transit System Project



The Structural Engineers at AIT Solutions, Asian Institute of Technology (AIT) visited the Mass Transit System Project in Bangkok on 25 May 2016 headed by Engr. Thaug Htut Aung, Deputy Projects Director and Engr. Keerati Tunthasawatana, Deputy

Director, ACECOMS to gain first-hand experience in a construction project.

One of the agencies involved in the development of the rail transport network, the State Railway of Thailand (SRT), has

implemented the construction of the Mass Transit System (Red Line) Project, Bang Sue-Rangsit Section since March 2013 and is expected to complete in the next four years.

The Mass Rapid Transit System Networks has three components: The Dark Red Line (Thammasat University's Rangsit Campus-Maha Chao) that will serve passengers traveling from northern to southern Bangkok; The Light Red Line (Salaya-Hua Mark) that will run from east to west of Bangkok; and The Airport Rail Link (Don Mueang-Suvarnabhumi) that will connect the two airports.

Dr. Virach Rungrojsaratis, Senior Vice President, Unique Engineering and Construction Public Company Limited welcomed the AIT Solutions team and presented the project. 🌐

## Workshop on Structural Design of Bridges in Sri Lanka



A workshop on “Advance Techniques and International Standards in Bridge Design” organized by the Ministry of Higher Education and Highways (MHEH) and Road Development Authority (RDA), Sri Lanka was held on 23-24 March 2016 funded jointly by Korea Consultants International (KCI) and Korea Engineering Consultants Corp. (KECC) to equip



engineers with the latest information on bridge design.

Nearly 60 engineers from Sri Lanka and Korea attended the two-day workshop held at Waters Edge, Colombo. Dr. Naveed Anwar, Executive Director, AIT Solutions and Structural Engineering Expert presented in the workshop which focused

on topics including Structural Design of Bridges; Advances and Recent Trends in Modeling and Analysis of Bridges; Modeling and Design of Bridge Super Structure and Sub Structure; International Bridge Design Standards and Approaches.

The workshop is under the Capacity Building Programme of the Southern Road Connectivity Project/ Expressway Connectivity Improvement Plan, a project of Sri Lankan government with assistance from Asian Development Bank (ADB) to improve 33.5 km of national highways that link to the three interchanges on the Southern Expressway. The project will also help RDA develop a long-term expressway connectivity plan. 🌐

December 2015

## International Conference: Performance-based and Life-cycle Structural Engineering, Australia



Engr. Thaug Htut Aung presented the “Effect of Using Performance-based Approach for Seismic Design of Tall Building Diaphragms”

The Second International Conference on Performance-based and Lifecycle Structural Engineering (PLSE 2015) jointly organized by the School of Civil Engineering, The University of Queensland and the Research Institute for Sustainable Urban Development (RISUD), The Hong Kong Polytechnic University was held in Brisbane, Australia from 9-11 December 2015.

This conference series was launched to provide an international forum for scientific exchanges in the areas of Performance-based and Lifecycle Structural Engineering within the context of sustainable urban development.

AIT Solutions, Asian Institute of Technology (AIT) participated in the conference through Engr. Thaug Htut Aung, who

delivered a presentation on “Effect of Using Performance-based Approach for Seismic Design of Tall Building Diaphragms”, he co-authored together with Dr. Naveed Anwar, Engr. Jose A. Sy, and Engr. Mir Shabir Talpur. Performance-based design (PBD) of structures is one of AIT’s signature services. PBD is an advanced simulation approach that determines the behavior of structures or buildings against hazards such as earthquakes. 🌐



## International Conference: Improving the Seismic Performance of Existing Buildings and other Structures, San Francisco

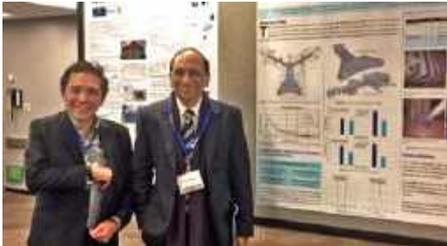
The 2nd Conference on Improving the Seismic Performance of Existing Buildings and Other Structures, a joint conference organized by Applied Technology Council (ATC) and the Structural Engineering Institute (SEI) of the American Society of Civil Engineers (ASCE) was held from 10-

12 December 2015 at the Hyatt Regency Hotel, San Francisco.

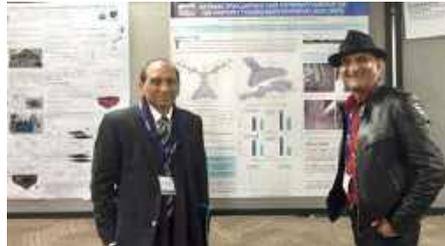
This conference featured a state-of-the-industry forum for the presentation and exchange of the most recent information on the seismic evaluation and seismic

rehabilitation of existing buildings. This also included case studies, emerging and innovative uses of new technologies and materials, standards and codes issues, and performance-based design methods.

A team from AIT Solutions submitted a poster titled "Seismic Evaluation and Retrofit Design of Airport Passenger Terminal Building." This poster focuses on the seismic evaluation and retrofit design of an airport passenger terminal building constructed in 1981. Dr. Naveed Anwar, Executive Director, AIT Solutions and Engr. Jose A. Sy, President Sy^2+Associates, Inc. co-authors of the paper attended the conference. Other authors include Engr. Thaug Htut Aung, and Engr. Mir Shabir Talpur. 🌐



Co-authors Jose A. Sy, President, Sy^2+Associates, Inc. and Dr. Naveed Anwar, Executive Director, AIT Solutions pose beside their poster presentation during ATC & SEI Conference in San Francisco



Dr. Naveed Anwar with CSI President/CEO Ashraf Habibullah



## Director, J-Power Japan Visits AIT Solutions to Explore Partnership



Mr. Hirofumi Kasa and Mr. Saku Moriyama (center) of J-Power with Ms. Rakdao Pakdisi, Mr. Keerati Tunthasuwattana, and Mr. Thaug Htut Aung of AIT Solutions

AIT alumnus Mr. Hirofumi Kasa, International Business Development Director, J-Power and Mr. Saku Moriyama, Senior Professional Engineer and Senior Manager, Business Development, J-Power visited AIT Consulting, now AIT Solutions (AITS) in December 2015 to explore collaboration opportunities. They met with AITS's Mr.

Thaug Htut Aung, Deputy Projects Director, Mr. Keerati Tunthasuwattana, Senior Manager, and Ms. Rakdao Pakdisi, Business Development Manager. AITS Executive Director Dr. Naveed Anwar, who was attending a conference in San Francisco also participated in the meeting through teleconference call.

The two organizations presented their areas of expertise and several salient projects, and discussed how they can work together. J-Power, Japan's state-owned enterprise established in 1952, owns and operates transmission lines and power stations, serving 10 regional electric power companies in Japan. It also operates 7 coal-fired power station and 6 major hydro power plants. J- Power also has a global business in engineering since the 1960s. In Thailand, it has been involved in about 40 engineering projects focusing mainly on provision of technical services and power plant operation.

J-Power and AITS are exploring the possibilities to jointly organize a seminar to promote knowledge and practice in the area of power generation. 🌐



## DRVR and AIT Solutions Discuss Collaboration Opportunities



DRVR (pronounced as driver), a smart driving service provider that brings the Internet of Things (IoT) to fleet management using big data analysis to improve the efficiency of the vehicle fleets

in Asia visited AIT Solutions (formerly AIT Consulting), Asian Institute of Technology (AIT) in December to discuss the possibility of working together in mutually-aligned areas of interest.

The meeting, arranged by Dr. Rafiul Ahad, AIT senior alumnus and Vice President, Software Development, Oracle Corporation, was attended by DRVR's CEO and Co-founder Mr. David Henderson, Chief Data Scientist Mr. Dana Blouin, and Software Developer Arkar

Min Aung and from AIT Solutions, Mr. Aung Htut Aung, Deputy Director, Mr. Keerati Tunthasuwattana, Senior Manager, Mr. Justin Finch, Project Development Manager, and Ms. Rakdao Pakdisi, Business Development Manager.

During the meeting, DRVR and AITS shared and discussed their focus areas, salient projects, and relevant plans for the future. A follow up meeting will be arranged by AITS to further explore collaboration in the area of logistics and supply chain. 🌐

# SPECIAL EVENT: Collaboration for Innovation

## Experts Emphasize Importance of Innovation and Collaboration

The importance of innovation going together with collaboration was stressed in the two-day event **Collaboration for Innovation** held on 12-13 May 2016 at Asian Institute of Technology. Besides focusing on the importance of innovation and collaboration, the event also provided experts from various fields to interact, share ideas, and explore collaborative approaches.

AIT President Prof. Worsak Kanok-Nukulchai in his welcome address mentioned commercialization of innovations as one of the biggest challenges faced by innovators. Prof. Worsak mentioned that collaborative approach to commercialization is one way to bridge the gap between academia and industry.

Mr. Martin Hart-Hansen, Deputy Resident Representative, United Nations Development Programme (UNDP) in his keynote address highlighted the thematic appropriateness of the event and mentioned, "the word innovation was the most used business buzzword in international online media in 2015 and next on the list was collaboration."

The Chief Guests for the event Governor of Industrial Estate Authority of Thailand (I-EA-T) Dr. Verapong Chairperm and Acting Governor of National Housing Authority (NHA) Thailand Ms. Ubonwan Suebybal while introducing their respective organizations also focused on the innovative and collaborative approach being planned and implemented in their organizations. The Guest of Honor Dr. Somchet

Thinapong, President of AIT Alumni Association, Chairman of both National Innovation Authority (NIA), Geo-Informatics and Space Technology Development Agency (GISTDA) also stressed the importance of innovation, saying "Now is the right time to convert these ideas into reality."

Speakers from the Day 1 of the event included: Prof. Sivanappan Kumar, AIT Vice President for Academic Affairs; Prof. Kazuo Yamamoto, AIT Vice President for Resource Development; Ms. Jintana Khumprakob, Expert, Small and Medium Business Enterprise Development, SME Bank; Ms. Sopitta Chotechuang, Assistant Vice President, BETAGRO; and Dr. Jonathan Shaw, Executive Director, AIT Extension, while Speakers from Day 2 included: Dr. Songphon Munkongsujarit, Senior Consultant, Innovation and Technology Assistance Program (ITAP-TMC); Mr. Madhu Avalur, Founder and CEO, Angaros; Dr. Paul Janecek, CEO, Think Blue Data; Dr. Siddharth Jabade, Dean and Professor, Vishwakarma Institute of Technology.

A key highlight of the event was the Innovative Idea Competition, an avenue for researchers to pitch their best strategies, ideas, and use of technologies that will provide solutions for community and industries. The winners will have the chance to further develop and commercialize their ideas with the technical and financial support from AIT Solutions along with partners from the private sector, business, and industry.



- 1 Mr. Martin Hart-Hansen, Deputy Resident Representative, United Nations Development Programme (UNDP)
- 2 Dr. Naveed Anwar and NHA Acting Governor Ms. Ubonwan Suebybal
- 3 Dr. Naveed Anwar, Dr. Somchet Thinapong, and Dr. Verapong Chairperm
- 4 Dr. Verapong Chairperm and Prof. Worsak Kanok-Nukulchai
- 5 Dr. Naveed Anwar with AITS Consultant Mr. Imran Saeed



National Housing Authority (NHA) Thailand Acting Governor Ms. Ubonwan Suebyubol (center), Chief Guest on 12 May 2016 with NHA officials (from left) Ms. Sureeporn Suwannaworn, Director of Technical Cooperation Division; Ms. Orapin Sooksongsil, Assistant to the Governor; Ms. Patcharawan Suwaprichapas, Assistant to the Governor; Mr. Nuntapon Thongpoung, Policy and Planning Analyst



Chief Guest, Dr. Verapong Chaiperm, Governor, Industrial Estate Authority of Thailand (I-EA-T) provided an overview of 55 industries estates functioning in various parts of Thailand. Dr. Verapong, who graduated from AIT with a doctorate in Environmental Engineering in 1991 shared I-EA-T's 4G+ strategy: growth, green, great, governance and innovation- the keywords of I-EA-T's vision



AIT President Prof. Worsak Kanok-Nukulchai encouraged the industry to collaborate with AIT, highlighting that the Institute serves as a neutral platform for sustainable development of the region through global collaboration in education, science and technology, and social entrepreneurship



Guest of Honor Dr. Somchet Thinapong stressed the need to creatively convert knowledge and resources towards societal wealth by employing innovative approaches



Solution Clinics, led by ITAP-TMC and AIT Solutions were held on both days where pre-registered SME clients had consultative dialogue with the experts



Dr. Naveed Anwar showed Dr. Somchet Thinapong the featured research projects in the exhibition of the Collaboration for Innovation event



Technical session on Infrastructure and Buildings with speakers: Mr. Sittichai Niemcharoen, SCG; Dr. Atsushi Mori, EJEC; Prof. Pennung Warnitchai, AIT; Dr. Punchet Thammarak, AIT; Mr. Thaug Htut Aung, AIT Solutions



Technical session on High Impact Talent Management: Strategy for Innovation with speakers: Dr. Nagendra Nath Sharma, BIMTECH; Mr. Voravate Chonlasin, AIT; Dr. Kanu Priya Mohan, AIT; Ms. Farzana Abbasi, SIDA



Technical session on Disaster Risk Reduction and Mitigation/ Transportation and Road Infrastructure with speakers: Dr. Guna Paudya, DHI; Dr. Indrajit Pal, AIT; Dr. Manzul Hazarika, AIT; Dr. Surachet Pravinongvuth, AIT



Technical session on Food, Agriculture, and Cities for Sustainable Future with speakers: Dr. Avishek Datta, AIT; Dr. Loc Thai Nguyen, AIT; Dr. Sohee Minsun Kim, AIT; Mr. Geert-Jan van der Zanden, Xyntéo

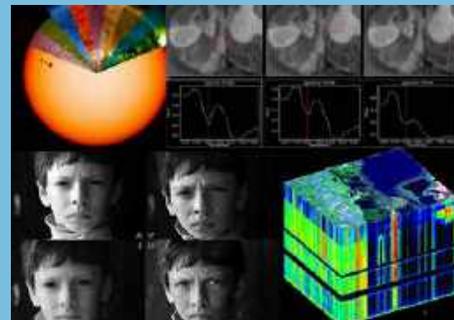
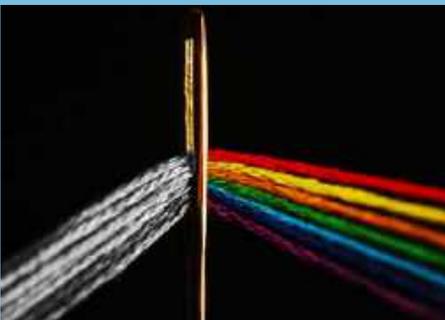
# INNOVATIVE IDEA COMPETITION

An Innovative Idea Competition was held during the Collaboration for Innovation event to provide a platform for AIT researchers develop their research/business idea that has the potential to be a scalable solution.

The winners were awarded cash prize and will be supported by Innovtech at AIT Solutions.

Technical, Financial, Intellectual Property (IP) assistance will be provided to the winners as well.

The winners are



## First Prize:

**Mr. Amin Shamseddini**

"A low-cost solution to convert standard camera to spatio-hyper-spectral camera"



## Second Prize:

**Mr. Ankit SJB Rana, Mr. Ambuj Vaidya, Ms. Vijitra Maneerattanakittikul**  
"Easy Expo"

## Third Prize: Mr. Govinda Khanal

"A low-cost and effective approach to improve seismic resistant of masonry walls"

## Inter-category Winners



### Infrastructure:

**Mr. Salman Ali Suhail**  
"Improving design of pile foundation for vibrating loads"



### Robotics:

**Mr. Shehan Caldera**  
"Vision-aided trajectory control tennis ball shooting robot"



### Information Technology:

**Mr. Umar Safdar & Mr. Muhammad Amir Izhar**  
"EDU-AIDI"



Winners of the Innovative Idea Competition with the judges: Dr. Oleg Shipin; Prof. Muhammad Abid; Dr. Siddharth Jabade; Mr. Madhu Avalur and AIT Solutions Dr. Naveed Anwar and Mr. Abhishek Shah



Dr. Naveed Anwar, Executive Director, AIT Solutions with First Prize Winner Mr. Amin Shamseddini. His winning idea: A low-cost solution to convert standard camera to spatio-hyper-spectral camera

The background of the entire page is a photograph of an offshore oil rig. The rig's complex metal lattice structure is silhouetted against a sky with soft, orange and yellow light from a setting or rising sun. The sea is visible at the bottom, with gentle ripples. A crane arm is visible on the right side of the rig.

# How Innovation Can Help Save the Oil Industry:

## A Case Study Highlighting Knowledge Based Economy

*By Siddharth Jabade*

The world has witnessed a rapid unpredictable slump in oil prices since June 2014 - from USD 114 per barrel to about USD 30 per barrel - up to this point in time. This has posed a great challenge for the “Oil Based Economies,” particularly Middle East GCC (Gulf Corporation Council) countries. The region is facing numerous challenges: oil prices declined by 70 percent and there is pressure on the fiscal budgets of all the regional economies. This has fuelled an interesting transition of these countries from **“Oil Based Economies”** to **“Knowledge Based Economy”** (or “Knowledge Economy”).

# How Innovation Can Help Save the Oil Industry:

## A Case Study Highlighting Knowledge Based Economy

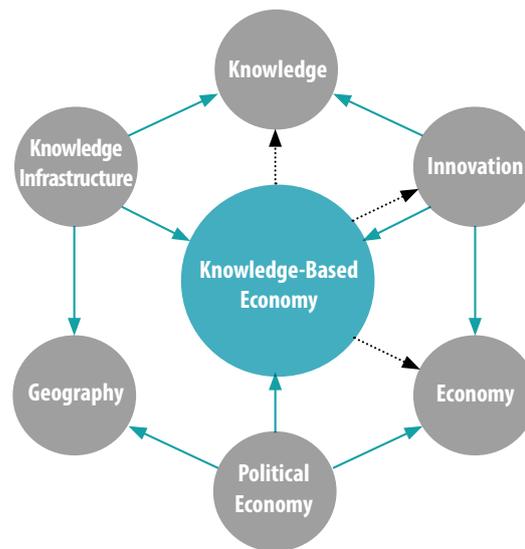
The world has witnessed a rapid unpredictable slump in oil prices since June 2014 - from USD 114 per barrel to about USD 30 per barrel - up to this point in time. This has posed a great challenge for the "Oil Based Economies," particularly Middle East GCC (Gulf Corporation Council) countries. The region is facing 70% decline in oil prices as well as pressure on the fiscal budgets of all regional economies. This has fuelled an interesting transition of these countries from "Oil Based Economies" to "Knowledge Based Economy" (or "Knowledge Economy").

### Crisis Spur Innovation

Winston Churchill once said "never let a good crisis go to waste!"

Can the falling oil prices and forced deviation from the "oil based economy" of the Middle East/GCC be considered as a "blessing in disguise?" Historically, it is a well-established fact that innovation plays a significant role to help economy in such crisis. Innovation is the main catalyst for achieving sustainable economic growth through economic diversification. Countries with strong innovation capabilities have resilient economies that can withstand periodic economic shocks to individual sectors. The downturn may be a source of opportunities for innovators and innovation systems.

What is innovation? It is all about the practical application of new inventions into marketable products or services. Innovation is 'the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations. The advantages of innovation are reduced costs, improved quality, more responsive customer service, better value proposition, competitive advantage and greater flexibility.



*The component of the economy that is developed under the influence of science and technology is called Knowledge Based Economy*

The world witnessed a crisis when the price of energy quadrupled in 1974 due to the oil embargo imposed, skyrocketing costs on consumers and structural challenges to the stability of national economies. To counter this, industries began to innovate substituting other things—insulation, efficiency, ingenuity. Fuel efficiency standards were adopted for auto manufacturers resulting in a doubling of the average new car's fuel efficiency. More efficient refrigerators, light bulbs, windows, and air conditioners came to market. Insulation sales soared. Numerous energy policies regarding conservation and efficiency were enacted. Similarly, the crisis of the oil embargo will spur innovation.

### What is Knowledge Based Economy?

In this "Knowledge Centric Flat World", the paradigm shift is towards "Knowledge Based Economy." The component of the economy that is developed under the influence of science and technology is called Knowledge Based Economy - the capacity to innovate (or popularly known as innovation capacity) is one of the inseparable

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*Linking educational institutes in the innovation system by enabling Transformational Research, in particular innovation-focused and industry-led research is of paramount importance to enable inventions from "lab" reach out effectively to the "society".*

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attributes of this economy. The knowledge based economy is enabled by creation, implementation, and maintenance of a system that focuses on innovation.

Nurturing and linking "Human Capital" with "R&D" is essential to drive innovation capacity development and develop applied knowledge. High performing knowledge economies comprise of a synergistic combination of well-educated and well-skilled workforce, enabling infrastructure, quality research institutions, value for learning and creativity and entrepreneur support system.

This is achieved through "National Innovation System / Ecosystem" that creates the right balance between human, physical, and financial resources forces and enables strong ties creating synergy between the stakeholders which encompasses Government (policy making), operations, public, private sector, entrepreneurs, research organisations and most importantly universities.

## **Transition from Oil Based to Knowledge Based Economy**

The phenomenon of this transition is seen in the oil based economy – Middle East / Arab region in terms of fostering innovation through promoting entrepreneurship, investing in smart infrastructure, encouraging R&D, green investment and upgrading the skills of workers as a part of medium and long-term initiatives. Technological innovation is the best, and perhaps the only way to overcome an economic crisis, and for this we do not need not need an indiscriminate expansive financial policy. The GCC governments have taken steps to combat the threat of low oil prices by committing to focus on human resources and attracting investors. They have opened technology and research clusters in recent years. These facilities aim to bring together various stakeholders and facilities such as universities, private-sector institutions, multinational corporations, and the public sector. Their goal is to foster collaboration on research and to leverage knowledge of the local market. Today several promising clusters have either been completed or are under construction in the GCC. These include the King Abdullah Bin Abdulaziz Science Park in Saudi Arabia, the Centre of Excellence for Applied Research and Training

(CERT) in the UAE, the Knowledge Oasis Muscat in Oman, and the Qatar Science & Technology.

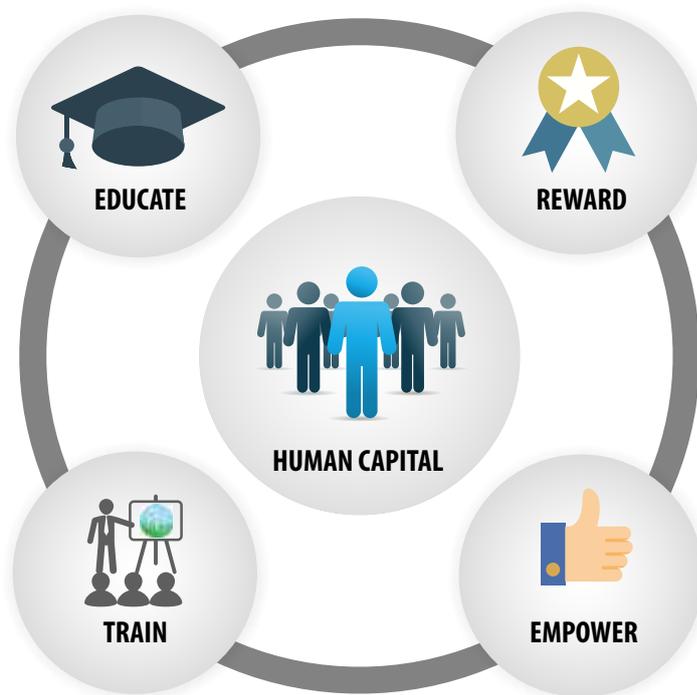
In October 2014, UAE announced national innovation strategy that aims to realize UAE Vision 2021's primary goal of turning the UAE into a global innovation leader. Abu Dhabi's well known Masdar project is one of the attempts to build knowledge economy. It comprises of four components viz. Masdar Clean Energy, Masdar Capital, Masdar City and Masdar Institute of Science and Technology developed in collaboration with Massachusetts Institute of Technology (MIT). Qatar's Science and Technology Park (QSTP) is called an incubator for start-up enterprises.

Educational institutes are well springs of knowledge. They contribute in the development of young minds. The institutes prepare the students to respond to ever-changing contours of socio-economic needs of society and thereby the nation. Linking educational institutes in the innovation system by enabling Transformational Research, in particular innovation-focused and industry-led research is of paramount importance to enable inventions from "lab" reach out effectively to the "society". The GCC member countries are focusing on this aspect.

## **Information, Communication, and Technology, an Effective Tool to enable Innovation Capacity**

ICT is one of the most preferred and enabling means for fostering innovation capacity. The pace of the digital revolution is phenomenal and exponential. The Internet has reached a scale and level of impact that no business, industry, or government can ignore, and its playground has shifted to emerging markets: almost 70% of Internet users are in emerging markets, compared to only 30% 10 years ago.

This region is well poised for adaptation and proliferation of innovation using ICT (Information Communication and Technology) enablement. With a collective GDP of US\$2.85 trillion, the Oil Based Economic Region (Arab world) ranks among the top ten largest economies. Between 2007 and 2012, internet penetration jumped 294%, while mobile data traffic grew 107% in 2013, compared



*Nurturing Human Capital to drive Innovation capacity development*

*World Economic Forum, Executive Opinion Survey 2010–2011 has rated and assessed the extent extent do business and universities collaborate on R&D in various countries. On a scale of 7, [1 = do not collaborate at all, 7 = collaborate extensively]; Switzerland is 5.8 and interestingly Qatar is 5.3, Saudi Arabia is 4.6, UAE 4.2, Oman 3.8, Bahrain 3.3 and Kuwait 3.2.*

**Reference:** World Economic Forum, Executive Opinion Survey 2010–2011 (<https://wefsurvey.org>); National Science Foundation, National Center for Science and Engineering Statistics, and The Patent Board™, special tabulations (2011) from Thomson Reuters, SCL, and SSCI;

<http://www.nsf.gov/statistics/seind12/append/c5/at05-27.xls>;  
[http://thomsonreuters.com/products\\_services/science/](http://thomsonreuters.com/products_services/science/);  
<http://data.worldbank.org/>

to 86% in Asia Pacific, 77% in North America and 57% in Western Europe.

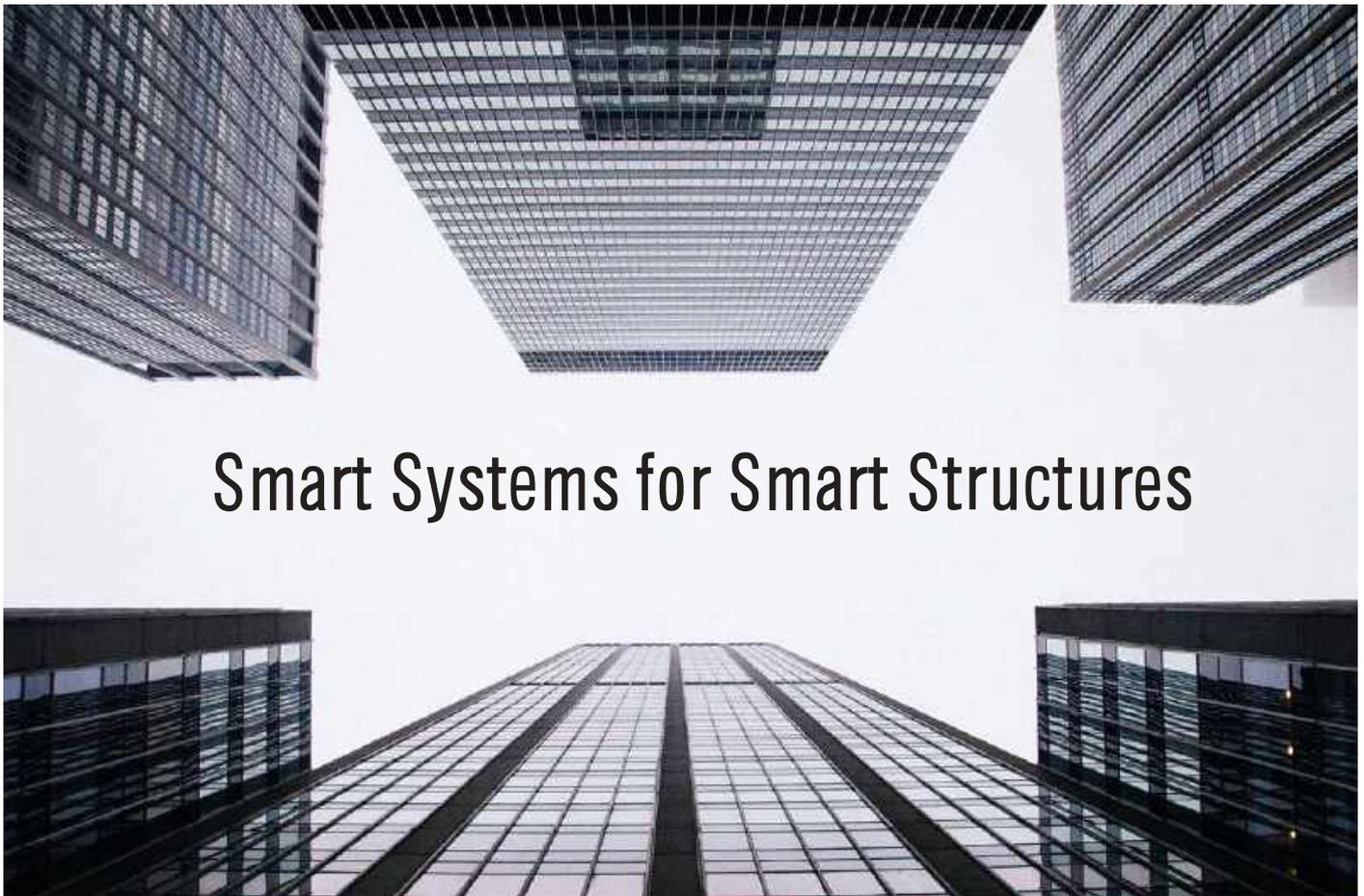
In summary, there is a paradigm shift wherein “knowledge, creativity, and innovation” is moving to center stage in the world by virtue of the transition and diversification of the economy from “Natural Resource Centric” (oil rich regions) to “Human Capital Centric.” This marks the revolution and change wherein dependence on natural resources such as oil is being substantially reduced by new and innovative alternatives using creativity and innovation of human beings. Change is the essence of life, as the famous adage says, only thing constant in this world is change! 🌐



# Smart Systems for Smart Structures

*By Naveed Anwar, Thaung Htut Aung, Fawad Najam*

Smart structures and systems have the ability to alter the controlling parameters to modify the response based on fluctuation of excitement and demand, resulting in desirable performance.



# Smart Systems for Smart Structures

## WHAT IS A “SMART” STRUCTURE?

**T**aipei 101 (formerly known as the Taipei World Financial Center) is a landmark 101-story skyscraper in Xinyi District, Taipei, Taiwan. Its construction started in 1999 and finished in 2004. The building was officially classified as the world’s tallest building in 2004, and held that title until 2009 after the completion of Burj Khalifa in Dubai. Besides being an icon of modern Taiwan, Taipei 101 tower is also considered an icon of the evolution of technology and Asian tradition. However, this supertall building is also famous for a special feature in its structural design i.e. a steel pendulum-type tuned mass damper suspended from its 92nd to the 87th floor. This pendulum sways to offset movements in the building caused by shakings from strong earthquakes and winds, resulting in reduced vibrations. With its innovative design feature and use of control damper at such a large scale, Taipei 101 symbolizes the great success of modern technology, and has also become as a famous tourist attraction soon after its completion. It is rightly an example of what is called a “smart” structure.



**Figure 1:** *The Taipei 101 Tower and its Tuned Mass Damper (from 92nd to the 87th floor)*

The conventional approach towards structural design is to provide them with sufficient strength to withstand loads that are manageable and with the ability to deform in a ductile manner for extreme events. Structures designed following this approach may have several limitations. With constant load-carrying and energy-dissipating capacities, conventionally designed structures may not be able to adapt to changing environmental conditions, loads and excitations.

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They have to rely on their inherent damping (which may not be sufficient) to dissipate energy induced by generally unpredictable external excitations such as earthquakes, wind, blasts etc. Such shortcomings in the traditional design approach opened a whole new paradigm dealing with possible ways to make structures “smart” (figures 2 and 3). If the loading is fluctuating both in magnitude and direction with time, why shouldn’t the capacity of structures be also responsive to that?

Latest advancements in material sciences and nanotechnology have resulted in conception of a variety of new materials with extra-ordinary and innovative properties. Besides having ultra-high-strength and high ductility, such “smart” materials also have the ability to alter their properties with changing external actions. When employed intelligently, these materials lead to structures with self-monitoring and adaptive features and responsive behaviors, referred to as “smart” structures (figure 4). Thus, a smart structural system has the ability to sense any change in external actions, diagnose any problem at critical locations, measure and process data, and take appropriate actions to improve system performance while preserving structural integrity, safety, and serviceability (Cheng et al. 2008).

In a typical smart structure, devices and/or systems are attached to achieve specific performance objectives. These devices may include energy-dissipating systems, active or passive control systems, and health monitoring and data acquisition systems. For resistance against seismic actions, the term smart systems can be used for base-isolation systems, control systems, material-based damping systems, as well as the devices which are used to separate apart the natural period of structure from the predominant period of earthquake ground motions. The structural performance can be greatly modified by the use of such technologies which are rapidly becoming an attractive option to enhance safety and serviceability. The use of smart systems also results

*Smart structures either increase the capacity when needed to meet the demand, or reduce the demand to match the capacity, or accomplish both.*



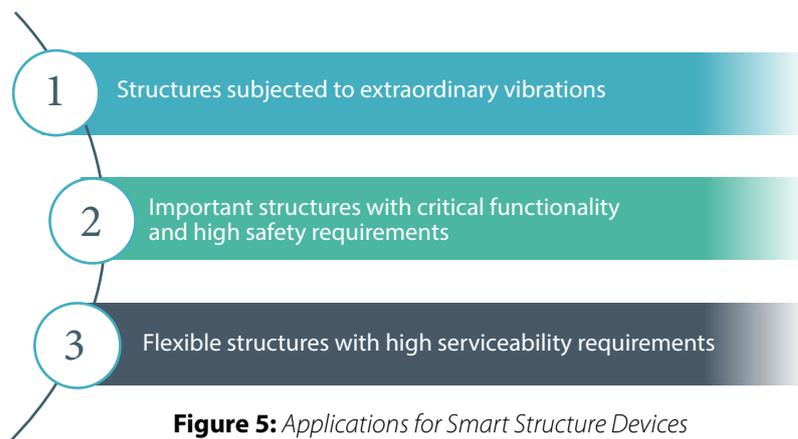
**Figure 2:** Smart technologies for future



**Figure 3:** The key players in smart structure technology



**Figure 4:** Key features of a Smart Structural System



**Figure 5:** Applications for Smart Structure Devices

in saving materials and construction effort which leads to economical designs. Although such systems can be applied to any structural type, occupancy or conditions, these can be extremely useful for performance enhancement of certain special cases as follows (figure 5).

- a. Structures subjected to extraordinary vibrations, such as extreme winds or strong earthquakes.
- b. Important structures with critical functionality and high safety requirements, such as hospitals, schools, and nuclear plants.
- c. Flexible structures with high serviceability requirements (affecting occupants' comfort), such as high towers, sky-scrapers, long-span bridges etc.

The potential control measures can widely vary depending upon the nature of applied actions as well as the type of desired response parameter. For example, in case of seismic actions, there can be following ways to reduce or suppress the lateral displacement of a structure.

- a. Increasing the damping ratio  $\xi$  (or energy dissipating capacity) of the system
- b. Reducing the intensity of ground motion  $\ddot{u}_g(t)$  experienced by the system
- c. Increasing the difference between forcing frequency  $\omega$  and the natural frequency of system  $\omega_n$  (which again depends on mass and stiffness of system) to avoid resonance amplification of response

These approaches have resulted in a number of practical solutions for seismic control and response suppression. For example, various control devices (mass dampers/drivers, tendons, braces etc.)

tend to serve as a source of additional energy dissipating capacity, corresponding to (a). On the other hand, base-isolation systems are intended to cut-off or reduce the energy transmission of earthquake ground motions to the structure, corresponding to (b). Lastly, various systems are available that apply a control force or alter vibration characteristics resulting in increased difference between predominant period of ground motion and natural period of structure, corresponding to (c). A brief review of various damping systems and base-isolation systems being used around the globe, will be presented here.

## DAMPING SYSTEMS FOR DYNAMIC RESPONSE CONTROL

When it comes to modifying the structural properties for better response control, adding damping through additional energy-dissipating mechanisms is more practical compared to other options (changing the mass and/or stiffness). The reason lies in the fact that most of tall structures exhibit small amounts of damping and their response is primarily governed by the restoring and inertial force components instead of damping force. A significant effort and high cost is required to practically introduce control forces resulting in reasonable changes in restoring and inertial force components. On the other hand, a much less effort is required to add control force resulting in additional damping. Therefore, modifying the structure's mass or stiffness is less practical compared to the use of additional damping source. Most of control systems for suppressing vibrational response against winds and earthquakes are mainly composed of dampers with minor impact on structure's overall mass and stiffness. Figure 7 presents a wide spectrum of such devices and techniques.

# Damping Systems for Dynamic Response Control

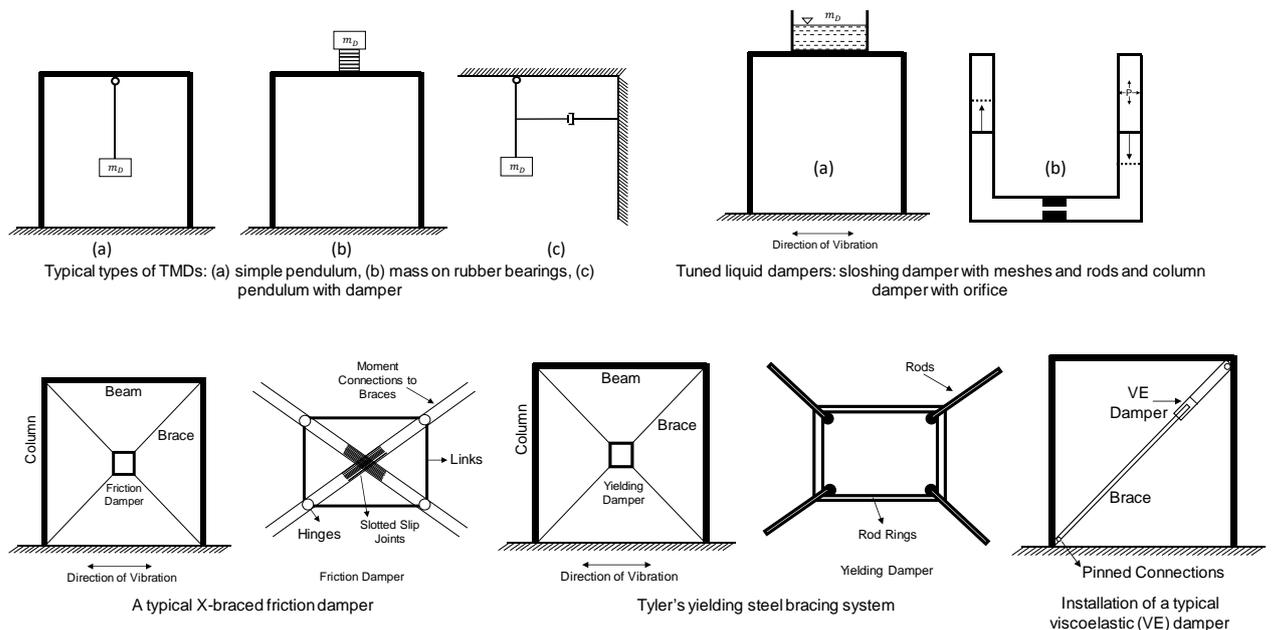
Passive Control Systems	Semi-Active Control Systems	Active Control Systems	Hybrid Control Systems
Tuned Mass Dampers (TMDs)	Semi-active Tuned Mass Dampers	Active Mass Damper (AMD) Systems	Hybrid Mass Dampers (HMDs)
Tuned Liquid Dampers (TLDs)	Semi-active Tuned Liquid Dampers	Active Tendon Systems	Hybrid Base-Isolation Systems
<div style="display: flex; flex-direction: column; align-items: center;"> <div style="background-color: #add8e6; padding: 2px;">Slushing Dampers</div> <div style="background-color: #add8e6; padding: 2px;">Column Dampers</div> </div>	Semi-active Friction Dampers	Active Brace Systems	Hybrid Damper-Actuator Bracing Control
Friction Devices	Semi-active Vibration Absorbers	Diagonal Braces	Intelligent Hybrid Control Systems
Metallic Yield Devices	Semi-active Stiffness Control Devices	K-Braces	
Viscoelastic Dampers	Electrorheological (ER) Dampers	X-Braces	
Fluid Viscous Dampers (FVDs)	Magnetorheological (MR) Dampers	Pulse Generation Systems	
	Semi-active Viscous Fluid Damper		

**Figure 6:** Various damping systems for dynamic response control

## Passive Control Systems

Passive energy-dissipating systems use various mechanical devices which react to structural vibrations resulting in dissipating a portion of their kinetic energy (figure 8). This results in suppression of structural response and ultimately reduced damage in both drift- and acceleration-sensitive components. These systems requiring no external power source are capable of generating large damping forces with increasing structural response. Some passive control systems, such as tuned mass dampers (TMDs) or tuned liquid dampers (TLDs), are tuned to be effective

only against specific forcing frequency (and time period) which is set to be the frequency corresponding to fundamental-mode of vibration of structure. This is based on the assumption that maximum oscillatory response is dominated by first mode. However, for taller structures, higher modes can also significantly contribute (especially in force responses) which may need to be suppressed. In such cases, more than one dampers may be considered for each significant mode of vibration.



**Figure 7:** Some passive control systems

Semi-active Tuned Mass Dampers	Semi-active Tuned Liquid Dampers	Semi-active Friction Dampers	Semi-active Vibration Absorbers
Electrorheological Dampers	Semi-active Stiffness Control Devices	Magnetorheological Dampers	Semi-active Viscous Fluid Damper

**Figure 8:** Common semi-active control systems

## Semi-active Control Systems

Semi-active dampers possess some adapting capabilities and are often referred to as controllable or intelligent systems. They have an additional adaptive system which collects and process the information about response of main structure and modifies the damper's property based on this information (figure 9). A typical semi-active control system comprises of vibration measuring sensors, control computer, control actuator and a passive damper. The computer processes the vibration measurements coming from sensors and generates the command for control actuator to modify the properties of passive damper according to requirement. In this way, semi-active dampers economically combine the advantage of both passive and active control systems.

## Active Control Systems

Passive systems are limited in their ability to adapt according to varying external excitations. Moreover, some passive systems (e.g. TMD and TLDs) are only useful within a narrow range of frequency and may not be useful for response contributions from more than one vibration mode. On the other hand, semi-active devices are limited by the capacity of their component passive devices. Active response control systems meet these limitations by using electrohydraulic actuators which directly generate the optimum amount of control force based on actual measured response of main structure. This control force serves as additional damping force and helps in suppressing both response

vibrations against winds and earthquakes, as well as ambient oscillations to improve structural serviceability. These systems offer the advantages of suppressing responses against a wide range of forcing frequencies (figure 10). A typical fully adaptive active control system consists of three types of elements (a) sensors (b) actuator, and (c) controller with a control system. The output from sensors is feed in to controller (usually in the form of electrical signals) for processing the information. The controller analyzes the data and generates suitable commands for the actuator, based on analysis.

## Hybrid Systems

Active control systems have two main limitations. First, they require significant amounts of external power supply and complex sensing and signal-processing units resulting in high costs. Second, they require actuators capable of producing large control forces. These limitations resulted in development of hybrid control systems which combine the simple and reliable working mechanism of passive systems with the cutting-edge technologies for development of smart algorithms for active control.

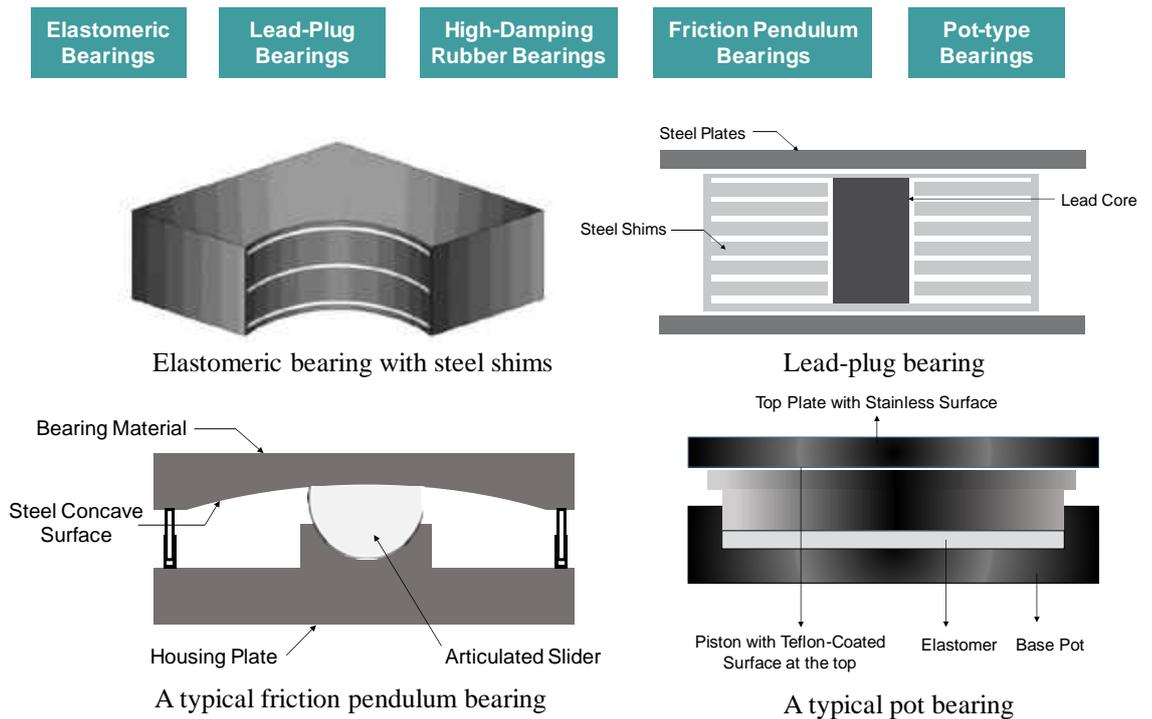
## BASE ISOLATION SYSTEMS FOR SEISMIC RESPONSE CONTROL

Base isolation is a well-established technique of passive control approach which tend to reduce the energy transfer from ground acceleration to structure. A structure mounted on a material



**Figure 9:** Advantages of active control systems

## Base Isolation Systems for Seismic Response Control



**Figure 10:** Various base isolation systems for seismic response control

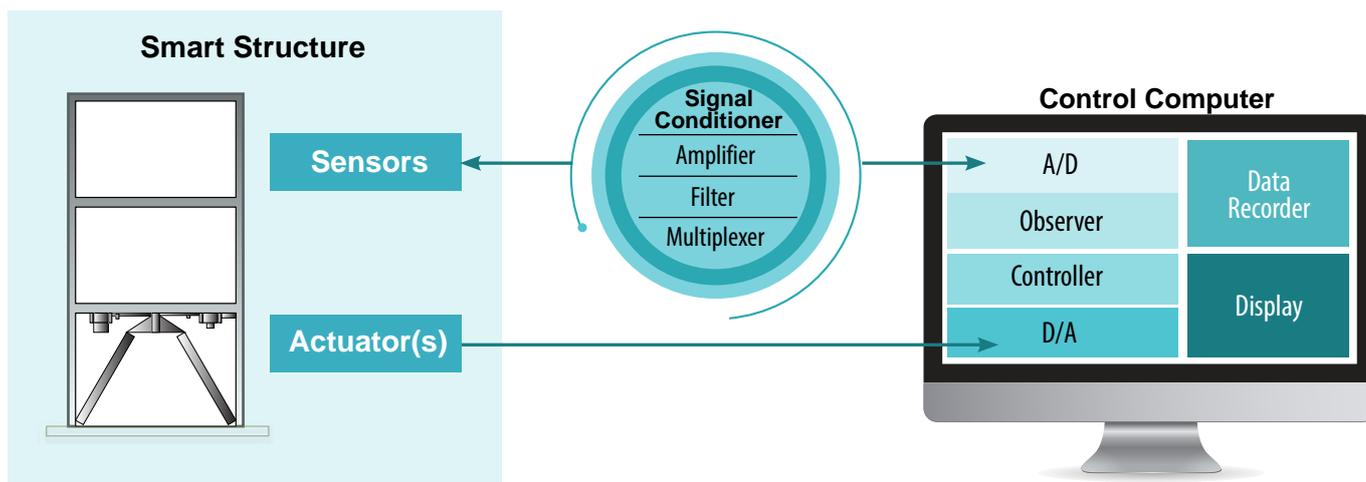
having significantly low lateral stiffness (compared to vertical) receives significantly lower amounts of seismic energy compared to a fixed-base structure. The presence of low lateral stiffness material filters out high frequencies in random excitations resulting in an improved seismic protection especially for low- to mid-rise buildings. The most important component of any base isolation system are bearings (also referred to as isolators). There are two common types of bearings (a) elastomeric- and (b) sliding-type bearings. Elastomeric bearings are mostly composed of rubber or its derivatives while the sliding-type bearings uses friction to provide intended behavior. Figure 11 shows some common base isolation systems and their components.

## SENSING AND DATA ACQUISITION SYSTEMS FOR SMART STRUCTURES

One of the basic elements of any smart structure is its ability to sense and collect data from real world. In case of seismic design, this data can be ground acceleration or any response quantity. The primary component for data acquisition are

sensors, which are electrical or mechanical devices which respond to changes in physical conditions and convert those changes in to electrical signals. The most commonly used sensors in all smart structure technologies include position transducers (either linear variable differential transformer, LVDT, or rotary variable differential transformer, RVDT), velocity transducers (e.g. electromagnetic linear velocity transducers and tachometers), accelerometers (capacitive, piezoelectric, and thermal) and force transducers (strain gauge-based, piezoelectric, or spring-displacement load cells).

Figure 12 shows the working mechanism of a typical data acquisition system for seismic demand control of structures with a digital controller. The main components include sensors, a signal conditioning unit (for filtering or amplifying the recorded signal) and the control computer (which analyzes the data and generate commands for actuator to activate). The control computer system comprises of signal processing units, memory devices and analog-digital converters. Nowadays several software packages are also available which help in collecting and graphical visualization of data without any special skill requirement.



**Figure 11:** Components of a data acquisition and digital control system for smart seismic structures

## CONCLUDING REMARKS

Rapid technological advancements and efficient devices are nowadays providing attractive alternatives for improving safety, serviceability, and performance (against wind and seismic demands) of both new and conventional structural systems. The use of control and monitoring devices is becoming common to design smart structures which not only rely on their own strength to withstand wind and seismic demands but also on these devices or systems to dissipate dynamic energy without undergoing significant story drifts and floor accelerations. In addition to and in conjunction with the control, a quick and accurate monitoring and damage assessment is of paramount importance to various stake holders, including owners, lessees, permanent and/or temporary occupants, users of infrastructures, city officials, insurance companies and rescue teams (in case of disasters) etc. This article presented a review of various smart systems being used around the world, to construct resilient and durable

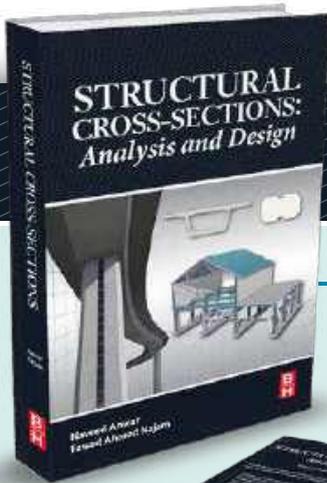
infrastructure. Although these technologies still have a long way to go to become a regular fixture in most buildings, recent rapid developments in the field of proficient computing tools, sensors, fast processing units and efficient numerical solvers will result in numerous new ways and lead to exponential growth of these techniques, resulting in intelligent, adaptive, smart and safer structures.

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NEW BOOK

# STRUCTURAL CROSS-SECTIONS: Analysis and Design



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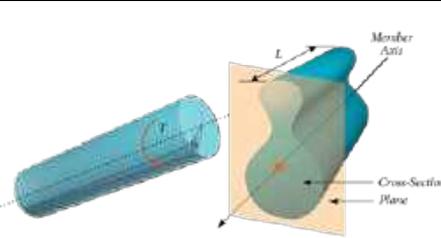


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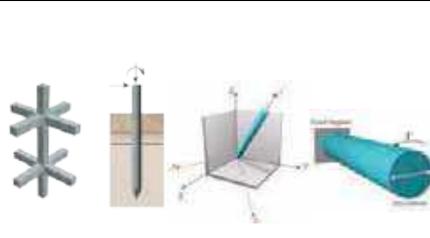
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### KEY TOPICS

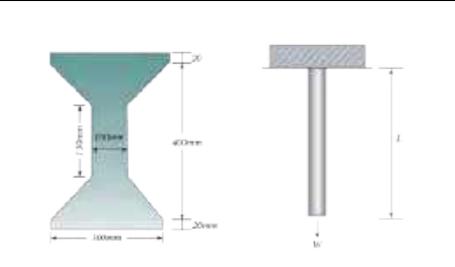
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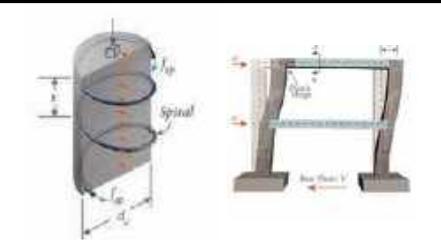
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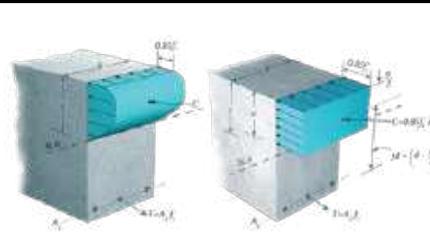
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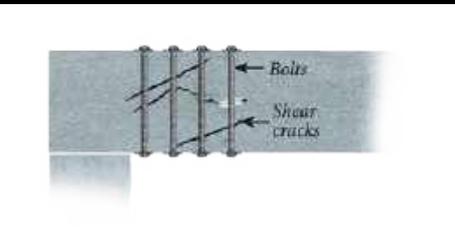
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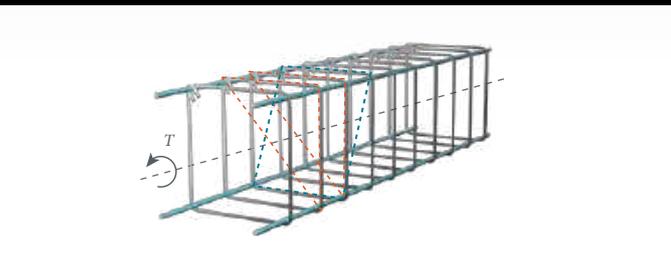
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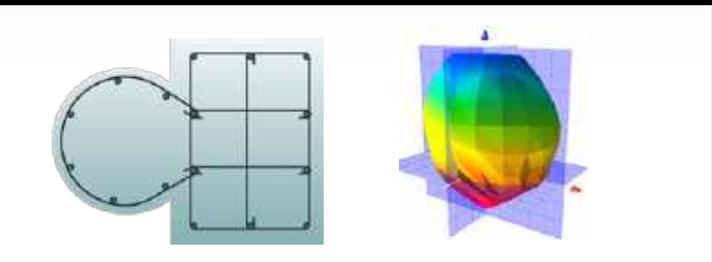
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# Replicating Wildlife Enforcement Monitoring System (WEMS) Framework in Asia

*By Manesh Lacoul*

The Wildlife Enforcement Monitoring System (WEMS) is a web-based model developed by the United Nations University (UNU) as a response to the member states' call for a common framework in collection, compilation, and analysis of data. The system serves as a uniform compliance measuring mechanism to ensure more timely information and analysis to facilitate wildlife crime prevention enforcement efforts at the national, regional and global levels.

# Replicating Wildlife Enforcement Monitoring System (WEMS) Framework in Asia

## Facts and Figures of Wildlife and Forest Crimes:

**USD 19B** (estimates)

Value of global illegal wildlife trade per year

**USD 10B** (estimates)

Value of illegal wildlife trade in Asia per year (*factsanddetails.com*)

**350 million specimens**

Number of animal and wildlife trafficked globally per year

**35,000** (estimates)

Number of Asian elephants

**35,000** (*bagheera.com*)

Number of African elephants killed per year

**3,500** (*savetherhino.org*)

Number of rhinos in Asia (one-horned + Sumatran + Javan)

**7 tonnes** (2009 – 2012)

Ivory seizures in Suvarnabhumi Airport

## What is WEMS?

The Wildlife Enforcement Monitoring System (WEMS) is a web-based model developed by the United Nations University (UNU) as a response to the member states' call for a common framework in collection, compilation, and analysis of data. The system serves as a uniform compliance measuring mechanism to ensure more timely information and analysis to facilitate wildlife crime prevention enforcement efforts at the national, regional and global levels. WEMS empowers national governments to monitor the effectiveness of enforcement of and compliance to legislations at national and international levels. WEMS can also serve as a policy tool to integrate national efforts regionally and globally to cater timely analysis and policy development with the goal of identifying risks early and developing corresponding action plans.

## Why WEMS in Asia?

Asia is a big piece in this puzzle of illicit trade of wildlife and their products. While most of the African countries are identified as sources, some of the Asian countries serve as sources, transits, and destinations, which complicates in defining the mix of approaches in effectively tackling the illegal trade. Further, the nature of the trade demands concrete transnational and transcontinental

information-sharing and persistent collaboration to counter this global evil geared at ridding this earth from its biodiversity critical for human survival.

Globally, poaching and trade in wildlife and forest products has reached unprecedented levels, pushing many of the most iconic species to the brink of extinction and undermining years of conservation efforts. According to the Convention on International Trade in Endangered Species (CITES) Secretariat, the estimated poaching rate of elephants is above the sustainability threshold, leading to the local extinction of the species. In the black market, the price of rhino horn ranges from USD 60,000 to USD 100,000 per kilogram, which supersedes its price in gold.

Strong demand and high profit coupled with low risk due to weak laws, poor enforcement and corruption, illegal trade in wildlife and forest products have flourished in the recent years. The recent UN report has identified illegal wildlife trade as the fourth most lucrative illegal business after narcotics, human-trafficking and arms, with an estimated value of USD 7 to 23 billion annually. The illegal trade involves a wide range of species including insects, reptiles, amphibians, fish, mammals and plants as well. Wildlife and forest crimes are multifaceted threats that do not only affect the species population but also

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**Manesh Lacoul**

Deputy Director, WEMS Secretariat, AIT Solutions



disrupt the ecosystem balance, bereave local communities of sustainable livelihood options, deprive governments of revenues and undermine rule of law.

Governments have recognized that biological diversity, namely the fauna and flora both on land and under water, is integral for sustainable development. This “natural capital” ensures that our biosphere is in balance, ecosystems are perpetual and economies productive. Poaching and illicit trade in wildlife and forest products emerge as a major impediment for sustainable development.

Further, in the “Future We Want”, member states have agreed to promote international cooperation, appropriate partnerships and information exchange for conservation and sustainable use of biodiversity, and committed to provide the best available policy-relevant information on biodiversity to assist decision makers. Through “Transforming Our World: 2030 Agenda for Sustainable Development,” the member states adopted the United Nations General Assembly Resolution on 25 September 2015 and reiterated their commitment to sustainable development underpinned by actions oriented towards people, planet, prosperity, peace and partnerships. The SDGs reflect the pledge to protect biodiversity, ecosystems and wildlife; and encompasses targets to end poaching and trafficking of protected species and strengthen relevant national institutions in developing countries to combat crime; while imploring ideas for innovative technologies and approaches to fill probable data gaps, capability to employ them, and the ways those new technologies and existing data infrastructure can be brought together or used in parallel to produce improved development data.

WEMS is currently in implementation in East Africa through the Lusaka Agreement Task Force (LATF). LATF is an intergovernmental body with the main function of facilitating cooperative activities in and among the Party states to the Lusaka Agreement, in carrying out investigations on violations of national laws pertaining to illegal trade in wild fauna and flora. WEMS has been deployed in four East African countries namely Kenya, Uganda, Tanzania and Congo Brazzaville; while Liberia and Zambia are the new additions.

WEMS has proved successful in providing a common platform for sharing information among national and local public sector agencies, crucial

to support national enforcement efforts while monitoring compliance to CITES and related multilateral environmental agreements (MEAs) at the international level. Further, WEMS not only caters to governments’ needs in managing information and reporting them but also provides evidence of the efforts exerted by the respective governments in attaining their national targets and fulfilling their international commitments including the Sustainable Development Goals (SDGs).



*LATF-UNU-ITC Meeting on WEMS Deployment, University of Twente, Enschede, Netherlands; September 2010*



*WEMS Review and Training Workshop, UNU Headquarters, Tokyo, Japan; March 2014*



*United Nations/Kenya Conference on Space Technology and Applications for Wildlife Management and Protecting Biodiversity and WEMS Review and Phase II Deployment, UNON, Nairobi, Kenya; June 2016*

## Objectives

1. Strengthening the monitoring of forest and wildlife crimes and compliance to national legislation and enforcement of multilateral environmental agreements (MEAs) in Africa, Asia and other continents based on the current African model; and
2. Reinforcing environmental governance at local, national, regional and global levels through capacity development and community of practice for knowledge transference, and outreach to influence policies to counter illicit trade in wildlife and wildlife products in collaboration with governments, development partners, MEA Secretariats and other stakeholders.

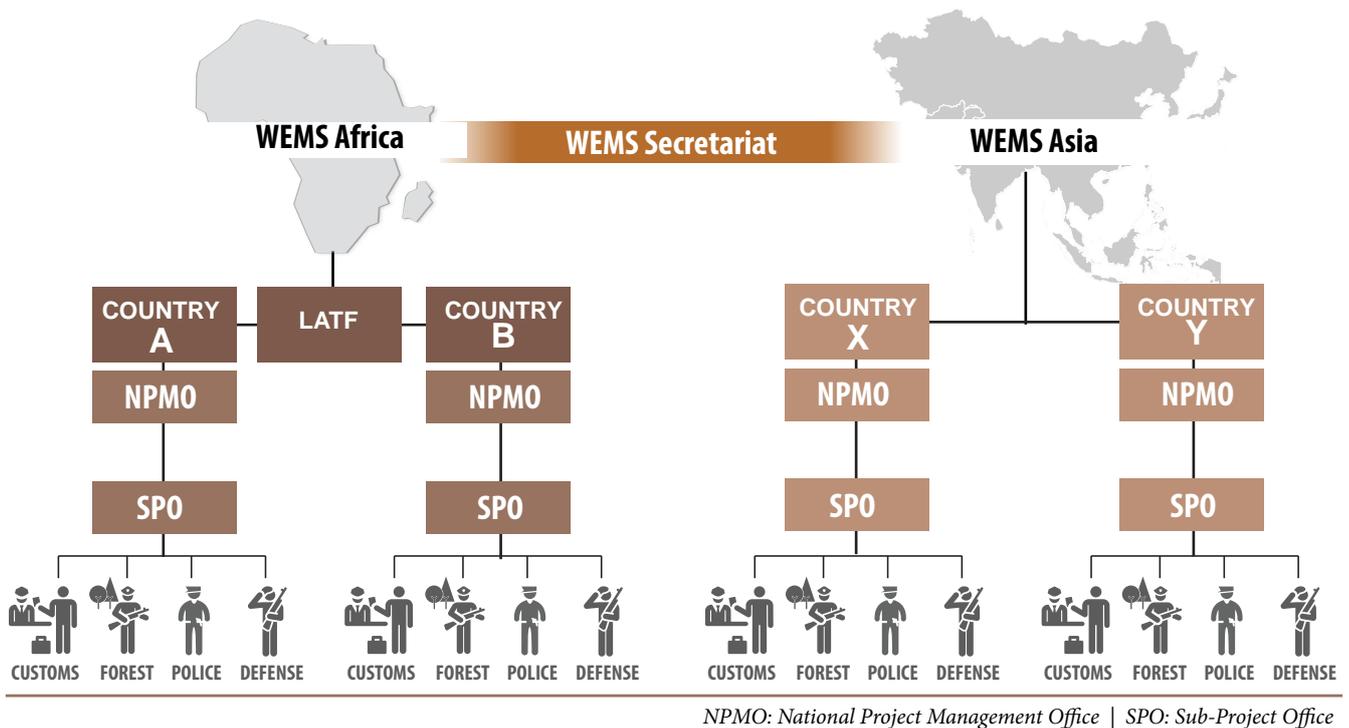
### Through implementation of the system across the African and Asian countries, WEMS intends to accomplish the following results:

1. Establishment of common information-sharing mechanism for monitoring enforcement of and compliance to national

level wildlife legislations and production of national law enforcement governance map in countries in Africa, namely Kenya, Liberia, Republic of Congo, Tanzania, Uganda and Zambia; and in Asia, namely Bhutan and Thailand;

2. Strengthened capacity of the enforcement communities to gather relevant data and ensure appropriate use of information for improved environmental governance; and
3. Enhanced transborder and transcontinental coordination through scale-up of the model in the countries in African, Asian and other continents, and institution of a community of practice for knowledge transference to enable the governments undertake concerted efforts to attain national targets and fulfil international commitments.

4. The information sharing protocol under the WEMS will be as depicted in the diagram below. For WEMS Africa, the LATF will facilitate the information exchange; while the role for WEMS Asia will be managed through the WEMS Secretariat at AIT.



## WEMS and AIT

Being hosted under AIT Solutions at the Asian Institute of Technology (AIT), WEMS Secretariat benefits largely from the stature, resources, and network that AIT holds in the region and globally. WEMS Initiative, also, complements the vision that AIT upholds. WEMS is an innovative technology that will contribute towards the development of the region and beyond through deeper and expanded engagement and AIT's delivery of research, knowledge, and expertise. Moreover, apart from the database, WEMS Initiative intends to strengthen AIT's engagement in the arena of biodiversity management, especially towards enforcement of MEAs and

support AIT's mission to develop capacity for sustainable development in the region and beyond.

Under the guidance of the Advisory Board, the WEMS Secretariat will advocate WEMS, ensure pertinent capacity building and facilitate information exchanges and dissemination at national and international levels through the overall coordination with AIT Schools and Centers, governments, MEA Secretariats, bilateral and multilateral development partners, academic and research institutions and other stakeholders.

**THREATENED WITH EXTINCTION  
HELP END WILDLIFE CRIME**

**WEMS** Wildlife Enforcement Monitoring System

 **AIT** Asian Institute of Technology  **AIT Solutions**

**VISIT: <http://wems-initiative.org>**

The WEMS initiative is still evolving and continuous efforts are being targeted at advancing cross-boundary information sharing and safeguarding the technology, protocols and policies to ensure that functionality, access control and privacy requirements are satisfied. The initiative will bring together various national institutions to a common information sharing platform, thereby building the capacity of states to manage knowledge on wildlife crime trends and threat assessments. The compiled data will be then analyzed and selected non nominal information will be made available online through the WEMS website.

WEMS will also help in providing analyzed information electronically to all national enforcement agencies and international policy makers including INTERPOL and CITES Secretariat.

Selected information will be shared with the public for bringing awareness about wildlife Crime. The WEMS initiative works by bringing together Customs, Police, and Forest to a common information sharing mechanism within the national government improving inter agency cooperation in tackling environmental crime holistically. Research and analysis of the crime data will be carried out for policy analysis identifying the trends and reasons for non-compliance.

This system can play a vital role in consolidating the various initiatives, treaties and conventions to protect endangered species and sustaining much-needed information for practitioners and policymakers for decision-making and awareness for the public. 



# Innovative Engineering Technologies: A Glance at the Most Famous Bridges in Japan

*By Atsushi Mori*

Transportation infrastructures in Japan face extreme natural hazards including the effects of large-scale earthquakes. This article focuses on road bridges, particularly the development, status, and innovative technologies in civil engineering to maintain safety and integrity of bridges in Japan.



# Innovative Engineering Technologies: A Glance at the Most Famous Bridges in Japan

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An ancient arterial national highway network in Japan was completed from the seventh century through the eighth century, built as a road network of 6,300km in total extension with road widths of 6m to 30m. The highway network completed centuries ago had become a frame of the current arterial high-standard highway network.

Figure 1 shows the current arterial high-standard highway network, with a total length of approximately 14,000 km including planned national roads (data from Ministry of Land, Infrastructure, Transport and Tourism of Japan in 2015). The total extent of the ancient arterial national highway network is around half of the total of the current one. So far, 80% of the arterial highway has been completed.

The construction of new roads and bridges is still continuing, but the pace of overall construction is decreasing. As shown in Figure 2, the level of construction of current road bridges has become less than 10% than the golden age of about 1970. In addition, as shown in Figure 3, the average ages of the bridges have become between 30 and 40 years, and most of the road bridges in Japan have run into a genuine maintenance and management era.

In the next 20 years, the number of bridges more than 50-year service period (of 40 million bridges which construction years are known) is expected to be approximately 70% of the total.

The convenience of the arterial high-standard highway network has highly improved as national roads have been constructed as a whole network, and also traffic congestion countermeasures have been implemented to make a more comfortable transportation environment.

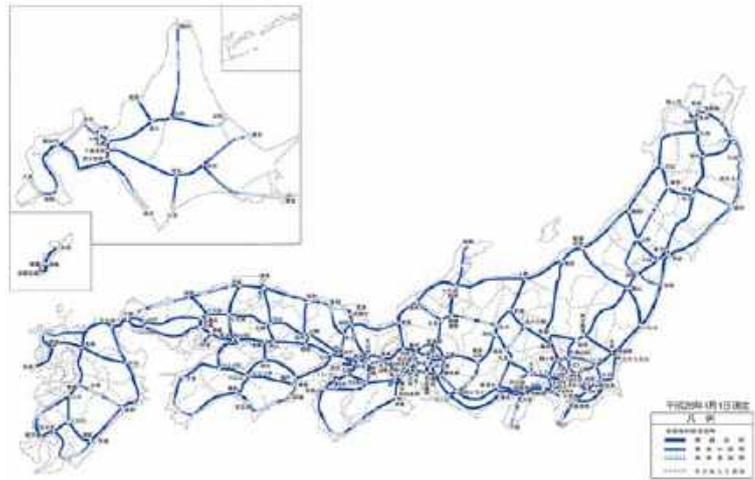


Figure 1: Current Arterial High-standard Highway Network of Japan (Data in 2015)

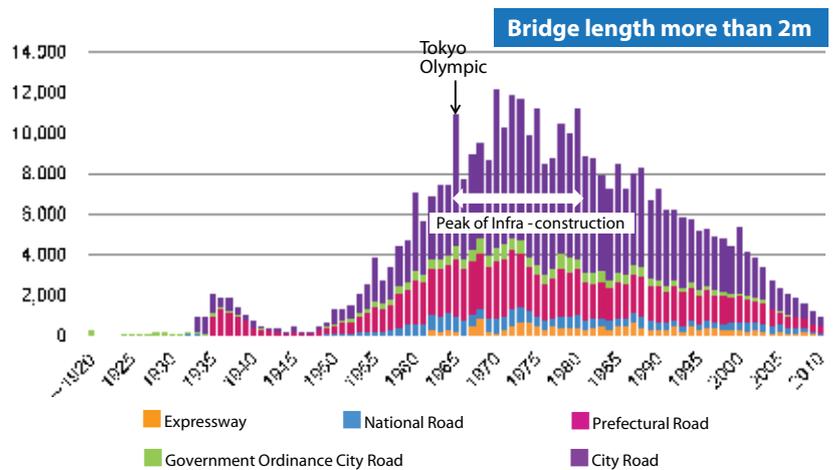


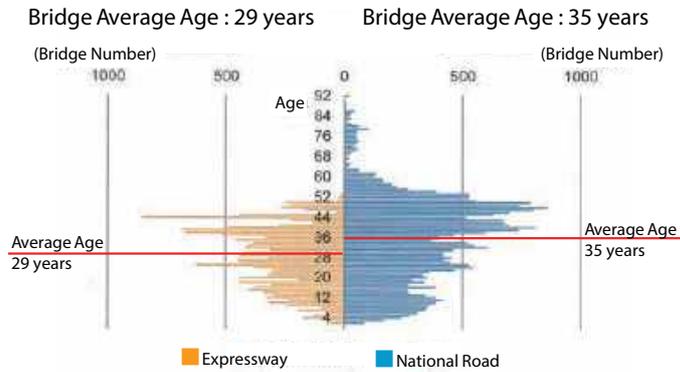
Figure 2: Number of the bridges according to the year constructed (MLIT Data in 2013)

In general, new roads and new bridges require maintenance and management treatment immediately after starting their services and also require to be safe and be used as long as possible without losing transportation convenience. It is important for new bridges to be designed in order to endure as much as possible. Therefore, it is necessary to consider the choice of materials which are hard to deteriorate, a choice of structure types which are easily able to inspect and survey, and a setting such as various structure details to improve the durability.

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**Figure 3:** Age Distribution of Bridges in Different Road Administrators (MLIT Data in 2013)

The large quantity of transport vehicles impacts the bridge's performance as heavy and congested traffic is a common issue in Asia. Japan's experience with seismic damage is quite distinct and remarkable, and technologies to mitigate the negative impact of earthquakes have improved overtime.

Despite the improvement, it is a fact that different seismic damage happens in every earthquake. Earthquakes in Kumamoto were recorded at JMA (Japan Meteorological Agency) scale of seismic intensity 7 twice during approximately one day in April 2016. This was very rare experience even for Japan as earthquakes with very strong seismic intensity occurred at the same specific place.

It is an important feat for civil engineers to create earthquake resistance structures that are able to protect and secure human lives and enable the structure to perform its role as a social and economic progress in normal situations.

Depending on the type and scale of the bridge, difference in consideration of loading capacity, seismic performance and corrosion resistance when bridges are in designing and construction phase may affect bridge life span. Which is why it is essential to maintain a safe and reliable level in bridge use by utilizing appropriate techniques by civil engineers. Civil engineers must also aim to make costless maintenance and management situation for infrastructures.

Furthermore, the scale and frequency of wind and flood phenomena, such as typhoons with fierce strong wind and torrential rains, are rapidly increasing infrastructure damage by the influence of wind and flood phenomena is increasing. Japan is currently facing the threat of "Mega Crisis" such as natural disasters caused by a huge earthquake, a huge typhoon and an intensive localized downpour of short duration. This can become a significant challenge and needs to be researched in-depth. A particularly serious issue, this is one of the new engineering challenge that civil engineers are assigned to.

Considering the effects of harsh environments caused by both natural phenomena and artificial phenomena, overviews of innovative civil engineering technologies to use bridges safely with costless maintenance and management situation, are mentioned.

There are a wide variety of bridges in terms of external shapes and technical characteristics and the following are examples of three different unique bridges.

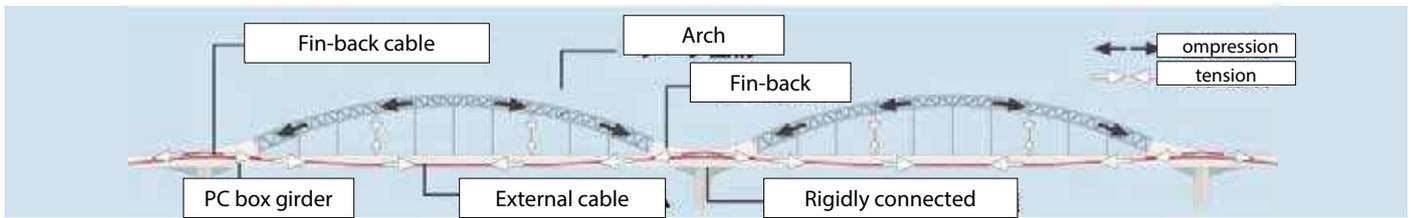
### 1. Otagawa-ohashi Bridge: Unique Steel-Concrete Composite Continuous Arch Structure

A very unique steel-concrete composite continuous arch structure in the world is described in this section as a bridge design case (see Photo 1). The basic information of the bridge is as follows:

<b>Bridge site:</b>	Ota river discharge channel in Hiroshima City, Hiroshima Pref.
<b>Road part:</b>	Length 412m / 6-span steel-concrete composite continuous arch structure
<b>Pedestrian part:</b>	Length 364m / Multi-span continuous PC slab bridge
<b>Completion:</b>	March 2014



**Photo 1:** Whole View of the Otagawa-ohashi Bridge

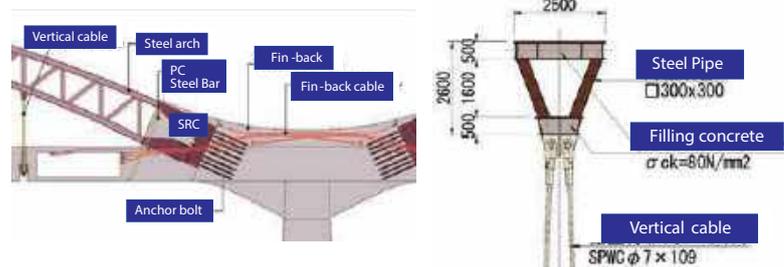


**Figure 4:** Structural System of the Continuous Arch

Three innovative structural features of the bridge are described below:

Figure 4 shows the structure system for the continuous arches of the bridge as the first feature. The horizontal force of the arch in the bridge system ends equilibrates with the tensioning force of the external cable. For the negative bending of the middle fulcrum, the fin-back structure and PC steel material can deal with it.

The second feature is the steel arch of the brace and rib structure as shown in Figure-5. The upper chord and lower chord are connected by diagonal members set by a square steel pipe, and



**Figure 5:** Braced-rib Structure Arch

Many favorable comments about the landscape, the design and usability for this unique structure have been submitted. Therefore, since its opening, the pedestrian bridge has been used by a lot of people.

## 2. Irabu-ohashi Bridge: The Dragon Bridge Connecting Remote Islands as Struggling the Severe Marine Environment

The Irabu-ohashi bridge has been constructed in one of the severest environments in Japan with subtropical heat and humidity, strong wind, and frequent typhoon attacks (see Photo 3, Photo 4 and Figure 6). Therefore, new concepts of steel box girder in Japan were applied for the bridge. The bridge is the longest toll-free bridge in Japan and also granted a long cherished wish of people living in remote islands. The basic information of the bridge is as follows,



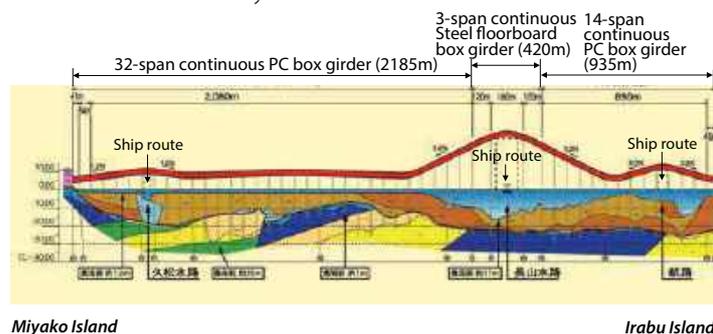
**Photo 2:** Pedestrian Bridge Supporting Structure (Hanging Cable Portion under the Girder)

this ingenious device made a compact steel box-shaped cross-section of V-shape possible. In order to establish this shape, the upper and lower chords are filled with high-flow concrete of high strength.

The third feature is the pedestrian bridge placement and its supporting structures, which makes the bridge easy to walk on and allows pedestrian to enjoy a beautiful view of the Seto inland sea. The pedestrian bridge is attached to the four supporting structures such as hanging cable form from the main bridge as shown in Photo 2, terrace bracket form from a bridge pier, hanging bracket form from the main bridge and roadway parallel section bracket form.

The Otagawa-ohashi bridge was designed to satisfy the current criteria including severely required seismic specification and live load specification, and also to satisfy the adequate safety for wind resistance of a unique hanging portion of the pedestrian bridge by applying three-dimensional wind tunnel tests.

<b>Bridge site:</b>	Between remote islands (Irabu island and Miyako island) in Okinawa Pref.
<b>Total length:</b>	3.54 km (2185m+420m+935m)
<b>Road width:</b>	9.7 m
<b>Structure :</b>	32-span continuous PC box girder (2185m, average span length of 70m) 3-span continuous steel floor-board box girder (420m:120m+180m+120m)
<b>Completion:</b>	14-span continuous PC box girder (935m, average span length of 70m) January 2015



**Figure 6:** Longitudinal Profile of the Irabu-ohashi Bridge



**Photo 3:** Full View of the Irabu-ohashi Bridge from Irabu Island



**Photo 4:** Full View of the Irabu-ohashi Bridge from Miyako Island

Four unique features of the bridge are as follows:

The first feature is to maintain the rich natural conditions of the construction site, so that the project shall reduce the impact on the natural environment. The second feature is to generate new tourism resources, so that the project shall be realized that bridges and highway can enhance environmental own value. The third feature is to propose the excellent durability bridges with minimum maintenance. This is one of the most important items in terms of maintenance and management for public facilities like the Irabu-ohashi bridge. The fourth feature is to reduce more life cycle cost by making positive efforts to use the latest technology into this project.

In order to meet the above four requirements, a steel box girder type was chosen from many types of bridge in considering following conditions as:

- i. Special consideration for aerodynamic stability of the bridge girder
- ii. Less maintenance work to manage the bridge for the future
- iii. Safety for strong wind during erection works (wind speed more than 10m/sec on a daily basis)

This project was the first in Japan to construct a long span bridge over ocean under very severe natural conditions. The Irabu-ohashi bridge was designed to satisfy the current criteria including required seismic specification, and also to satisfy the adequate safety for wind resistance of the central highest span of the steel box girder bridge by carrying out wind tunnel tests with a maximum wind velocity of 82.2m/s. The bridge was constructed without an additional aerodynamic stabilizer, and has been used without any problem in terms of wind resistant stability so far.

This innovative design and construction to withstand the severe environment will significantly contribute to the development of excellent future bridge technologies.

### 3. Kiyosu Bridge: Innovative Collaboration Technology to Protect an Active Cultural Property Bridge from Large Earthquakes

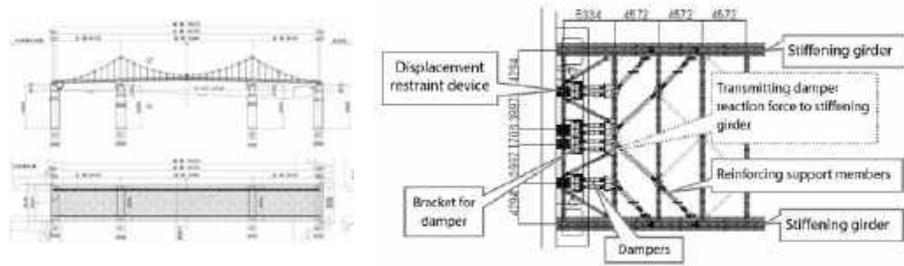
The Kiyosu Bridge is well-known as a unique structural form built nearly 90 years ago in Japan. It was designated as an important cultural property bridge of Japan in 2007. As seen in Photo 5, the Kiyosu bridge is a suspension bridge with steel chains (flat bars) as the main suspension member. Therefore, the bridge shape shows forcefulness and also a beautiful form of parabola. This is a big difference in terms of visual aspect compared with a suspension bridge having wire cables as the main suspension member. Figure 7 shows a side view and a plan view of the bridge. The pneumatic-type foundation used in the bridge was constructed as the second earliest one in Japan. It is evaluated that the space under the bridge girder is one of the most beautiful view points in the Kiyosu bridge. and also the pin-type bearings on the bridge piers are evaluated as a beautiful and unique shape as shown in Photo 6.



**Photo 5:** View of the Kiyosu Bridge

<b>Bridge site:</b>	Bridge site Near Sumida river estuary in Chuo Ward, Tokyo Metropolis
<b>Total length:</b>	186.2m 186.2m
<b>Road Width:</b>	26.1m
<b>Structure:</b>	Steel three-span self-anchor-type chain suspension bridge (for super-structure), Reinforced concrete wall-type piers and pneumatic caisson-type foundations (for sub-structure)
<b>Completion:</b>	March 1928 (88 years old)

This bridge functioned as an active service bridge, but completed seismic strengthening in 2015. Since the bridge is quite old it does not satisfy current seismic design criteria of Japan. The requirement of the Japanese seismic design for bridges was that the bridge must stand a seismic coefficient of 1.75G for the second category of ground type (ex. 2.0G for the first category of ground type). When the bridge was originally designed more than 90 years ago, a seismic coefficient of 0.33 was applied which was even larger than other bridges' seismic coefficients at that time. In order to satisfy the current design criteria, the Kiyosu bridge needed to strengthen to resist five times larger seismic coefficient than it for original design.

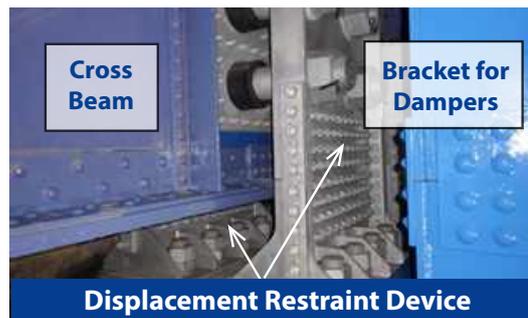
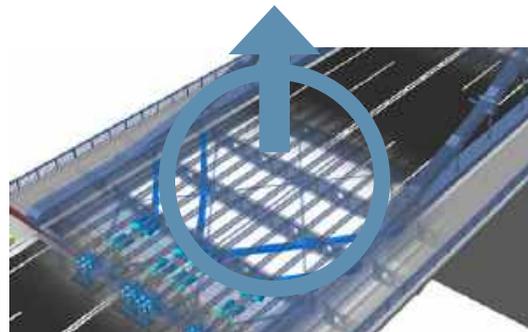


**Figure 7:** Side View and Plan View of the Kiyosu Bridge



**Photo 6:** Pin-type Bearing on a Bridge Pier

Only the seismic performance of the bridge was not satisfied in light of current design criteria for loading capacity, seismic performance and corrosion resistance. In order to reach a better solution to satisfy the current seismic criteria while implementing both the safety and cost performance, a unique design method was proposed to verify dynamic performance of the bridge more precisely under severe seismic actions. This unique design method comprises of firstly, applying a non-linear dynamic analysis while considering seismic interactive effect between foundation and soil. Secondly is to precisely estimate damage process of substructures and soil due to a seismic action to verify their usability and reparability by applying an FEM elasto-plasticity analysis, and finally to implement dampers to reduce seismic energy getting into the bridge as shown in Figure 8.



(To resist up-lift force after the tilting bearings are damaged)



(Damping force of a damper : 1500kN)

**Figure 8:** Implementation of Dampers to Reduce Seismic Energy Getting into the Kiyosu Bridge

This is an example of innovative design method as seismic strengthening of bridge substructures was avoided and construction cost was reduced to 5% of the standard design method. Moreover, construction period was shortened to one year. An example of excellent collaborative work by installing contemporary innovative technologies into the old but elegant forceful iron bridge.

Further, construction work for bridge life extension to maintain corrosion resistance will be carried out after 2016 and will be completed by the next Tokyo Olympic Games in 2020. If you happen to be in Tokyo then, I suggest visiting this beautiful bridge which will be reborn using a combination of old and innovative technologies.

# Institutions Nurturing Innovators and Entrepreneurs: Contribution in Innovation Ecosystem

By Maria Shahid and Jennifer Pangilinan

The value of innovative technologies and their potential for accelerating socio-economic growth is now being recognized globally by governments. National polices are advancing initiatives for a new economic model with campaigns like Thailand 4.0, Make in India, Creative Economy (South Korea), and Design in Innovation(UK).

The key resource that will support the realization is the new generation of students, researches and entrepreneurs who need relevant skills, the creative space and liberty to take informed risks.

This has led many to query if people are born entrepreneurs with an instinctive knack for innovating, creating businesses or is it a skill that can be learned.

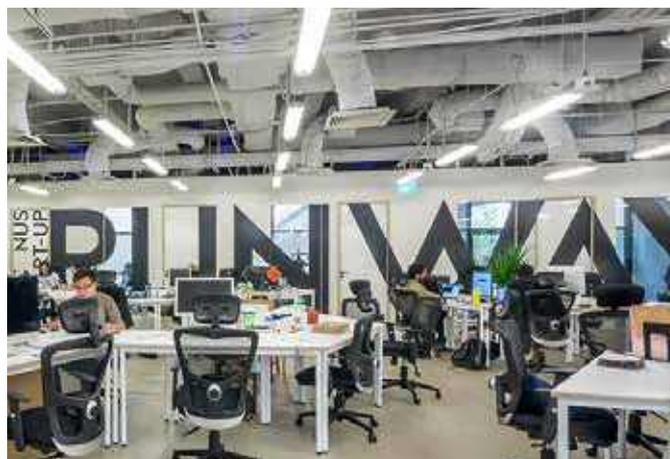
This article highlights key elements of the new approach to creating an innovative ecosystem and the role that universities can play in supporting this.

## A Paradigm Shift

The belief that entrepreneurship and innovation can be taught is slowly changing as many academic institutes offer degrees, courses in Entrepreneurship, Innovation and Leadership studies. A paradigm shift is taking place in academic entrepreneurship, whereas the traditional perception of entrepreneurship focuses on generating patents, licenses for profit and financial gain. This emerging perceptive is not only more student-centric but measures innovation capacity in a more holistic way. This new shift reimagines the purpose of innovation and entrepreneurship to provide a wider social and economic benefit to the innovation ecosystem with student-led startups and on campus collaborations with industry partners that result in job creation for the local community (Siegel and Wright, 2015).

As a regional institute with the mandate to contribute to the socio-economic development of the region, the Asian Institute of Technology (AIT) is challenging itself with the combination of the emerging and traditional approaches to establish an integrated innovation ecosystem and culture for its students.

Students are encouraged to be the leaders of their own start-up ventures and accelerators instead of just selling their



*The National University of Singapore Start-up Runway offers comprehensive university-based incubation acceleration programme in Singapore.*

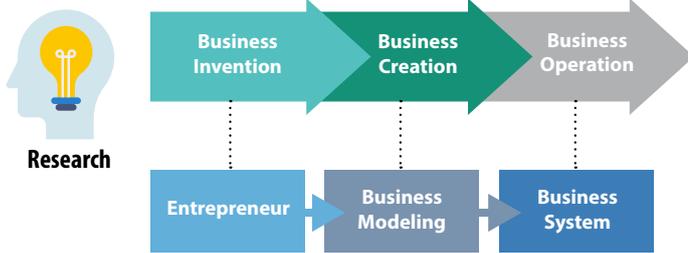
*Source: <http://enterprise.nus.edu.sg/entrepreneurial-support/start-up-runway>*

inventions and business ideas to industry. For many university professors who mentor and teach entrepreneurial studies, being innovative is a quality and skill set that can be nurtured and is not limited to just starting new companies (though that can be a result) but the ability to bring and manage change.

A support system or an enabling environment can be created to nurture the entrepreneurial spirit, especially within the educational institutes that can help shape the mindset of the upcoming generation of students and human resources. For



*AIT President Prof. Worsak Kanok-Nukulchai with Mr. Kjell Hakan Narfelt during a Workshop organized by Ministry of Science and Technology, National Science Technology and Innovation Policy Office, Suranaree University of Technology*



*Mr. Kjell Hakan Narfelt visited AIT in November 2016 to conduct a mini-workshop and special talk for AIT faculty, staff, and students. The mini-workshop was conducted exclusively for AIT Solutions team to learn valuable insights on how to create and manage a successful innovation lab.*

**Reference:** Workshop with Mr. Kjell Hakan Narfelt at AIT Solutions

Mr. Kjell Hakan Narfelt, Senior Program Manager from Sweden's Vinnova (Swedish Innovation Agency) an incentive system that offers rewards, points, and scholarships for exploration of creative ideas or ideas that address challenging needs to be in place to encourage student's talent and identify valuable ideas and opportunities.

## Innovation Lab: AIT's New Initiative

AIT's efforts to promote innovation amongst its students and staff strives to gain from the new model of nurturing innovation which is already in practice by European counterparts which places more emphasis on students and connecting with alumni to support startup ventures and mentor the students. This approach is much more flexible, allowing the creative process to take its time and is led by students.

In 2016, AIT's innovation and technological advancement agenda was launched through *The Collaboration for Innovation* event. An intellectually stimulating and major networking event which brought together policymakers, industry experts, venture capitalists, development agency partners and connected them with researchers and students at AIT with several partners and collaborators supporting the event. The event brought students research and ideas in to the forefront through the AIT Innovative Idea Competition, and also provided opportunity to the finalists to present their ideas to entrepreneurs, professors and government officials from the region. Students received cash prizes as well as guidance and technical support to incubate, develop a business plan to commercialize their ideas.

The first of a series of Mini-Hackathon's *Create the Next Killer App Challenge* was initiated as a brainstorming session where students and researchers flesh out their ideas in allocated time to add to the competitive edge. Their concepts will be turned into tangible prototypes by the team at AIT Solutions.



*The Collaboration for Innovation event at AIT introduced importance of collaboration between academia and industry, and showcased innovative ideas from AIT students, researchers, innovators*

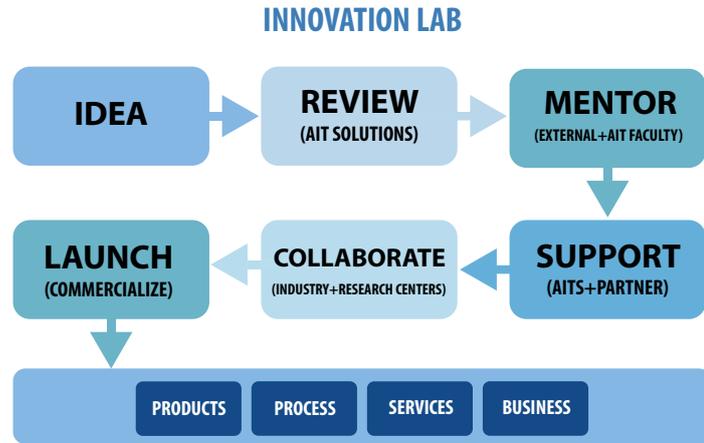
Another significant step to nurture the talented youth within the ASEAN region is the AIT-Tiger Leong Leadership and Innovation Camp, a two-week fun filled training and mentoring opportunity for the brightest undergraduate students from ASEAN countries. These students will not only get the opportunity to travel and interact with other international students but will also receive the guidance to navigate through their fields of studies, leadership training and exposure to innovative approaches to tackle problems. The camp is fully funded by AIT and Mr. Tiger Leong, a significant alumni of the university and founder of the Ellipse Enterprise SDN BHD Malaysia. Mr. Leong's contribution as a former student of AIT would positively impact and inspire the current students as they can relate to his achievements and success.

Reaching out to alumni, key experts and connecting them with students is a key element of the new entrepreneurial model. Their support helps to build the innovation ecosystem where students can become mentors in future to share their experiences with the new generation of young professionals.

AIT is implementing this new innovation model through AIT Solutions, a specialized unit dedicated to develop creative

and innovative solutions for industries and communities. The established Innovation Lab @ AIT Solutions (ILab@AITS) is a student-centric creativity hub aimed at developing and exploring solutions. The Lab will support the development of innovations and nurturing entrepreneurship through mentoring, connecting students and researchers with industry experts to develop and create products, services and businesses for the benefit of their societies and support growth of industries through collaboration.

At ILab@AITS, students will be introduced and have access to a wide-range of resources and opportunities to unleash their potential. It will also act as a business incubator that provides a carefully designed environment for something



young and fragile to grow. By providing resources and guidance, ILab will maximize the chances of converting bright ideas into flourishing startups.

## Embracing the Technological Era

Innovations in technology has given the opportunity to individuals to become their own business men and women by selling and marketing their own merchandise via Instagram or Carousel. Today Facebook, Tinder, Alibaba, Lazada, Uber, Ebay, Candycrush are household names and the ASEAN scene in relevance to start-up ecosystems is picking up slowly but surely. Singapore in many ways is leading and setting the scene while Malaysia, Philippines also have a competitive and creative edge with popular startups like GrabTaxi, KFit, and SALt that are gaining attention.

Many of these companies and services were developed and established by young pioneers in universities, who now employ thousands of people and influence how we live and perceive our world today. The online world represents an endless variables of opportunities where you need one good idea and the drive to see it through.

To support this endeavor, both the current and new generation of future leaders, entrepreneurs, employees will need to acquire new skills and

knowledge to survive and thrive in this economic system. According to the World Economic Forum the top 10 skills that people will need include: Complex problem solving, creativity, critical thinking, people management, coordination and negotiation. These competencies are also essential to being entrepreneurial, thus in the new economic model individuals have to push their intellect and capabilities to flourish.

As students play a leading role in the innovation ecosystem, the guidance and mentorship from academic institutes is vital for refining the raw and talented ideas of the younger generation. 🌐

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*The National University of Singapore Enterprise*  
<http://enterprise.nus.edu.sg/entrepreneurial-support/start-up-runway>

# Some Innovations in AIT

**A** key mission of the Asian Institute of Technology (AIT) has been to contribute to the socio-economic development of the community. Researchers at the Institute are always ready to address challenges head on and offer their most innovative solutions and create technologies.

Here are some examples of the current initiatives:

## HABITECH BUILDING TECHNOLOGY

*Affordable, sustainable, disaster-resilient housing technologies and techniques*



This technology uses natural soil as the key ingredient and therefore uses less cement, sand and wood reducing carbon footprint which means less wastage of resources. This method can be applied to construct residential and other commercial buildings. Buildings constructed under this project are already ongoing in Thailand and Nepal and other parts of Asia.

<http://www.habitech.ait.ac.th/new/index.php>

## POLICE EYES: REAL WORLD

*Automated detection of traffic violations*



Funded by the National Science and Technology Development Agency (NSTDA), Police Eyes is a mobile, real-time traffic surveillance system developed to enable automatic detection of traffic violations. It aims to assist traffic police in traffic law enforcement by taking a snapshot and a short video clip of the violating vehicle when the violation is detected. These data can be used as evidence of the traffic law violation.

## REINVENTING THE TOILET

*Decentralized Waste Water Management*

The Naturally Acceptable Technological Sustainable (NATS) is a project undertaken by researchers led by Dr. Thammarat Koottatep from the Environmental Engineering and Management at the Asian Institute of Technology (AIT). Since 2011, the team has been researching and testing innovative technologies to provide sustainable sanitation in developing countries. The initiative has been funded by the Bill and Melinda Gates Foundation and is exploring innovations to develop thermal septic tank, nano disinfection, solid-liquid separation devices such as a Hydrocyclone toilet, this technology is able to separate solid-liquid and disinfects the liquid composition of fecal waste.

[http://natstoilet.com/v2/about\\_us.php](http://natstoilet.com/v2/about_us.php)



# OPINION PIECE

## Why Writing a Press Release can be as Important as Publishing a Paper

By *Bajinder Pal Singh*



When I was about to embark on data collection for my thesis, my supervisor suggested that I should aim at publishing a paper in a top journal. Having published a research paper at the young age of 18 as a second-year undergrad student, his proposition did not sound exciting to me. I responded by saying that publishing in a top journal was not on my priority list. Rather, I wanted to write a press release for a newspaper.

Two weeks into my fieldwork, I sensed that I was on the verge of hitting a jackpot. The first two rounds of data clearly indicated a trend, and if this trend was true (much at variance with my initial theoretical assumption), then I reckoned that this would make it to the newspapers. By the time I concluded my project, there were subtle suggestions by my two supervisors, both global leaders in the field of statistics, that my work could make it to a top journal. It was time for me to reiterate that rather than writing a paper, I would be presenting my work before the media. Both were skeptical about the prospect of a press conference being organized on the basis of a thesis.

A week later, I addressed a press conference to present my findings. Within 12 hours, six leading newspapers had published my story, with three newspapers placing the story on the front page. A day later, a television crew landed at my doorstep to interview me. A week later, the government announced that

it was establishing a registry to collect more data, with the Minister concerned announcing that this was a priority task.

Surprised?

Not exactly. Few journal papers will ever provoke such an immediate reaction. Journal would normally have an impact only after they are picked up by the media. I never published a journal paper on this bit of work, but even today, if any researcher writes a paper, the author inevitably quotes newspaper report featuring my work.

Which now takes me to a very recent experience. Five months ago, the Helsinki-based United Nations University World Institute for Development Economics Research (UNU-WIDER) published a working paper. It was one of the many working papers that was regularly brought out by the premier institute of development economics. Ever since its establishment, UNU-WIDER has published over 2,000 working papers, that are known for its quality as well thoroughness.

One working paper caught my eye. It was titled: "For whom does the phone (not) ring? – Discrimination in the rental housing market in Delhi, India." It may sound like yet another research based on the problems faced in renting homes in the

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Indian capital. But the title was catchy enough for a detailed reading. An hour later, I knew that this had the potential to become a newspaper story.

But how could it be a newspaper story? There was a context to this study. Only two days prior to the appearance of this working paper, Indian newspapers had published a story about a 21-year old boy who had cracked India's prestigious civil services exam. Finding it hard to rent a room on account of his religion, this boy changed his surname to avoid discrimination because of his identity. Newspapers carried this story, highlighting the discrimination faced by minorities in finding accommodation in Indian cities. While the country debated on whether it was a one-off episode or a systemic issue, and whether the problem was confined to the Indian subcontinent or whether it was a matter of global concern; this study could not have come at a more opportune time.

The only problem was that unlike the newspaper story about the 21-year old boy, this Working Paper was not being discussed.

Linking the two is what helped me write a story. Relating it to recent events in India, I wrote a 600-word article based on the working paper and pitched it to a The Indian Express, undoubtedly India's best known investigative newspaper. An hour later, I received editorial clearance, and after gathering quotes from the authors, the story was published on the front page of the newspaper. What is more, all nine editions of the newspaper had featured the story prominently in what is known in media parlance as an "anchor."

More was to follow. The Wall Street Journal, Huffington Post, and most Indian news websites

followed the story. Needless to say, most academicians and researchers were pleasantly surprised, but for me, I experienced the adrenalin rush of having breaking a story. An endless round of phone calls followed, with people narrating their experiences at the discrimination faced in the housing market. Some conceded that they were guilty of this practice, but sought to justify their act.

But the story does not end here. Within a month, officials in the Government of India decided to introduce an anti-discriminatory clause under the Real Estate Act. The Act had been passed earlier in 2016, and the Government was getting ready to notify the rules. "The anti-discrimination clause will provide recourse to buyers who are denied a house by builders owing to their caste, ethnic origin, gender, sexual orientation, dietary choices or any such factors," an official was quoted in the media. This time, the government decided that the anti-discriminatory clause would include other factors like sexual orientation and dietary choices also. In other words, the story yielded a much bigger response than its original remit.

These two cases of how news can impact public policy are examples of channeling the power of the mass media, and holds lessons for both academicians and researchers. Not all research will make it to newspapers and television. On most occasions, journalists have other important stories to follow. In some cases, they may not bother to read your work and follow up. But if you can make it attractive for them, it will probably lead to a bigger impact than a journal impact factor.

So next time, you are writing a paper, consider writing a press release as well. 🌐





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January 2017 | Thailand



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[www.innov-camp.solutions.ait.asia](http://www.innov-camp.solutions.ait.asia)



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