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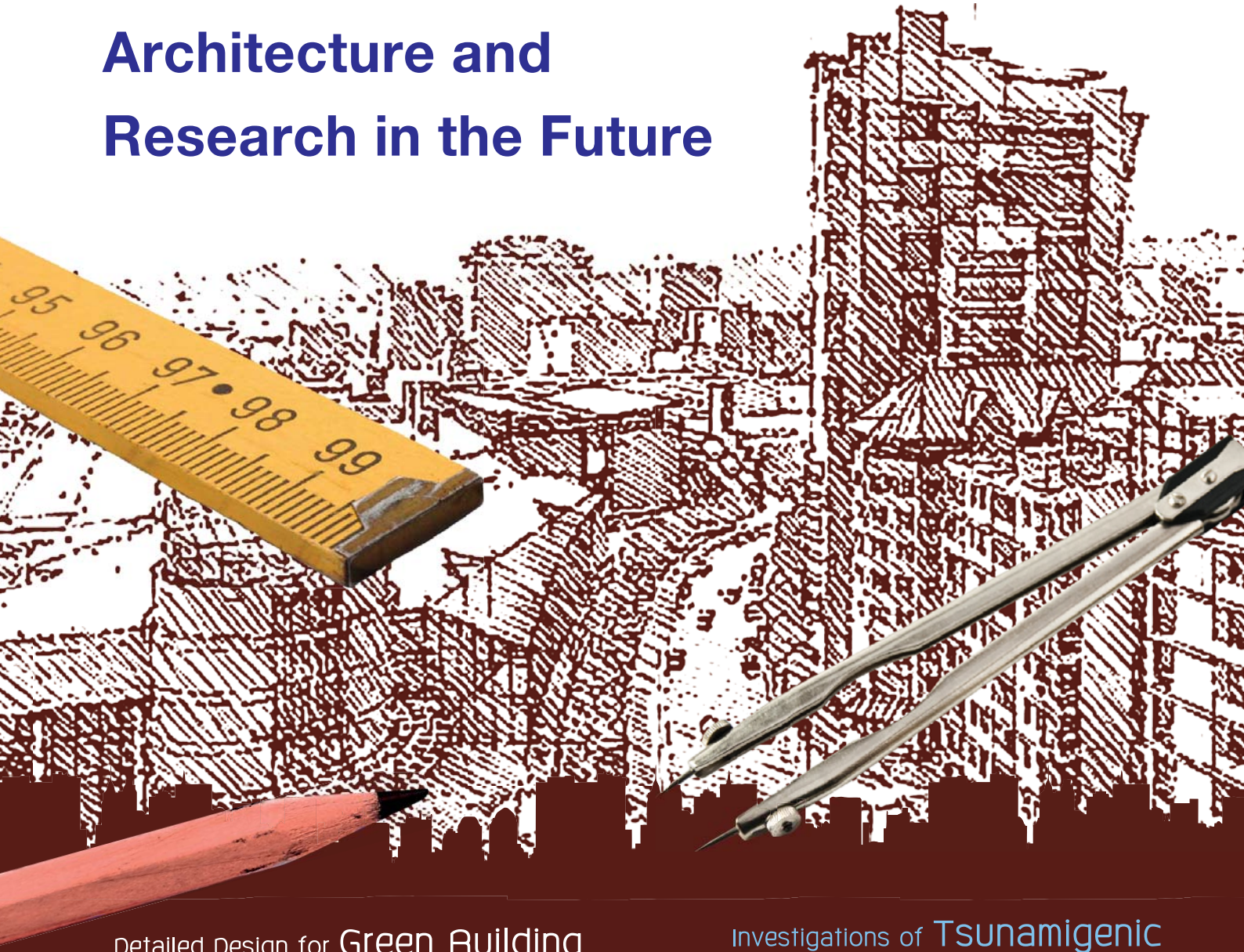
Trend, Concept of Architecture and Research in the Future



Detailed Design for Green Building Retrofit of the PEA's Building

Development of Construction and Detail Drawing of Low Carbon House and Row House

Design for the Construction of Regional Administrative Court Office

Investigations of Tsunamigenic Sources in Mainland Southeast Asia: Implications from Seismicity

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EDITOR's NOTE

The design of contemporary structures such as buildings, homes and infrastructure is frequently bold, outstanding, and sometimes controversial. At the same time, increasing attention has focused on structural strength and safety, as well as their environmental performance. Today's buildings are expected to be energy-saving, use natural resources efficiently and be eco-friendly. The concepts of *"Green"* and *"low-carbon"* buildings have gained rapid support; the *"Leadership in Energy and Environmental Design"* (LEED) standard is today widely used around the world as a benchmark in architectural and engineering design. LEED criteria are used in designing new buildings as well as in retrofitting existing buildings to save energy, reduce water and electricity consumption, and provide a safe, comfortable and healthy environment for the occupants. LEED also prioritizes use of eco-friendly materials wherever possible.

Today's building designs are also legally required to withstand hazards such as fires, floods and earthquakes, resulting in increasing attention to construction strength and quality of materials. Innovative materials and designs are needed to meet these stringent requirements in a cost-effective and eco-friendly way.

Focusing on this challenge, this issue of the Unisearch Journal brings together examples of recent research into structural design and architecture, covering themes such as aesthetics and functional designs, eco-friendly buildings, and structural safety. This issue also features interviews with some of Thailand's most renowned architects, who offer inspiring insights into future trends and styles in Thailand's structural and architectural designs.

The Editorial Board

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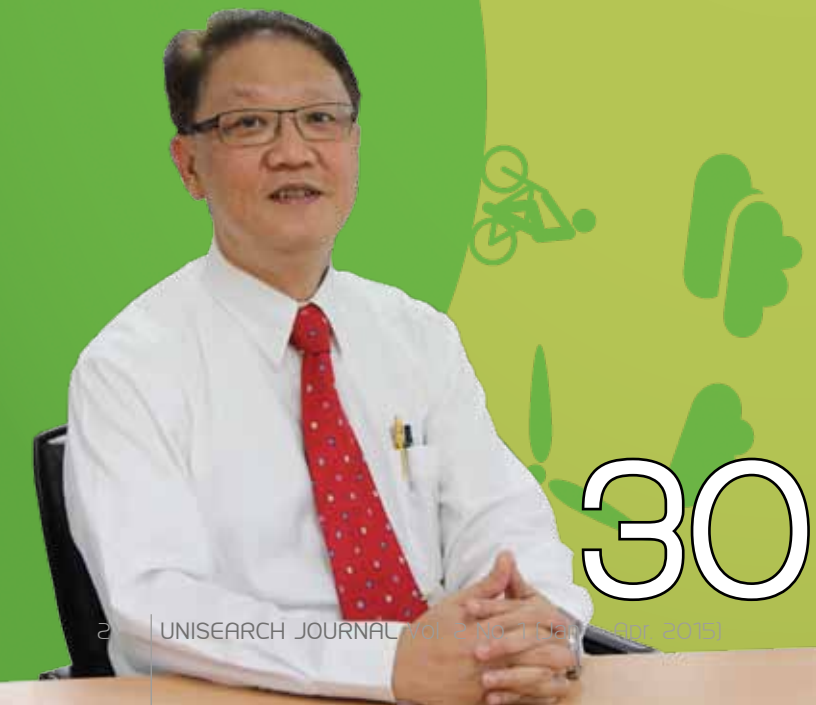
ARTICLE



Detailed Design for Green Building Retrofit of the PEA's Building Following LEED

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Introduction

The Provincial Electricity Authority (PEA) has set a policy to transform its buildings into energy efficient and environmentally friendly ones in order to set an example for others. PEA appointed a research team from Chula Unisearch, Chulalongkorn University, first to audit the existing compliance status of PEA Building 4 with LEED for Existing Building Operations and Maintenances (LEED EBOM) criteria, and secondly to analyze costs and benefits from upgrading the building to achieve LEED Gold and Platinum certification. The scope of the audit and analysis included architectural design, engineering systems, interior design and operations of the building.

METHODOLOGY

1) Audit of Existing Conditions

The audit of existing conditions aimed to collect information for assessing possible LEED credit compliance and identify potential areas for improvement. The audit included surveys of the following: space use, furniture units, interior materials, office equipment, electrical lights, air-conditioning system, building envelopes, plumbing and water fixtures, comfort and indoor air quality, indoor lighting level and view assessment

In addition, data were collected on building operation and maintenance, including green cleaning, waste management, energy management, water management, exterior maintenance, pest management, parking management and occupants' means of travel.

2) Post-Occupancy Evaluation (POE)

Post-occupancy evaluation of the project was conducted using a questionnaire survey to assess opinions of building users toward their working environment and building management.

3) LEED credit assessment

An impact analysis for proposed improvements was conducted, focusing on lighting and energy, along with a preliminary cost/benefit analysis.

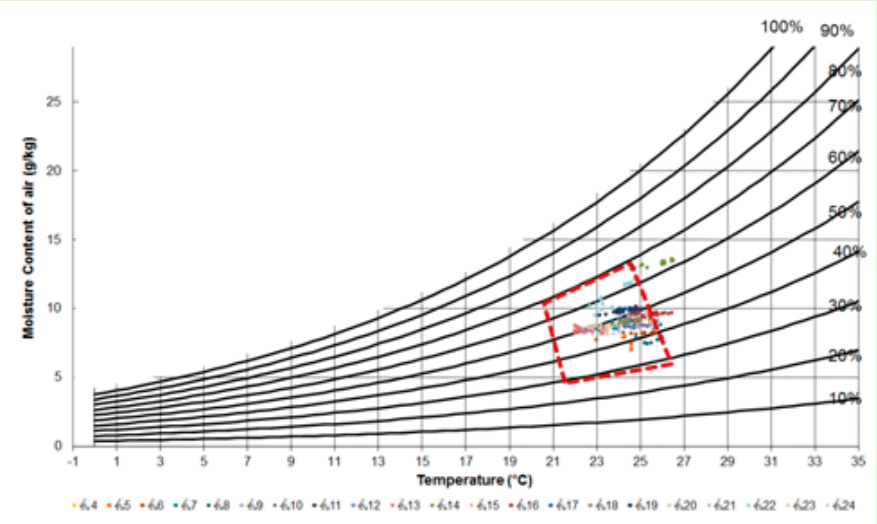


Figure 1: Recorded temperature and humidity plotted on psychometric chart
Source: Detailed Design for Green Building Retrofit of the PEA's Building Following LEED (2013)

FINDINGS

1) General conditions

Construction of PEA Building 4 started in 1996 and was completed in 2001. The building was first occupied in 2003 and its current total occupancy is now 1,555. The building also welcomes an average 88 visitor seach day.

Most interior spaces are open-plan offices with private offices around the perimeter. This design limits access to daylight and external views in the open plan office areas. There are many desktop computers, and some occupants also have their own portable electrical fans for use during off-hours, especially in high-occupancy areas.

The lighting power density (LPD) in Watts/m^2 was assessed for the office spaces. The average LPD for the building was found to be 6.04 Watt/m^2, which is below the regulatory minimum. Thailand's Building Energy Code and Regulations established in 2552 B.E. and ASHRAE 90.1-2007 stipulate a LPD for office spaces of 14 and 12 Watts/m^2, respectively.

In regard to air-conditioning, the building uses a centralized system with a central plant comprising four 450-ton chillers using R-123 refrigerant and eight cooling towers. Chilled water from the plant is supplied to air handling units and fan coil units on each floor, where fresh air is introduced into the systems. However, it was found that fresh air supply was not present in some areas; this will require rectification in order to comply with LEED prerequisites.

With regard to the building envelope, the building envelope has good thermal performance and thus may not need further improvement. However, a ceramic coating is suggested for the exterior roof surface in order to mitigate the urban heat island effect.

In terms of water usage, the building can potentially earn a higher LEED score in terms of water efficiency by replacing water fixtures, installing water sub-meters and using a conductivity meter to control water refill in cooling towers.

2) Indoor air quality and thermal comfort assessment

In terms of thermal comfort, Figure 1 shows that in most areas of PEA Building 4, temperature and humidity ranges within ASHRAE 55-2004 (American Society of Heating, Refrigerating, and Air-Conditioning Engineers) standard's thermal comfort zone (area within the dashed red line). However, occupancy was relatively low in some areas of the building, and during the measurement, outside temperature was lower than

Figure 2: CO_2 Concentrations
Source: Detailed Design for Green Building Retrofit of the PEA's Building Following LEED (2013)

normal. Should an audit be undertaken at a different time of the year or under higher levels of occupancy, the result could differ.

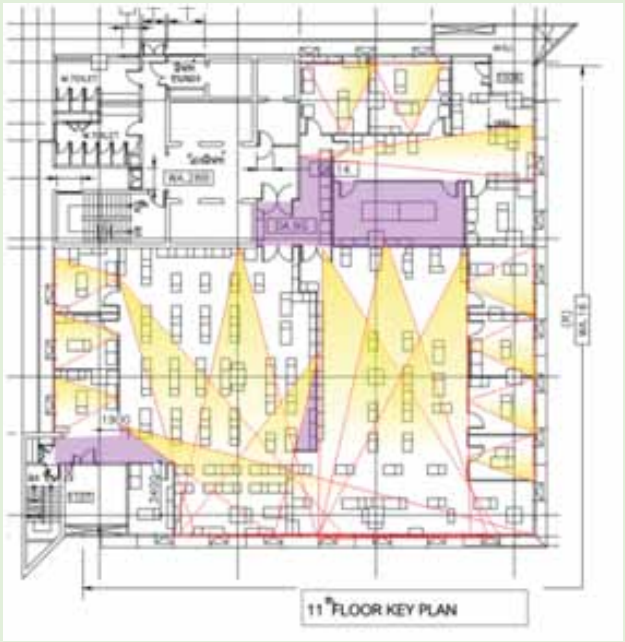
Average CO_2 concentration in Building 4's was found to be below 980 ppm (part-per-million), which is considered acceptable. Nonetheless, some areas with concentrations exceeding 980 ppm were also found, as illustrated in Figure 2. Improvement will be needed increase the fresh air supply in these areas.

Comparison of figures from illuminance measurement (using portable device) using Illuminating Engineering Association of Thailand (TIEA) and Illuminating Engineering Society of North America (IESNA) standard figures showed the majority of the building's regularly occupied spaces, including offices and conference rooms, are adequately illuminated. The result of the building audits correlated with the questionnaire survey findings which indicated that the majority of occupants find illuminance levels to be satisfactory.

In order to pass the LEED requirement, it is fundamental that 45 percent of the regularly occupied spaces such as offices, conference rooms and break rooms, have access to an outside view. However, in the current office layout, the open-planned office area is surrounded by private offices situated along the perimeter. Access to external views from the open-plan area is therefore limited con. Notwithstanding this deficiency, the determination of area with access to outside view indicates that PEA Building 4 should pass the LEED 45 percent requirement.

3) Building operation and maintenance assessment

No specific policy, implementation, or training in terms of green cleaning (which are LEED prerequisites) was found. Considering the existing condition and LEED



Area with no access to outside view

Figure 3: Floor 11 View assessment result
Source: Detailed Design for Green Building Retrofit of the PEA's Building Following LEED (2013)

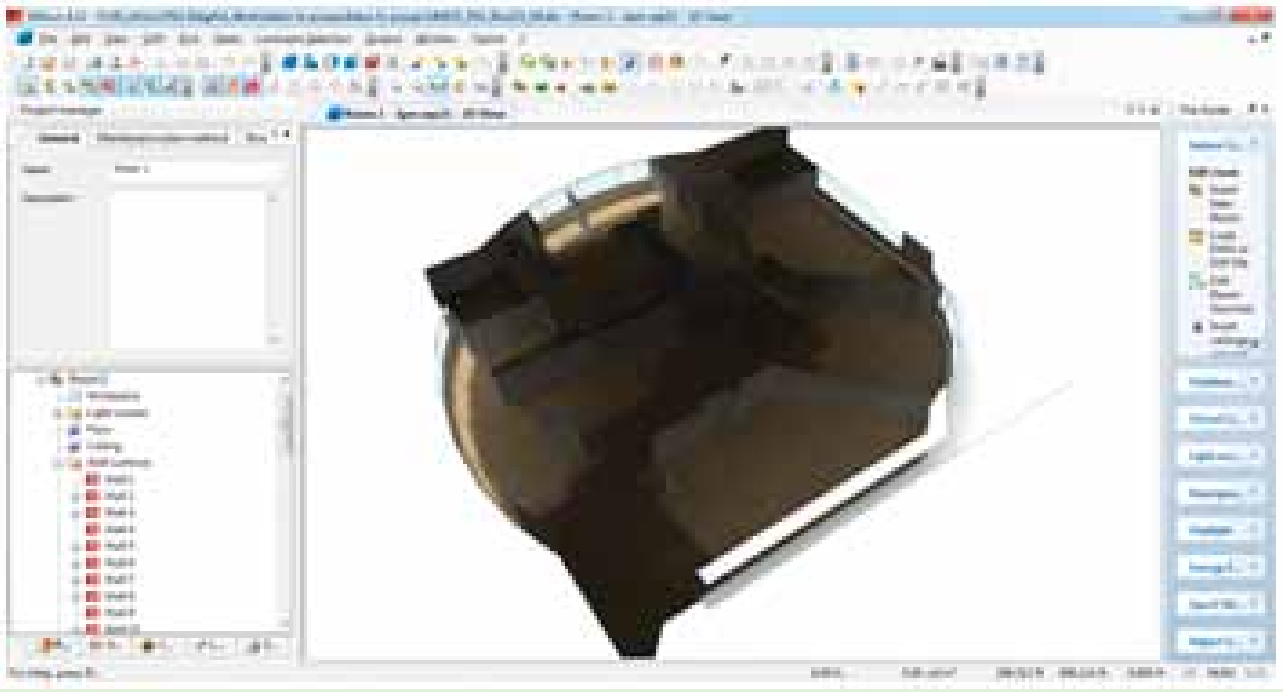


Figure 4: Dialux daylight simulation
Source: Detailed Design for Green Building Retrofit of the PEA's Building Following LEED (2013)

requirements in terms of green cleaning, PEA may improve its LEED score by establishing an appropriate green cleaning policy, together with consistent implementation.

Similarly, no explicit policy for waste management, nor measures such as logging of waste volume were found. The only measure implemented to increase waste utilization was the segregation of paper waste.

Outsourced staff are contracted to manage the building's systems including the M&E operating schedule, observation and evaluation of the M&E system, maintenance activities, and data logging.

Pest management measures focused on pest extermination. No preventive or environment-friendly pest control measures were found to be implemented.

4) Day lighting and energy simulation for outlining future improvements

Due to the building's relatively small glazed area, only a low amount of daylight could access the building's interior. However, in areas adjacent to windows, the high levels of daylight illuminance presented a risk of discomfort glare. Despite the increased area lit by

Table 1: Electricity cost reduction comparison

Simulation case		Total EUI (kWh)	Reduce EUI (kWh)	Saving (baht)*	Saving %
Existing		2,005,305			-
Alternative 1	Existing + fresh air required by LEED	2,190,616			-
Alternative 2	Alternative 1 + daylight dimmers	2,176,981	13,635	53,995	0.6%
Alternative 3	Alternative 1 + occupancy sensors	2,184,990	5,626	22,279	0.3%
Alternative 4	Alternative 1 + COP improvements	2,004,305	186,311	737,792	8.5%
Alternative 5	Combination of all alternatives	1,985,721	204,895	811,384	9.4%

*1 kWh = 3.96 THB

Source: Detailed Design for Green Building Retrofit of the PEA's Building Following LEED (2013)

daylight resulting from several improvement scenarios, less than 50 percent of the building's regularly occupied area is sufficiently day lid, as required by LEED due to the glass property.

For the energy simulation, the building's physical features were used to create an energy simulation model using Visual DOE 4.1. Table 1 shows 5 alternative building improvements and their consequences for energy use.

The simulation results indicate that modification of the lighting and cooling systems do not bring significant reductions in the building's energy use, due to the high efficiency of the existing systems. Thus, in order to further reduce energy use, the PEA should focus on improvement of the building's facility management.

SUMMARIZED RECOMMENDATIONS

As different levels of LEED EBOM certification require different levels of effort and investment, two categories of recommendations for modification are presented.

1) Gold Certification: Minimum modification to acquire LEED EBOM Gold Certification.

2) Platinum Certification: Additional modifications needed (in addition to those required for Gold Certification) to acquire LEED EBOM Platinum Certification.

PEA Building 4 has the capacity to modify its operation and management into LEED's green building practices. However, currently no stringent measures are in place to enforce implementation. Therefore, training and instruction are recommended to educate the building's users on operating and managing a green building. The following modifications are needed in order for PEA Building 4 to be LEED certified (Table 2).

As mentioned above, in order to be achieved LEED certification, apart from the physical modifications detailed in Table 2, modifications in terms of building operation and facility management are also crucial. This will require stringent policies and strong cooperation of all parties. As such, to efficiently carry out the necessary modifications and management, as well as efficiently coordinating all parties, formation of a specific team responsible for green building tasks by the PEA is recommended.

Acknowledgements

This article is part of the research project *"Detailed Design for Green Building Retrofit of the PEA's Building Following LEED"* conducted by the Provincial Electricity Authority, Ministry of Interior.

Table 2: Recommended modifications for PEA Building 4

	Gold Certification	Platinum Certification
Physical Modifications		
Exterior components	• Application of ceramic coating paint on the building's roof, to reduce heat accumulation and heat transferred to the interior of the building.	• Convert the existing hardscape at the south side of the building into a xeriscaped vegetated area, to increase vegetated area whilst minimizing irrigation requirements. • Application of stormwater retaining measures.
Interior Components	• Installation of permanent entryway systems (grilles, grates, mats) to capture dirt and particles entering the building at all public entry points.	• Installation of an automatic lighting switch system and control of exterior lighting direction, to prevent light pollution in the vicinity and to reduce electricity consumption.

	Gold Certification	Platinum Certification
Plumbing system	• Placement of existing faucets (4.8 litre/minute) with water efficient faucets (0.81 litre/cycle). • Submetering to identify lavatory water use and landscape water use. • Installation of conductivity meter to reduce cooling tower's water use.	• Modification of existing urinal flush valves (6 litre/flush) to water efficient flush valves (2.2 litre/flush). • Modification of existing toilet flush valves (6 litre/flush) to water efficient flush valves (5.2 litre/flush).
Air conditioning and fresh air supply systems	• Installation of fresh air supply system to areas required by LEED. • Proper verification and maintenance of air-related systems.	• Installation of air flow monitor in the AHU. • Installation of CO_2 sensor in conference rooms and rooms with split-type air conditioner, in order to measure and verify indoor air quality. • During building renovation activities, air-pollution control measures must be implemented. • Installation of thermal-comfort-related meters and alarm systems.
Energy use	• Modification of the existing BAS to cover electrical lighting control system. • Installation of meters to specifically measure electricity use of each system. • Installation of switches for personal lighting control as well as furniture arrangement modification in accordance with luminaires arrangement.	-
Daylight and View	• With the existing glass property, it is unlikely that PEA Building 4 could attain LEED credit for daylighting. However, improvement of daylighting including planning modification and installation of glare prevention devices could be beneficial, as it could increase productivity and reduce the cost of lighting. Moreover, planning modification with private offices in the inner area would also increase occupants' access to external views.	
Building Operation and Facility Management		
	• Compile a plan and manual for Environment Friendly Integrated Pest Management. • Arrange green cleaning practice training for cleaners. • Establish policy, plan and compile manual for purchasing of environment friendly products with consideration of ergonomics and users' wellbeing. • Establish policy, plan and compile manual for waste management including logging and measures to increase waste utilization. • Arrange smoking area with sufficient distance from building's openings, to prevent smoke from entering the building and prohibit smoking in PEA Building 4. • Conduct inspection of building systems as well as arrange building systems commissioning. • Compile report of PEA Building 4's CO_2 emissions and submit to Thailand Greenhouse Gas Management Organization (TGO). • Conduct occupant comfort survey during performance period to identify occupants' requirements, thus modification of the building could be done accordingly.	• Arrange training courses to develop building system management skills in personnels and conduct evaluation of PEA Building 4's modification, to increase energy efficiency and efficiency in managing building systems. • Purchase construction materials manufactured within Thailand to reduce transportation, resulting CO_2 emissions and pollution, as well as promote locally produced materials.

Investigations of Tsunamigenic Sources

in Mainland Southeast Asia: Implications from Seismicity

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Introduction

Following the tsunami generated by the Mw-9.0 Sumatra Earthquake on December 26th, 2004, Thailand, along with other affected countries, began to seriously appraise social and economic impacts, along with impacts on physical resources such as coastal erosion. In order to contribute to an effective mitigation plan for future hazards, this study explores 1) seismic activity and 2) prospective sources of future earthquakes. The study focuses on all seismic sources that are capable of generating a tsunami hazard in both the Andaman Sea and the Gulf of Thailand.

Earthquake Sources

According to the Nation Oceanic and Atmospheric Administration (NOAA), the predominant source of major tsunami events is tectonic activity in subduction zones that generates earthquakes and vertical movement of the Earth's crust. Thirteen such subduction zones in Southeast Asia have been identified as capable of generating earthquakes and tsunami events (Figure 1), viz. 1) the Andaman Subduction Zone; 2) East Luzon Trench; 3) East Sulawesi Trench; 4) Halmahera Subduction Zone; 5) Manila Trench; 6) Minahassa Trench; 7) Negros Trench; 8) Palawan Trench; 9) Philippine Subduction Zone; 10) Ryukyu Trench; 11) Sangihe Double Subduction Zone; 12) Sulu Archipelago Trench; and 13) Sulu Trench.

Earthquake Catalogue and Completeness

The main database utilized in this seismicity investigation are the earthquake catalogues derived from 1) the Incorporated Research Institutions for Seismology, 2) the US National Earthquake Information Center, and 3) the Global Centroid Moment Tensor, which together recorded around 300,000 earthquakes in 50 years from 1960-2010. Based on detailed investigation, the data are composed of various reporting magnitude scales, e.g., body-wave (mb), surface-wave (MS), including moment (Mw) magnitude scales. It is noted that each magnitude scale is derived by a specific assumption and analytical

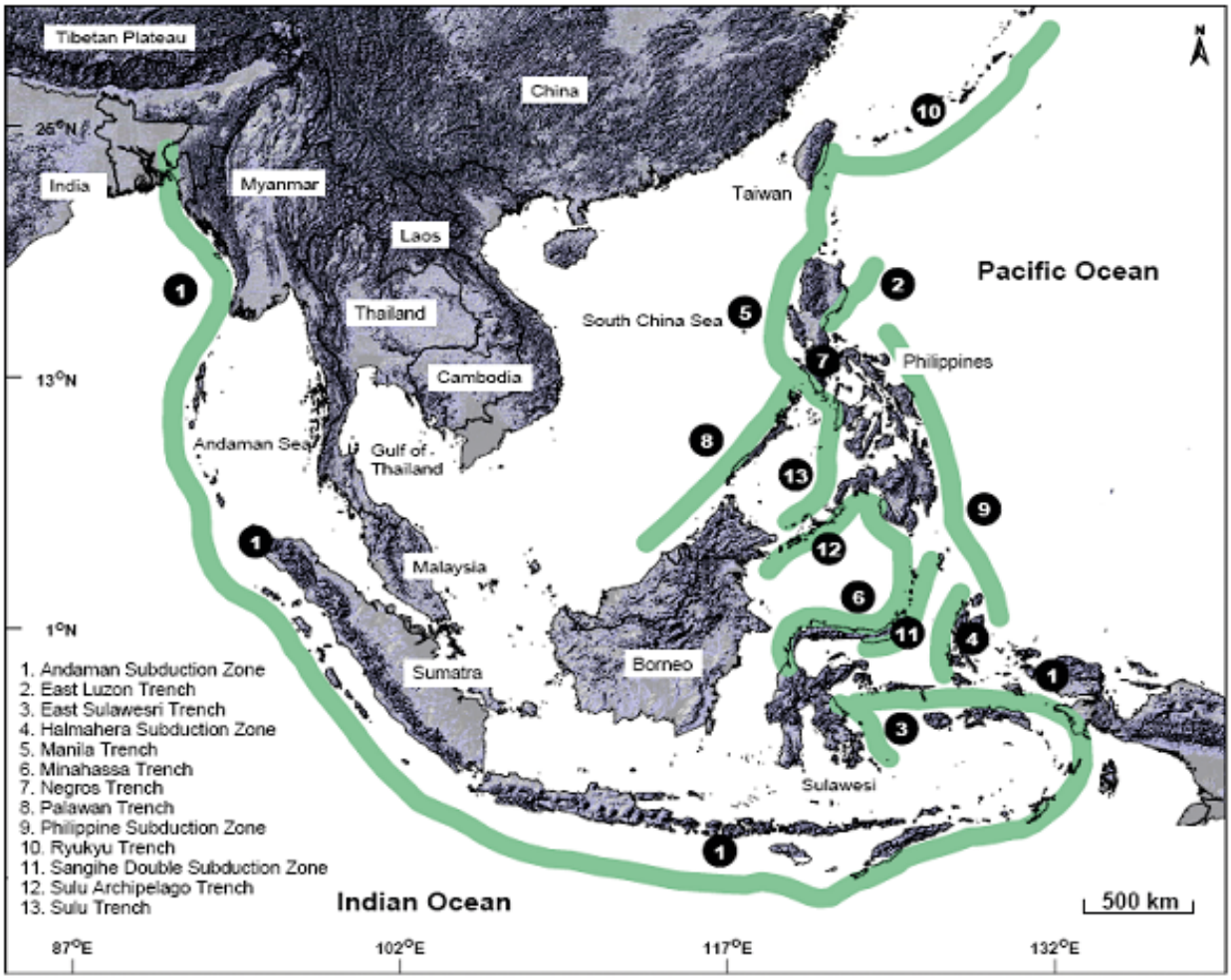


Figure 1: Map of Southeast Asia showing distribution of tectonic subduction zones (green lines) that might present seismic and tsunami risks for Thailand.
Source: Investigation and Design of Tsunami Resistant Infrastructure (2013)

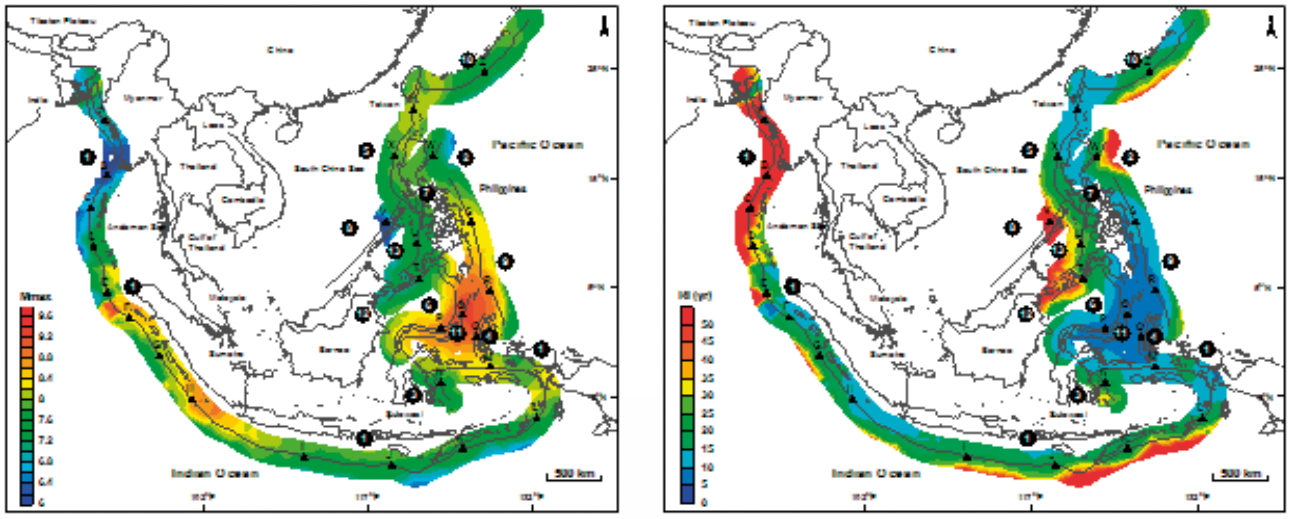
method that have a valid but different value and unique meaning. Thus, the other reported magnitude scales were homogenized to a single Mw which represents directly the physical properties of an earthquake. In order to screen the foreshock and aftershock sequence, the algorithm of Gardner and Knopoff (1974) are analyzed. As a result, only mainshocks that represent exactly the tectonic activities are remained. Moreover, the obtained mainshocks are also screened for man-made seismicity, e.g., mining explosions and recording network improvement (Habermann, 1987). Therefore, the latest version of the completeness earthquake catalogue is the tectonic mainshock data reporting magnitude in Mw scale.

Earthquake Activities

Based mainly on the frequency-magnitude earthquake distribution (Gutenberg and Richter 1944), the empirical relationship between the average number of earthquakes per year (N) with a magnitude equal to or larger than M is expressed in equation (1);

$$\log(N) = a - bM \quad \text{or} \quad \ln(N) = \ln \alpha - \beta M \qquad (1)$$

In equation (1), a and b are constants. The a-value implies the entire seismicity rate whereas b-value represents the ratio of the occurrence of small to large earthquakes. Meanwhile, the parameters α and β are related to a and b by $\alpha = \exp(a \ln(10))$ and $\beta = b \ln(10)$, respectively.



(a) (b)

Figure 2: Map of Southeast Asia showing (a) potential maximum magnitude evaluated for the next 50 years; (b) return period of the earthquake with Mw 7.0.
Source: Investigation and Design of Tsunami Resistant Infrastructure (2013)

Based on Yadav et al. (2011), various values representing the earthquake activities can be calculated using both α and β values. For instance, the possible maximum magnitude in t year of interest u_t can be estimated as shown in equation (2);

$$u_t = \frac{\ln(\alpha t)}{\beta} \quad (2)$$

Moreover, the earthquake return period of individual magnitude M (T_M) was evaluated as in equation (3).

$$T_M = \frac{\exp(\beta M)}{\alpha} \quad (3)$$

To assess the earthquake activities spatially, the study area was gridded with a 1x1 degree spacing. In each grid node, all earthquakes located within a fixed 100-km radius from node were selected. The a- and b-values are evaluated and convert to their corresponding α and β. The obtained α and β are then used to calculate the potential maximum magnitude in 50 years according to equation (2) and return period of the Mw-7.0 earthquake as described by equation (3) the results were then contoured and mapped as shown in Figure 2.

The results indicate that the study area can generate earthquakes with magnitudes up to 8.8 Mw over 50 years. For the Andaman Subduction Zone associated with the Andaman Coast of southern Thailand, the possible maximum magnitudes are calculated at around 6.0 Mw in the northern Nicobar Island-western Myanmar segment. Meanwhile for the Sumatra Island-southern Nicobar Island segment, the magnitude is up to 8.0 Mw in 50 years. For the Manila Trench (defined as the tsunami source of the Gulf of Thailand), the magnitude is estimated at around 7.0-7.5 Mw (Figure 2a).

In case of earthquake return period, the Andaman subduction zone has a potential to generate a Mw-7.0 earthquake in 50 years. Meanwhile for the Manila Trench, the return period is 11-15 years (Figure 2b).

Earthquake Forecasting

Generally, the b-value of equation (1) is equal to 1 in particular for the global scale (Frolich and Davis, 1993). However, at the regional or local scale, a number of researches, e.g., Wiemer et al. (1998) and Gerstenbergeret et al. (2001) etc., have indicated that the b-values may vary for both spatial and temporal aspects. Moreover, Nuannin et al. (2005) proposed that high/low b values imply low/high tectonic stress accumulated in an individual region. Therefore, a relatively low b is an effective precursor of a forthcoming

earthquake. Based mainly on the procedure demonstrated by Nuannin et al. (2005), this study calculated and mapped b-values using the most recent seismicity data, i.e., 1960-2010 (Figure 3). The results indicated that the northern segment of Sumatra Island shows a prominent low b-value. Meanwhile, for the Manila Trench, the precursory low b-value is not prominent.

Conclusion

In this study, the potential of tsunamigenic sources, i.e., earthquake subduction zones, in Southeast Asia were investigated statistically. Based on the completeness earthquake catalogue, the result reveal that Andaman Subduction Zone and Manila Trench have relatively low hazard comparing with the other earthquake sources (Figure 2). However, analysis of potential earthquake sources indicates that northern Sumatra Island, showing comparatively low b-values, has the potential to generate future earthquakes. The study has implications

Philippe Lopez / AFP/Getty Images

for the effective design of tsunami-resistant infrastructure. The Andaman coast of southern Thailand is particularly at risk and should be carefully evaluated.

Acknowledgements

This article is part of the research project *"Investigation and Design of Tsunami Resistant Infrastructure (2013)"* funded by the Department of Public Works and Town & Country Planning, Ministry of Interior.

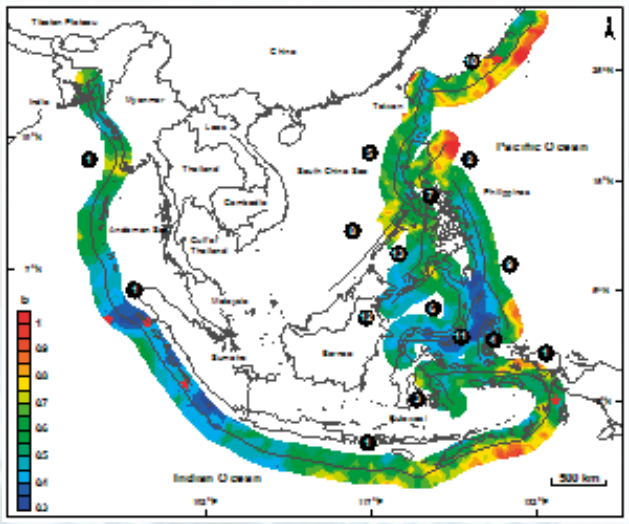


Figure 3: Map of Southeast Asia showing distribution of b-values along the earthquake subduction zone, derived from seismicity data recorded during 1960-2010. Red stars indicate earthquakes with Mw ≥ 7.0 occurring after the utilized seismicity data set, i.e., 2010-2012.
Source: Investigation and Design of Tsunami Resistant Infrastructure (2013)

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Design for Landscape Improvement of

Utthayan Road

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Introduction

Located near the Royal Palace in Thawiwattana District, Bangkok, Utthayan Road forms part of the route for many royal ceremonies. Due to its cultural significance, Thawiwattana District Office appointed Chula Unisearch to improve and restore the route, to harmonize with the surrounding environment and provide green space and recreational areas, while maintaining the road's unique features. The project covers 3.561 kilometre of the road in Thawiwattana District, Bangkok (from Buddhamonthon 4 Road to Buddhamonthon 3 Road), and a 300 metre section in Buddhamonthon District, Nakon Pathom Province. The scope and phases of the project are as follows:

1) Conceptual and detailed designs: surveys of the project area were first conducted, including physical and environmental characteristics and existing development plans, in order to analyze the situation, identify problems and propose solutions. Following meetings to determine the scope of the project to meet objectives and requirements, the detailed design was concluded, materials and equipment requirements finalized, and the landscape design and the improvement scheme planned in detail.

2) Construction drawing and documentation: operation plans, B.O.Q and construction drawing were carried out during this phase.

Design Concept

The design concept aimed to create a serene and relaxing atmosphere with unique features, implicit in the word *"Utthayan"* meaning *'park'*. The road improvement emphasized the creation of new green spaces, footpaths and bicycle lanes, which will all help improve the visual amenity, reduce traffic speeds and provide a perfect backdrop for Royal ceremonies at the Buddhist diocese. The design was heavily influenced by Buddhist cues, and the gardens include plants with significance in Buddhism and traditional Dharma. This design method is known as *"A Buddhist Approach"*. The approach was used in this project to design two major components of the road: a Buddhist approach for plant selection and a Buddhist approach for landscape design and composition.The Buddhist approach for plant selection led to planting trees that were mentioned in Tripitaka or in biography of Lord Buddha; trees that represented ancient believes or trees that associated with dhamma. For example, several deciduous plants were grown along the road since shedding leaves represented uncertainty. Buddhism also inspired the landscape design and its composition such as in decorative sculptures for floor tiles, courts, and open space (Figure 1-2).

Material concept:

As for material concept for the road construction, materials were selected for construction of hardscapes according to their durability, visual appeal and ease of maintenance. Materials used for the construction included various types of decorative granite tiles that could evoke a sacred atmosphere. The granite was used to decorate courtyards, activity areas, fountain courts, stairs, and linking courts.

Softscape concept:

In terms of softscapes, perennial plants were used to reflect the concept of Buddhism using auspicious trees referred to in Buddha's biography, trees that connote rituals and beliefs, and trees that represent Dhamma. Below are five species that carry special significance from a Buddhist perspective, and are considered auspicious:

1) Indian Gooseberry: A herbal plant that was used as traditional medicine during the Buddha era, which monks could keep for a nighttime supply;

2) Sugar Palm: The plant was referred to in Lord Buddha's biography that, after his enlightenment, Lord Buddha proceeded to the Palm Grove (Lathivana) and gave King Bimbisara and the townspeople a teaching. The elated king later became the first Royal Patron;

3) Indian Oak or Muchalinda, was referred to in Lord Buddha's biography as the name of a naga who protected Buddha after his enlightenment;

4) Golden Shower or Rajapreuk is an auspicious plant used in many important ceremonies, as the golden yellow colour represents Buddhism. The yellow flowers are displayed in clusters hanging from the branches. The name also connotes prosperity and wealth. Many such trees are already planted along the Utthayan Road; and

5) Pink Cassia, the Wishing Tree or Kalaprapreuk, which symbolises victory and freedom. It is believed that the Kalaprapreuk tree belongs to divinity, and possesses sacred and possessed divine powers according to the legend of the Lord Buddha.

In selecting shrubs and ground-cover, plants such as Mok, Hokkien tea, Chinese banyan, Gardenia, cape

(Figure 1)

(Figure 2)

Figure 1-2: Conceptual images from Budapest, Hungary
Source: Budapestdailyphoto (2013) and Whereisbudapest (2013)

jasmine, Climbing Wedelia, calico, false heather, ground-morning glory, and sessile joyweed were selected due to their attractiveness and ease of maintenance.

Moreover, aquatic plants such as the Sacred Lotus are also used to further evoke the concept of Buddhism. The Sacred Lotus appeared in Buddha's biography and is deeply symbolic. The flower symbolizes Buddhism and always forms part of any offering to monks.

Design results

There are 5 zones to be constructed. The plans are as followed:

1) COMMON ZONE - covering the peripheral areas and street islands along the road: The design concept for the Common Zone is to increase green space and emphasize simplicity, beauty and shade. New plants will be planted to augment the existing planting of Golden Shower and Mok.

2) ZONE 1 - at the entrance on Buddhamonthon 4 Road: The design concept for this zone is to increase awareness and provide an open space for special activities. Buddhism-related trees will be planted in this area for landscape improvement.

3) ZONE 2 - at the entrance on Buddhamonthon 3 Road: The design concept for this zone is to increase awareness by building an arch as well as adding more open space for activities. The open space will be decorated with plants related to the concept of Buddhism for landscape improvement.

4) ZONE 3 - at the areas around the big fountain: The design concept is to increase awareness and use

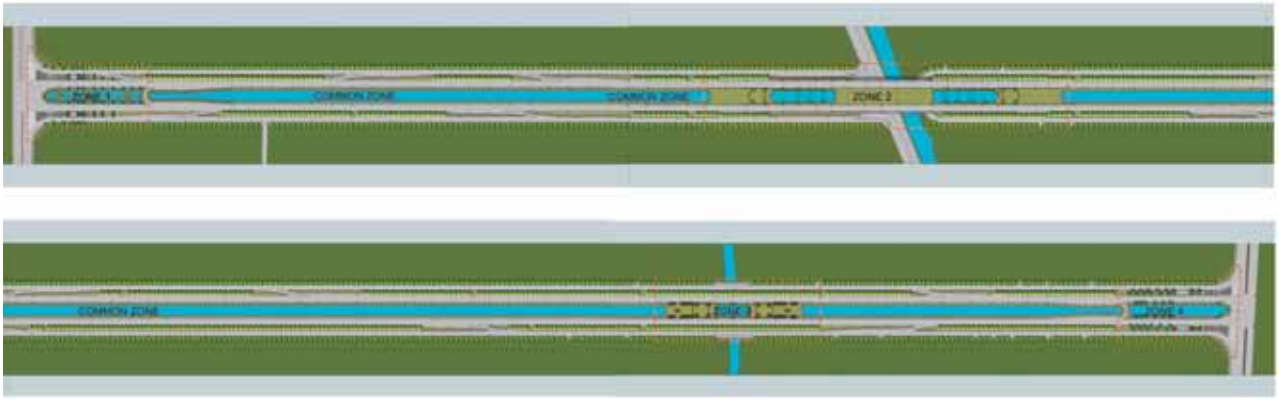
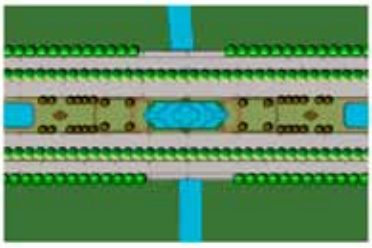


Figure 3: Overall conceptual plan

Source: Consultant project on landscape improvement of Utthayan Road, Thawiwattana District, Bangkok

(Figure 4)



(Figure 5)

(Figure 6)

Figure 4-6: Closer views of ZONE 1, ZONE 3 and ZONE 4

Source: Consultant project on landscape improvement of Utthayan Road, Thawiwattana District, Bangkok

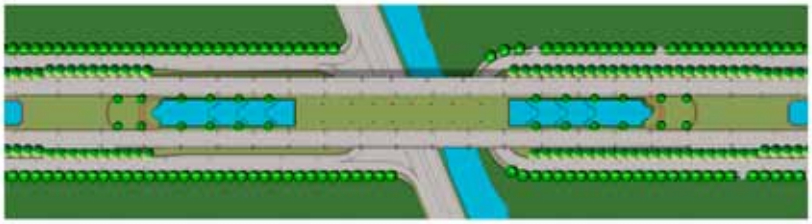


Figure 7: A closer view of ZONE 2

Source: Consultant project on landscape improvement of Utthayan Road, Thawiwattana District, Bangkok

the area for recreational purposes. Landscape improvement will be undertaken in an open space for activities located in front of, and to the rear of the big fountain.

5) ZONE 4 - areas around the small fountain: The design concept is to increase awareness and use the area for recreational purposes. Landscape improvement will be undertaken in front of and next to the small fountain.

Furthermore, additional projects are to be launched in the future, including the detailed design for the bridges located between, in front of, and behind the big fountain. The detailed design for the area around the small fountain will also be undertaken.

Since the entrance of Buddhamonthon 3 Road forms the start of Utthayan Road leading to the Buddha image in Buddhamonthon, the project suggests three detailed design options for a gateway. These are presented below:

Option 1: Talipot-fan-shaped gateway

This concept connotes Buddhist teaching, and inspired by the shape of the sugar palm leaf. The Talipot-shaped gateway can also be used to display the King and the Queen's photographs during Royal celebrations.

Option 2: The Lotus Gateway

This concept refers to the worship of Lord Buddha with the Lotus as an offering. It is inspired by a sculpture of 9 lotuses indicating the number of kings who have reigned over Thailand. The combination of tree-like shapes indicates the prosperity of Buddhism in the Kingdom.

Option 3: The Bead Gateway

The Bead Gateway represents the supremacy of

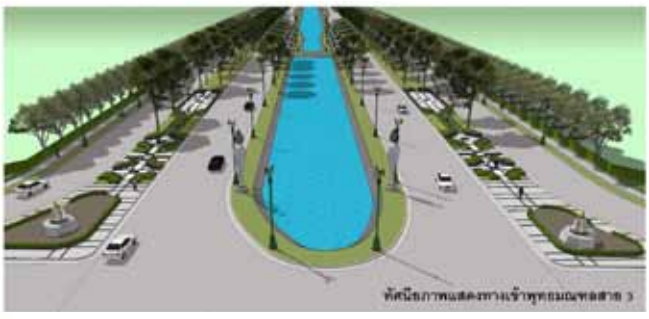
Figure 8: The "talipot-shaped" gateway concept

Source: Consultant project on landscape improvement of Utthayan Road, Thawiwattana District, Bangkok

Figure 9: The"Lotus"Gateway

Source: Consultant project on landscape improvement of Utthayan Road, Thawiwattana District, Bangkok

(Figure 10)



(Figure 11)

Figure 10-11: The "Bead Head"Gateway

Source: Consultant project on landscape improvement of Utthayan Road, Thawiwattana District, Bangkok

Figure 12: Overview of the landscape
Source: Consultant project on landscape improvement of Utthayan Road, Thawiwattana District, Bangkok

the Buddhist religion, and Thailand as the centre of Buddhism. The Bead Gateway will be adapted to suit the road and links the road and swan pillars.

After consideration, the Thawiwattana District Office selected Option 3: The Bead Gateway. In order to connect the design to the road harmoniously, the top part of the spherical bead was modified into a *"lotus-shaped"* bead.

In addition, brass structures were added to the areas for hanging heart-shaped bells horizontally along the gateway. These heart-shaped bells serve as wind chimes. The pillar and its bases were adapted and used as temple boundary markers, or *'Sema'*. Additionally metal balls or *'Nimit'* are to be buried in the temple compound as boundary markers, following traditional practice. The Nimit, were designed in the shape of budding lotus and lotus petals. The height of the bronze structures is 9 metre, symbolizing King Rama IX.

The gateway also indicates the link to Utthayan Road which is symbolically impressive and memorable to by-passers. Moreover, it improves the image of the area and enhances its importance.

Acknowledgements

This article is part of the research project *"Design for landscape improvement of Utthayan Road"*, funded by Thawiwattana District Office.

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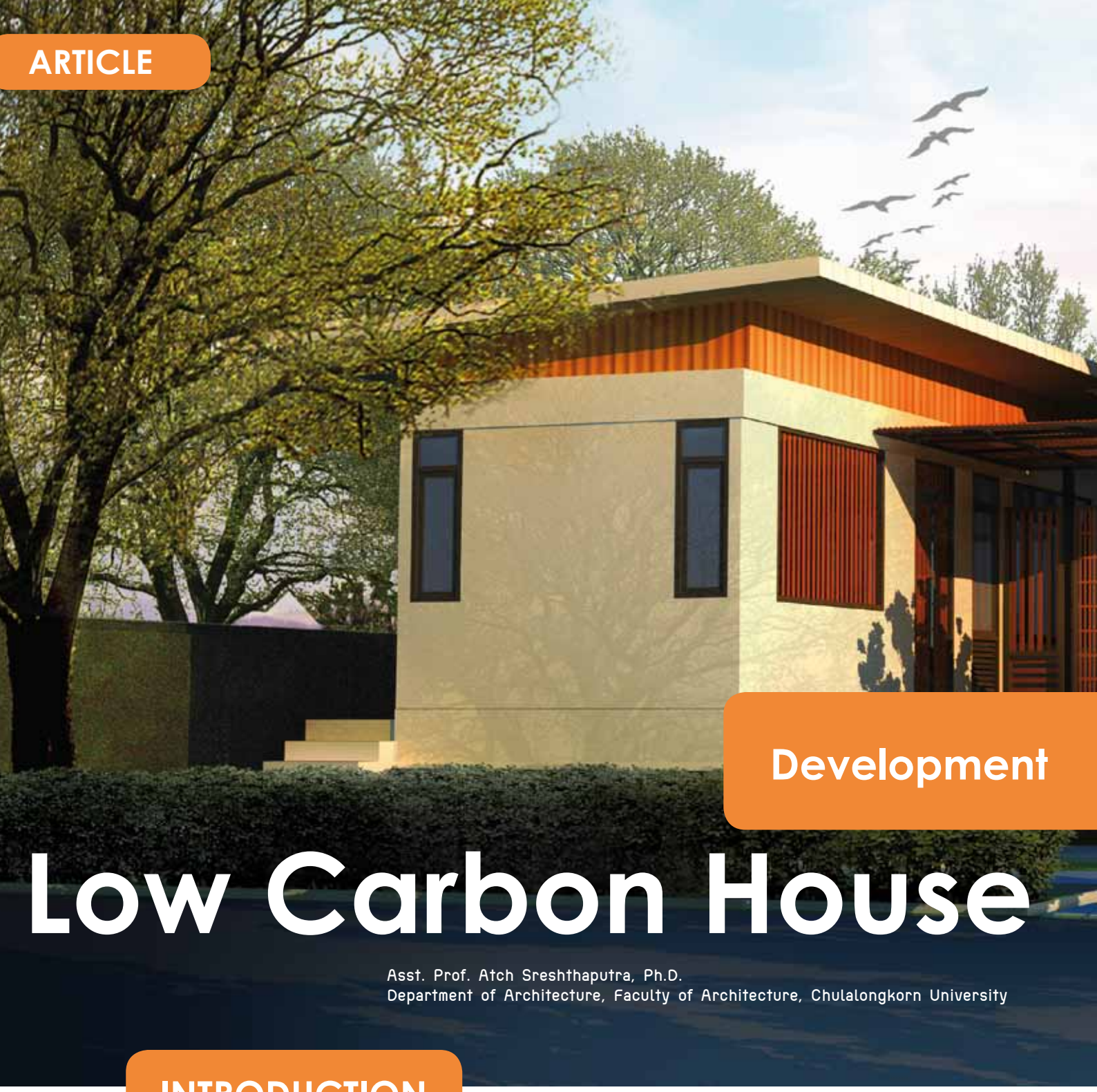
ARTICLE



Development

Low Carbon House

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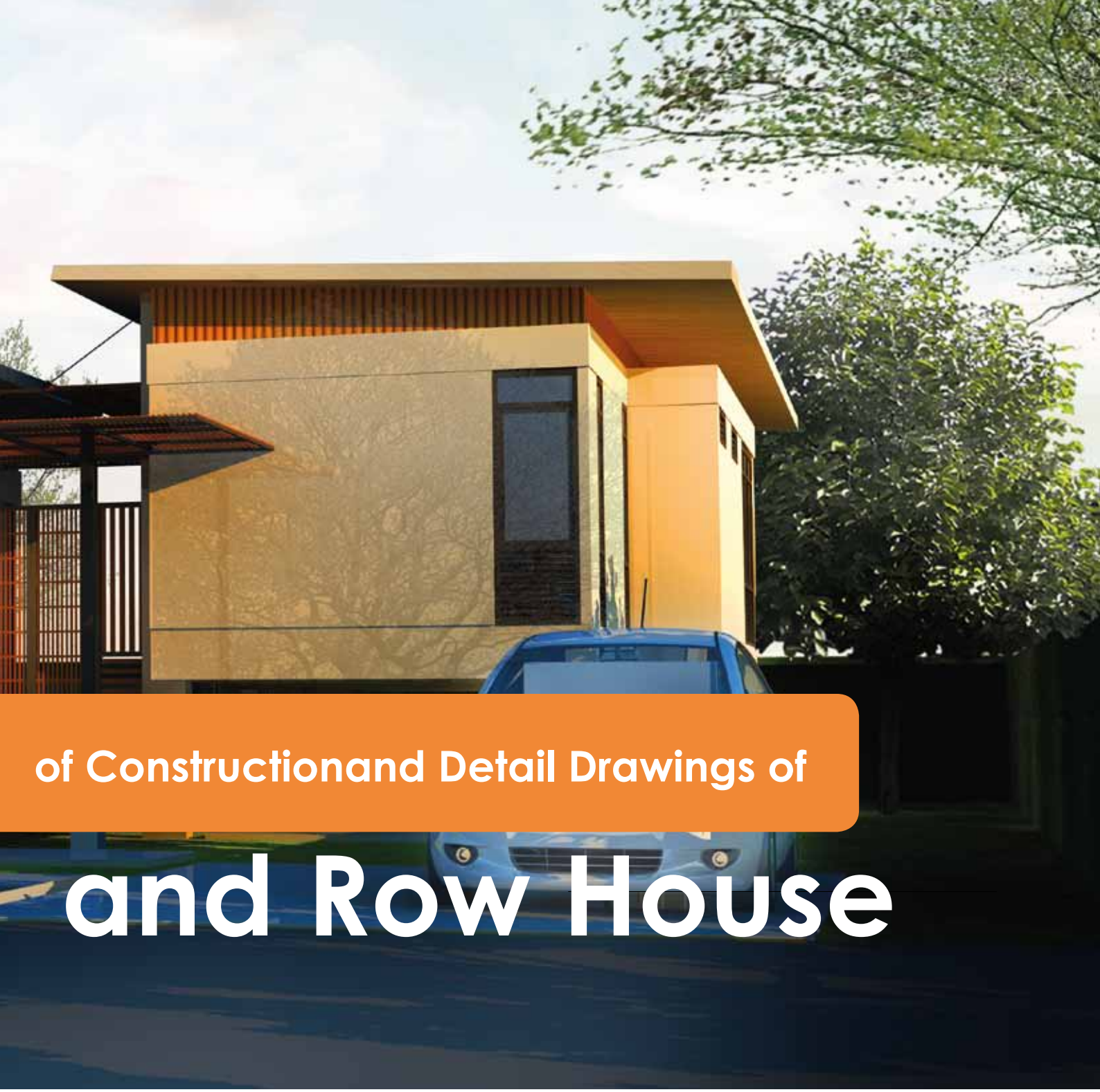
INTRODUCTION

Emissions of greenhouse gases (GHG) from the residential sector have increased along with population growth, especially in urban areas. The problem is exacerbated by a trend in the real estate market towards Western-style designs which are unsuited to hot climates and require excessive energy consumption for space cooling. However, increasing awareness of climate change impacts has triggered an emerging interest in environment-friendly residential building design, aiming to reduce GHG emissions and conserve finite natural resources such as energy.

This paper discusses two conceptual designs that meet these needs: a low-carbon house and a row house.



# of Constructionand Detail Drawings of and Row House

In 2012, the Thailand Greenhouse Gas Management Organization (Public Organization), or TGO, in cooperation with the Siam Cement Group PLC., launched a conceptual design competition for a low-carbon house and row house. The winning designs were to be publicized as prototype low-carbon houses to create awareness of low-carbon building design and establish GHG mitigation and low-carbon footprint as design criteria for architects, real estate agents, builders and homebuyers. First prizes were awarded to the following works: *'Baan-Baan'* for the single-storey house category (Figure 1); *'Under Tree'* for the 2-storey house category (Figure 2) and *'Vertigo'* for the row-house category (Figure 3).

Figure 1: Perspective of "Baan-baan"
Source: Development of construction and detail drawings of low carbon house and row house project

Figure 2: Perspective of "Under Tree"
Source: Development of construction and detail drawings of low carbon house and row house project

Figure 3: Perspective of "Vertigo"
Source: Development of construction and detail drawings of low carbon house and row house project

In order to develop and transform the winning conceptual designs into construction and detail drawings which could be supported by empirical evidence of reduction of GHG emissions, TGO appointed *Chula Unisearch* to undertake a research project with four key objectives: 1) development of construction and detail drawings for the winning designs; 2) computational energy simulations; 3) GHG emission calculations and 4) low-carbon house design manual.

METHODOLOGY

The research team produced construction and detail drawings for the winning designs and studied their energy consumption. The analysis comprised two components: 1) computational energy simulation, illustrating energy use for air conditioning, electrical equipment and lighting and 2) energy consumption from production of construction materials and the building construction process. The building life cycle is assumed to be 30 years (Sreshthaputra, 2011).

Finally, total energy consumption resulting from the two components was converted to a GHG emission estimate using emission conversion factors provided by TGO. However, the scope of the analysis did not cover GHG emissions during demolition, due to scarcity of empirical data. Based on the findings of Jaisan (2012), who estimated that GHG emissions during demolition contributes only 1 percent to the total GHG emission over the building's life cycle, GHG emissions from this source were considered insignificant and thus omitted from the scope of analysis. Finally, the analysis did not include energy consumed during transportation of building materials, as the site location was not specified.

Embodied energy of construction materials

Calculating the embodied energy of construction materials involves more complex consideration of material components since tabulated material lists for bills of quantity provide insufficient data. The analysis requires that the energy consumption of building materials be categorized according to international manufacturing process standards. These data can then be used to calculate GHG emission factors for each construction material. As Thailand-specific data were rarely available, this analysis used research data from the Inventory of Carbon & Energy or ICE, produced by the Sustainable Energy Research Team (SERT) of the University of Bath, UK (SERT, 2011). The GHG emission

factors used in this research are the second version, published in 2011

Operational energy

Operational energy data were acquired from computational energy simulations using DOE 2.1E (Sreshthaputra, A., 2011). This allowed an estimate of annual energy use based on assumptions of building usage patterns obtained from other studies (Sreshthaputra, A., 2005). The annual energy consumption estimates were then used to calculate operational energy, assuming a life cycle of 30 years.

Conversion of energy consumption to GHG emissions estimate

To estimate embodied and operational GHG emissions from embodied and operational energy estimates requires multiplication of the energy consumption in kWh by a GHG emission conversion factor of 0.5812 $kgCO_2eq/kWh$ (TGO, 2013). The converted values were then tallied to provide a *'Total Life GHG'* emission estimate. However, the assumption of this method is that the emission factor remains constant throughout the building life cycle.

Analysis of total Life GHG emissions

Total Life GHG emissions for each winning design were analyzed, taking into account the two main factors that affect total emissions: construction materials and building usage patterns. This allowed identification of opportunities to reduce emissions. The analysis used the following criteria:

1) Emissions per building square-metre ($TonsCO_2eq/m^2$) provides an estimate of total GHG emissions per unit of built area. This provides an

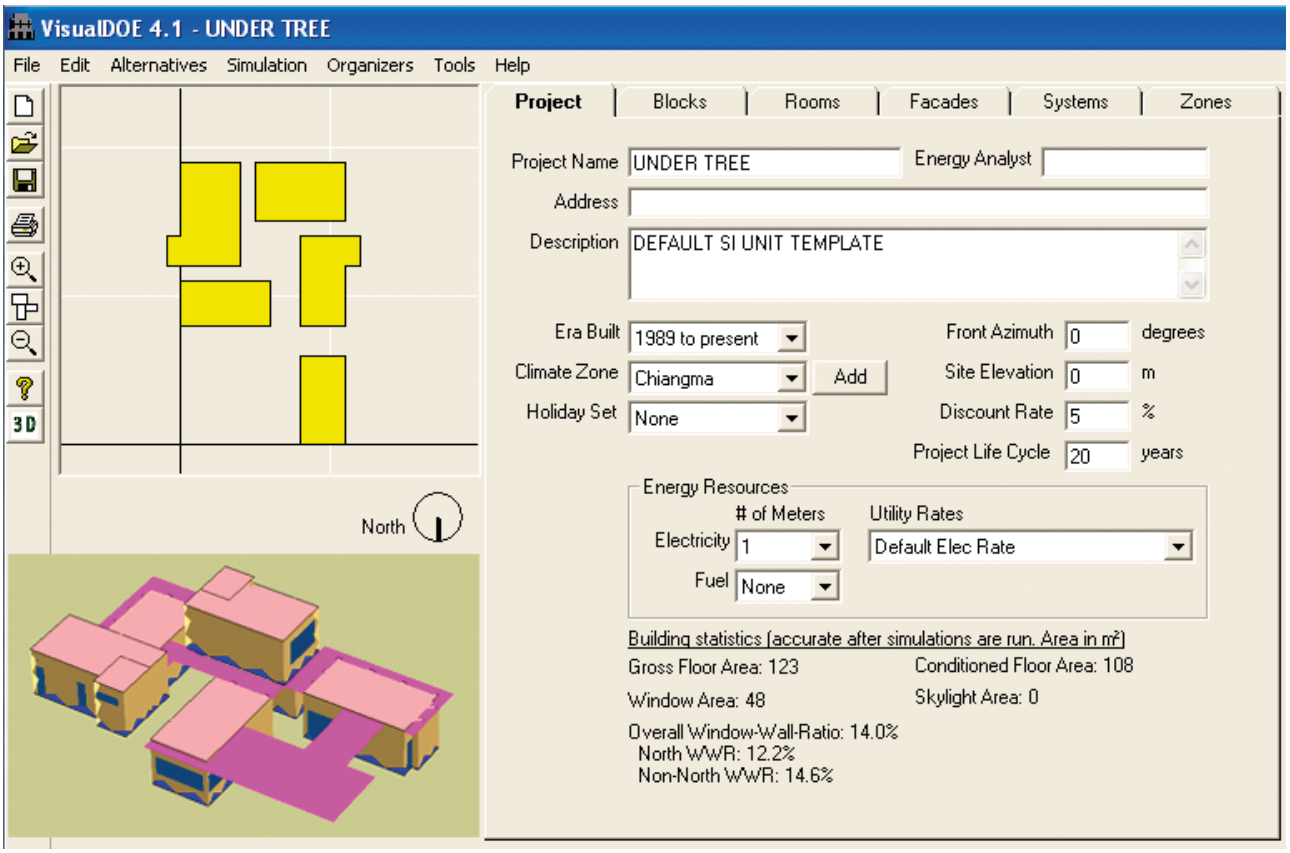


Figure 4: Computational energy simulation for 'Under Tree' house using DOE 2.1E
Source: Development of construction and detail drawings of low carbon house and row house project

indication of total energy used in construction material production, building construction and operation. This value can be used for comparison purposes.

2) Emissions per person (TonsCO_2eq/person) provides estimate of building occupant density as related to total GHG emissions. House sizes can thus be compared to estimate GHG emissions compared with the designed occupancy.

3) Compare the results with *'standard house'* from similar research focusing on emission from homes generally available in Thailand's market and extrapolation to calculate a total life GHG emission per capital for Thailand (Sreshthaputra, 2011).

Conclusion

Total life embodied and operational GHG emissions for the three winning designs were found to be lower than those for comparable '*standard*' house designs. Moreover, it is clear that building design and material selection both contribute significantly to embodied GHG emissions. Therefore, it is important to select building materials which have low embodied GHG emissions.

Table 1: Construction materials and calculation of embodied energy for 'Under Tree' house

Material	Amount Unit	Weight kg/Unit	Embodied Energy MJ/kg	Embodied GHG $kgCO_2eq$
Concrete	93.89 m^3	2,400.00	0.75	27,283.85
Steel bar RB6	3,918.64 m	0.22	17.40	2,421.76
Steel bar DB12	6,442.80 m	2.47	17.40	44,703.75
Light weight concrete	20.02 m^3	750.00	3.50	8,484.57
Mortar	10.68 m^3	2,403.00	0.82	3,396.78
Gypsum board	153.24 m^2	6.25	1.80	278.32
Steel frame	191.55 m	5.00	21.50	3,324.40
Laminated flooring	0.90 m^3	900.00	11.00	1,435.91
Ceramic tile	16.42 m^2	1.93	12.00	61.40
Wooden floor	54.93 m^2	14.00	10.00	1,241.56
Steel beam 150x50x20	42.70 m	26.00	21.50	3,853.57
Steel joist 125x50x20	146.10 m	23.60	21.50	11,968.06
Stainless	0.11 m^3	7,850.00	56.70	8,169.19
Steel rail	369.30 m	21.00	21.50	26,919.37
Aluminium window frame	275.65 m	0.16	214.00	1,542.80
Glass pane	36.39 m^2	14.60	15.00	1,286.62
Wooden door frame	0.11 m^3	510.00	10.00	86.45
Wooden door	12.29 m^2	408.00	10.00	8,092.05
Total Embodied GHG				154,550.41

*** Remarks:** 1 MJ = 0.28 kWh; 1 kWh = 0.5812 $kqCO_2eq$

Source: Development of construction and detail drawings of low carbon house and row house project

Clearly, energy-efficient building design can also decrease GHG emissions. Energy use for space cooling was found to be the most critical factor; space cooling requirement should therefore be minimized by design to lower operational GHG emissions. Efficient space use can also play an important role in substantially reducing total GHG emissions per person, and per unit area.

Figure 5 shows the operational GHG emissions of the three winning designs, compared to the standard design. It can be seen that the winning designs, which made extensive use of natural resources (or passive design), can reduce operational GHG by more than 50% compared with the standard house, which generally uses air conditioning (so-called active design). Choosing natural materials can boost the ratio of embodied GHG to total Life GHG, due to the reduction in operational GHG emissions.

However, the ratio of embodied GHG to total life GHG may be insufficient to support a claim that any building has a low operational GHG emission, may have high embodied GHG emission as a result of construction material selection. Therefore, it is crucial to take both components into consideration, by selecting construction materials which have a low embodied GHG emission and nevertheless can help saving energy, to ensure that the buildings will have low GHG emission throughout their life cycles.

Table 2: Comparison of winning designs with 'standard' house

	Unit	Baan-baan (1-storey)	Under Tree (2-storey)	Vertigo (row house)	Standard house
Building area	m^2	90.00	123.00	225.00	230.00
Occupant number	person	4.00	4.00	4.00	4.00
Occupant density	m^2/person	22.50	30.75	56.25	57.50
Construction					
Embodied GHG	$TonCO_{2e}q$	47.60	154.55	492.18	278.00
Embodied GHG per person	$TonCO_2eq$/ person	11.90	38.64	123.05	69.50
Embodied GHG per area	$TonCO_2eq/m^2$	0.53	1.26	2.19	1.21
Building life					
Operational GHG	$TonCO_2eq$	39.82	46.34	141.76	312.80
Operational GHGper area-year	$TonCO_2eq/m^2$-yr	0.015	0.013	0.021	0.045
Total					
Total Life GHG	$TonCO_2eq$	87.43	200.89	633.95	590.80
Embodied tototal life GHG	%	54%	77%	78%	47%
Total Life GHG per area	$TonCO_2eq/m^2$	0.97	1.63	2.83	2.57
Total Life GHG per person	$TonCO_2$/person	21.86	50.22	158.49	147.70

Source: Development of construction and detail drawings of low carbon house and row house project

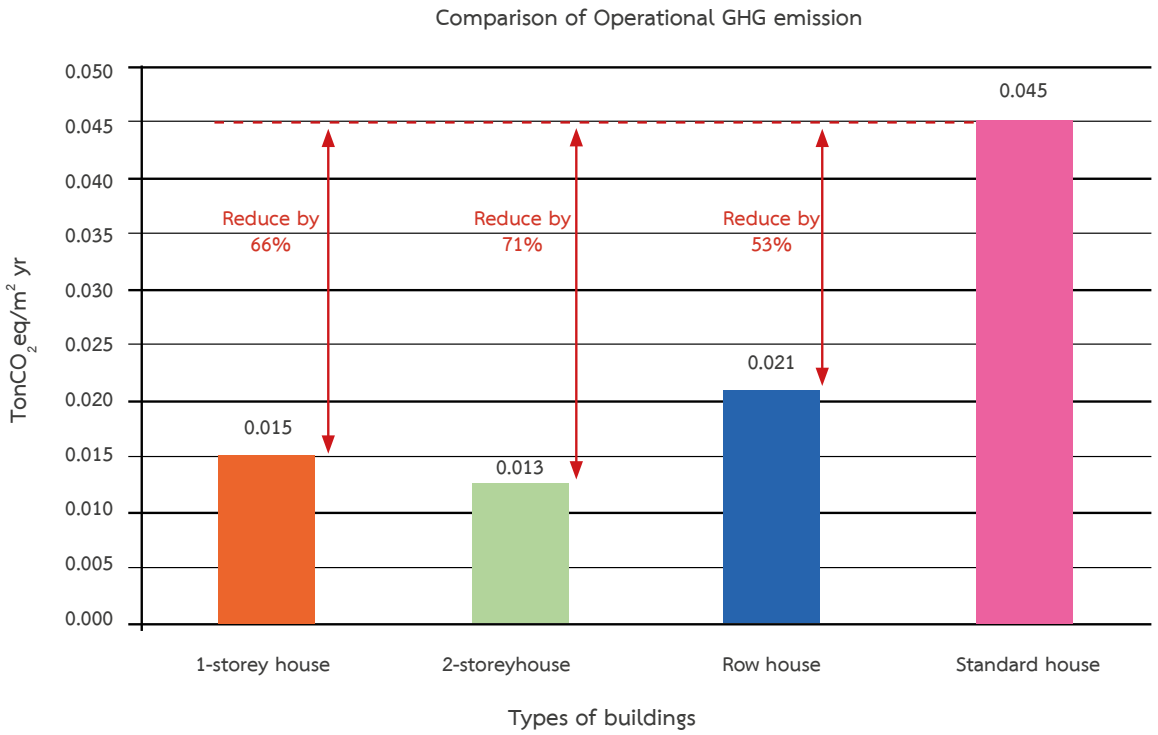


Figure 5: Comparison of Operational GHG Emission in $TonCO_2eq/m^2$ yr

Source: Development of construction and detail drawings of low carbon house and row house project

Acknowledgements

This article is part of the research project *"Development of construction and detail drawings of low carbon house and row house"* funded by the Thailand Greenhouse Gas Management Organization (Public Organization)

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ARTICLE

Design for the Construction of Regional Administrative Court Office

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Introduction

Thailand's network of Administrative Courts around the country serves an important mission as part of the judicial system, in ensuring access to justice for legal issues involving state organization. In order to modernize systems, improve administration and enhance the working environment for Court officers, the Administrative Court implemented a construction plan to renovate 8 regional administrative court offices-in Khon Kaen, Petchaburi, Phuket, Suphanburi, Nakhon Sawan, Pitsanulok, Udonthani and Yala. Chula Unisearch was selected to provide consultancy services, facilitate research studies and provide advice on architectural aspects.

For the three new constructions at the Petchaburi Administrative Court Office, and the Administrative Courts at Khon Kaen and Phuket, the architectural design aimed to preserve the existing exterior architecture as far as possible.

Architectural design concept

The design concepts for the three regional Administrative Courts aimed to communicate an open, people-friendly and environment-friendly message. With the buildings standing in the midst of a natural environment, trees and plants were added and organized in order to allow people and its officers to perceive the sense of nature which would improve their quality of life. Meanwhile, effects on the environment were taken into consideration for the landscape architecture design, from conceptual overview to detailed design (e.g., exterior and interior garden design, selection of materials, selection of plants, selection of electrical systems focusing on energy saving, etc.)

In addition, the designs incorporated aesthetic improvements to the surrounding areas, using the front spaces as an open zone including roads, footpaths, and open green spaces. This aimed to improve the visual amenity for passers-by and provide some green activity space for recreational purposes.

Development of energy-saving buildings (Green buildings)

Green building design aims to reduce energy use and greenhouse gas emissions from both the construction process and operation of the competed building. Eco-friendly materials were selected to minimize energy requirements, and management of wastewater and solid wastes was designed to meet *'Green Building'* criteria. Technological advances in energy saving and environmental improvement were employed, both inside and outside the buildings. Adopting such technological innovation allowed greater flexibility in developing strategies and effective resource management methods to reduce energy use and improve the quality of life for those using the buildings.

Conceptual design, for building structure

The building structures were designed using reinforced concrete as the primary construction materials. Concrete was laid at the construction site and reinforced concrete was used to build foundations, depending on local ground characteristics. The details are as follows:

• **Foundation**: In soil types with strong horizons, with an allowable bearing capacity of 10 tons/m^2, only shallow foundations were required. Where soil horizons were less strong, a 40x40 square reinforced concreted column was used to provide a more substantial foundation. The length and the allowable bearing capacity were determined appropriately according to drilling data for each construction site.

• **Car park construction**: the floor of the car park was laid with ferro-concrete, 15-20 centimeters think, and reinforced-concreted ground beams and columns were used for the construction.

• **Construction of floors 1-3 and the rooftop:** construction was designed using flat reinforced concrete slabs with a thickness of 22-28 centimeters, band beams, reinforced concrete.

• **Elevator walls, bearing walls, cisterns, and others**: reinforced-concrete of 20-25 centimeters thickness was used for the elevator walls, bearing walls, and cisterns. The stairs were constructed from reinforced-concrete supported by beams.

Figure 1: Construction area, Petchaburi Administrative Court
Source: Phoonsak Pheinsusom et al. (2012)

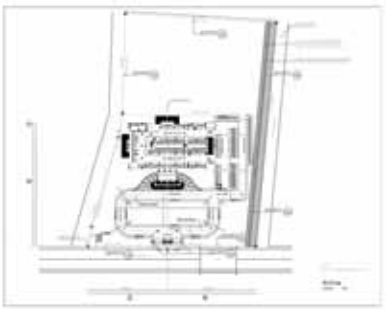

Figure 2: Basic layout, Petchaburi Administrative Court
Source: Phoonsak Pheinsusom et al. (2012)

Figure 3: Construction area, Phuket Administrative Court
Source: Phoonsak Pheinsusom et al. (2012)

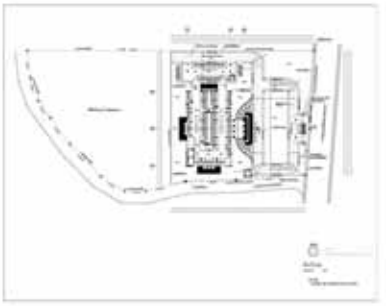

Figure 4: Basic layout, Phuket Administrative Court
Source: Phoonsak Pheinsusom et al. (2012)

Figure 5: Construction area, Khon Kaen Administrative Court
Source: Phoonsak Pheinsusom et al. (2012)

Figure 6: Basic layout, Khon Kaen Administrative Court
Source: Phoonsak Pheinsusom et al. (2012)

Construction area

The construction areas are located on Crown property granted by the Treasury Department; all are flat and located in the suburbs, with no residency allowed. Surveys showed that there were no rivers or waterways near the construction areas of Petchaburi Administrative Court or Phuket Administrative Court (Figures 1 and 3), while at Khon Kaen Administrative Court, a natural water resource was located in the vicinity (Figure 5). No historic sites or schools were located near the three new construction areas; therefore, environmental measures were not required for the construction. As the ground level was generally lower than roads on the construction site; infill was necessary to raise the ground level to the level of the roads. In addition, the level of the building's ground floor was raised above road level.

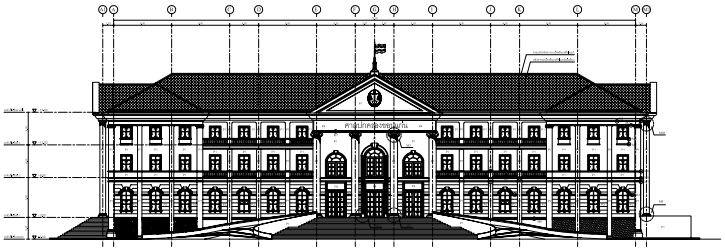

Figure 7: front of the building
Source: Phoonsak Pheinsusom et al. (2012)

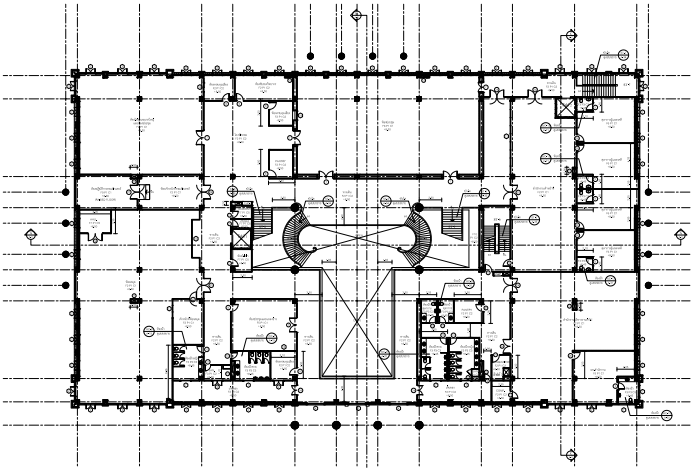

Figure 8: layout of the 2nd floor
Source: Phoonsak Pheinsusom et al. (2012)

Renovation and construction design plans

According to the architectural concept and structural engineering designs to meet the criteria for *'Green Buildings'*, the renovation and construction design plans for the 3 regional Administrative Courts (Figures 7 and 8) are summarized as follows:

1. Upgrade 2.50 meters of the 1st floor level to allow space for a car park;
2. Expand 4.00 meters of the areas to the left and right of the building, and modify the terrace on the 2nd and 3rd floors to allow more space;
3. Modify the area on the 2nd and 3rd floor to create an open space, and add a skylight space on the rooftop.
4. Construct additional doors and windows in the front of the building from the 1st to the 3rd floors to increase light and space in the lobby area.

These modifications were designed to improve convenience in accessing services at the Administrative Courts buildings.

Acknowledgement

This article is part of the research project "*Consultancy for engineering and architecture: Project Design for the 3 constructions of Regional Administrative Court Offices (Khon Kaen Administrative Court, Petchaburi Administrative Court, and Phuket Administrative Court)*", funded by the Administrative Court Office.

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Assoc. Prof.

Trend,

of Architecture

architectinperson.wordpress.com

Cdr. Traiwat Viryasiri

Style, and Concept

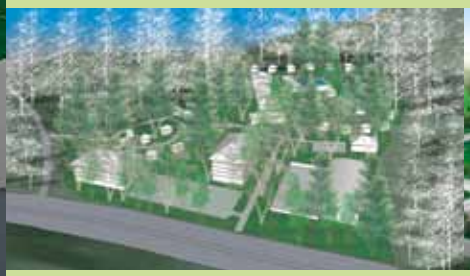
and Research in the Future

Assoc. Prof. Cdr. Traiwat Viryasiri is an architect and instructor at the Department of Architecture, Faculty of Architecture, Chulalongkorn University. His credentials extended from various federal to private projects including serving as an architect at the Design Division; Civil Engineering Battalion, Sattahip Naval Base; Public Work Department; Royal Thai Navy; and as a Committee Member of the Architect Council of Thailand (ACT). Prof. Traiwat also has extensive and proven track records in terms of both academic research and architectural design. Some examples of his major accomplishments included the projects such as the Geriatrics Center and Hospital, Bang KhunThian District; the new offices of Metropolitan Electricity Authority in Khlong Toei District; the new office at Bureau of Budget on Phahonyothin Road; and the PTT Group's Community Learning Center in Rayong; as well as the Standard Stadium and Arena project by the Sports Authority of Thailand. With such remarkable and diverse experiences, Prof. Traiwat offered various insights into the future trends of Thai architecture and design.

Architectural Design Concept: Past-Present-Future

"...design works have to keep pace with and take into consideration the latest technologies that could be applied and helped into modernizing the design in order to meet its intended purposes; and at the same time, remain versatile enough to future changes or modifications if needed..."

Historically speaking, when building any architecture, there had always been two primary concerns leading the idea i.e. functioning and ease of construction whereby keeping the minimum use of machinery. Buildings were simply not tall. However, with forthcoming a factor of land scarcity, it has subsequently influencing the structure rapidly.



We now tend to see larger, more complex structures which required a multi-disciplinary approach in order to ensure its efficient use of land while looking elegant and aesthetic. Furthermore, it has now been accepted to take into account other factors such as those concerning convenience, users' health, and environment impact alongside its main functioning purpose.

In addition, advance of technology and innovation in material science means that buildings are no longer required to follow the same rectilinear form. Today's architects enjoy far greater freedom to use their imagination to create unique and spectacular designs - *"distorted"* buildings, non-horizontal axis buildings, non-square buildings, triangular buildings, and cylindrical-shaped buildings. Apart from the need of all such designs to comply with increasingly stringent building control regulations, design concepts will continue to be predominantly influenced by the construction budget, environmental concerns, traffic congestion, resource limitations, energy prices and ensuring resilience to natural disasters.

Trends in Thai design

"...development of design depends on the project size, type, and budget. The greater limit of the budget, the more difficult it is to make design meet its desirable quality and efficiency..."

Thailand has achieved many large construction projects with floor areas over 10,000 square meters, and tall buildings higher than 23 meters or 8 stories. Eventhough the department of

building design in Thailand cannot be compared with other countries such as China or Singapore, a transformation has nevertheless taken place in many of the Thai commercial and public architectures, particularly with iconic projects designed to global standards, and with explosion of individual interests in architecture as a discipline or profession. Thailand has seen a massive growth in the numbers of unique architectures in school, both state- and private-owned, to serve a rapidly expanding market that increasingly reflected global trends in return.

Meanwhile, major new factors influence on design including efficient use of energy and resources, environmental impact/carbon footprint, resilience to earthquakes and other natural



disasters, as well as quality of life for building occupants and visitors. Today's architects and engineers must prioritize these factors in order to comply with other recognized international benchmarks such the Leadership in Energy and Environmental Design (LEED) standards as an example. National laws have also enshrined some of these principles, enforcing for instance, environmental impact assessment (EIA) for large projects. The Thai Green Building Institute's energy conservation programme has been incorporated into Bangkok's city planning regulations.

Research and design

"...when educational institutes have the opportunity to conduct research and provide educational services for other organizations, this offers an opportunity to fast-track the application of cross-disciplinary research to new challenges inarchitectural design..."

In the past, architectural research has been constrained by low ceilings of professional fees for architects and engineers in Thailand. The government enforces standard service fees for design and construction supervision, which are among the lowest in the world. Such restrictions discouraged and served as a distincentivized investments in R&D in the sector, e.g. in improvement of materials or techniques.Therefore, research expertise tends to be concentrated in the older universities where they have in time become lesser application to the real world. A rare instance is the inspired work of Prof. Soontorn Boonyatikarn, Ph.D, who has been recognized at an international level. As a direct result, Thai architects are aware of his recent advance in energy-related research, which is most frequently applied and incorporated into construction designs.

Other realm of research finds more limited applications, for examples in the areas of design management, design process development, building control regulations, building safety

inspection, legal development, architectural and community history research, architectural and community conservation, and facility management. However, universities are frequently requested by industry to undertake feasibility studies for building construction projects, due to their cross-disciplinary expertise.

Competitiveness of Thai Architects, Engineers, and Designers in the Global Markets

"...for Thai architects and engineers to compete successfully in a global market, they will need much more research and development supports from the government and the private sector..."

In December 2015, the ASEAN Economic Community (AEC) will come into an establishment, resulting in a greater mobility of trades and services among member states. Design and construction are among the first professional groups to be granted freedom of operation in all member countries under the Mutual Recognition Arrangement (MRA) signed by all. The arrangement will create a new opportunity for architectural design and engineering across the region, and is expected to boost investment in industrial production, construction, tourism, real estate, economic development, city and inter-city transportation expansion.

Thailand is known for its strength in architectural and engineering design, and its long track records in producing internationally recognized architects and designers. With wide choices of top-class service providers in the field, competition is fierce and ultimately benefits clients in terms of quality and price. Bangkok has provided an ideal stage for Thai architects to showcase their abilities to a global audience, and it is clear that Thailand's architectural and design community is well positioned to compete effectively in the regional market of the AEC.

However, this competitiveness is to some extent constrained by their lower service fees for Thai architects and engineers. This in turn constrains investment in research and development, limiting their potential to develop from a minor subordinate role e.g. subcontractor, to a leading prestigious global project leader.

The sector therefore needs a significant boost in R&D to ensure that Thai architects and engineers become more competitive in the global arena. If we are to unlock Thailand's creativity and leadership in this field, we need public and private sector support in terms of financial backing, development capital, and greater international exposure through collaboration with overseas designers.

Assoc. Prof. Cdr. Traiwat Viryasiri

Graduated with a Bachelor of Architecture and Master of Architecture from Chulalongkorn University

Work experience/ profile:

- Qualified architect in architecture (EIT. 361)
- Architect at Design Division, Civil Engineering Battalion, Sattahip Naval Base and the Public Work Department of the Royal Thai Navy
- Committee Member of the Architects Council of Thailand for controlling the license for architectural practice, Ministry of Interior
- Committee Member and Public Relations Officer of the Architects Council of Thailand
- Subcommittee for Architectural Service Free Trade, the Architects Council of Thailand
- Chair of Subcommittee for Examination of Building Inspector according to Building Control Law, the Architects Council of Thailand
- Member and Secretary of Subcommittee for Legal Affairs, the Architects Council of Thailand
- Assistant to the President of Chulalongkorn University (for Physical Resources Management)

"Around Us"

Design and Solutions

Assoc. Prof. Thavivongse Sriburi, Ph.D.

When we think of the word *"design"*, we might come up with different ideas depending upon our exposure to the field of design, or other disciplines. Scholars have defined *"design"* in diverse ways, according to their own professions. For example, architects or engineers might see *"design"* as a structure ready to be utilized, while artists might see *"design"* very differently, as a combination of artistic elements ready to be appreciated.

Some examples of such definitions of *"design"* are provided below:

1. Design is an innovation or adaptation and improvement of existing materials, a different form of an object with increased utility, created with well-organized plans: selecting the materials, creating the structure with appropriate methods while striking a balance between utility and aesthetic appeal.
2. Design is an innovation without copying in order to fulfill human needs.
3. Design is an innovation in either 2 or 3 dimensions, aimed to convey beauty, draw interest, and be utilized in certain circumstances
4. Design is a solution to a problem using artistic techniques in order to create a product of utility and beauty.

Design can be classified into ten broad categories, depending on product:

1. Structural Design is undertaken by architects and engineers to provide the basis for safe and cost-effective construction of buildings and infrastructure. Structural design requires quality and three-dimension design. Furniture, setting, and stage designs are also included in this category.

2. Modeling Design is a design used to provide a visualization of a real piece of work, and may be created to be smaller or bigger than the original or final real product. The purpose of modeling design is to study the details of particular objects such as houses, cities, machines, vehicles and robots. These models can be created using a new or existing design, and may be functional or non-functional; examples include models of monuments, coins, models of the globe, topographic models, machinery, etc.

3. Decorative Design aims to serve consumer needs such as in home and garden decors. As the term suggests, the aim is primarily to add aesthetics to functional items. Decorative design includes both interior and exterior design.

4. Product Design refers to the design of mass-produced consumer goods, striking a balance between utility and aesthetics of products such as furniture, durable products, sanitary ware, household utensils, jewelry, clothing, packaging and equipment.

5. Symbols & Signs refers to design that conveys

for Environmental Issues

a message and can be interpreted and understood without requiring language. Examples include traffic lights and road signs. The symbols used in such designs typically provide warnings or guidance to avoid danger (traffic, warning signs on equipment or machinery, symbols on electronic devices, symbols on products and utensils, etc.).

Signs are similar to symbols, and also aim to inform. Though they are perceived similarly, signs differ from symbols. For example, nations use a flag as a sign; organizations use logos as a sign. Product trademarks are also considered as business signs.

6. Creative Design aims to convey beauty and satisfaction. Creative new ideas inspire and arouse interest and excitement. Creative design can be applied using existing materials in an innovative way, or newly invented. The five categories of creative design are differentiated as follows:

- *Painting* - including drawing, painting using oils or watercolors, charcoal, pencil or dyes, in order to express certain moods, messages and feelings in 2 dimensions.
- *Sculpture* - a piece of art that combines molding, carving, and connecting in 3 dimensions: width, length, and thickness.
- *Printmaking* - a piece of art created with printing processes and techniques. Examples include woodblock printing, metal printing, rock printing and other types of printing.
- *Mixed media* - a piece of art that combines

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various types of materials such as paper, wood, metal, plastic, steel, etc. in innovative ways.

- *Photography* - with advanced technology and minimal cost nowadays, it is easy for photographers to create a piece of work.

7. Printing Design a design created for printed matter such as books, covers, newspapers, posters, name cards, wishing cards, brochures, leaflets, fabric patterns, symbols, trademarks, logos, etc.

8. Advertisement Design a design aiming purely to persuade and sell products, brands, services, and ideas. Advertisement plays a ubiquitous role in our everyday life and in business since it is considered a driving force that encourages consumption and helps people to meet their needs. People may compare products and services based on advertisements, and advertisement is a powerful influencer of consumer decision-making.

9. Commercial Design requires artistic skills to convey the beauty of a product. It aims to catch the viewer's attention and emphasizes the beauty rather than the utility of the product. Commercial design typically target fashions that change with current trends.

10. Art Design Artificial emphasizes elaborate detail in a work in order to please the eye, rather than expressing moods or feelings. Such details might include creative decoration or delicate pattern work. Common examples include vegetable arrangements in Thai food, jasmine wreaths, sewing, decorating, etc.

For the future, Architecture Design is expected to assume increasing prominence, given the growing relevance of energy cost and other environmental issues including climate change as drivers of design. Consideration must now be given, by architects at the design stage, to energy saving, energy and environmental performance in new constructions. Even though most of us have heard the term *'Green Building'*, the meaning is often misunderstood. Scholars have defined the term *"Green Building"* in various ways, as follows:

- energy efficient building
- energy saving and eco-friendly building
- green building
- sustainable building.

Green buildings exhibit the following characteristics:

- reduce effects on the environment during construction and throughout its useful life
- save energy
- save water
- make efficient use of resources
- focus on the health and well-being of people in the building.

In order to build a Green Building, assessments are required to ensure that the design meets the *'Green Building in Thailand'* standard. Architects and engineers must coordinate and work together to maximize energy savings in all aspects. Criteria set jointly between the Thai Engineer Club and Thai Architect Club areas follows:

- Stability criterion in terms of energy and environment for construction and adaptation of buildings by Thai Green Building Institute (TGBI)
- TREES – NC Version 1.0 (Thailand Rating of Energy and Environmental Sustainability for New Construction and Major Renovation).

Meanwhile, the United States has set criteria for the Green Buildings standard known as LEED (Leadership in Energy and Environmental Design), which has been widely adopted in many countries.

The standard was developed by the United States Green Building Council (USGBC), established in 1993, to bring together the construction and design industries to promote Green buildings. LEED has been applied for 30 years since then, and has been continuously developed to meet new standards and requirements.

Green buildings are required to exhibit the following characteristics:

- reduce reliance on non-renewable energy sources such as gasoline
- reduce effects on environment such as water, air, and soil
- reduce use of natural resources
- reduce garbage output.

In addition to these direct benefits, there are many more indirect benefits from adoption. For example, people living in Green buildings enjoy better health conditions and are more comfortable as a result of improved air quality. Electricity and water costs are reduced, while rental rates and market demand are boosted due to the building's higher quality. Certified buildings are also eligible for government support in the form of lower property taxes.

The increasing importance of environmental issues, especially as affected by climate change, means everyone needs to be aware of measures that can be implemented at the design stage to reduce the environmental footprint of buildings as well as improve the working environment and health of the occupants. Without doubt, green design is crucial for our future.

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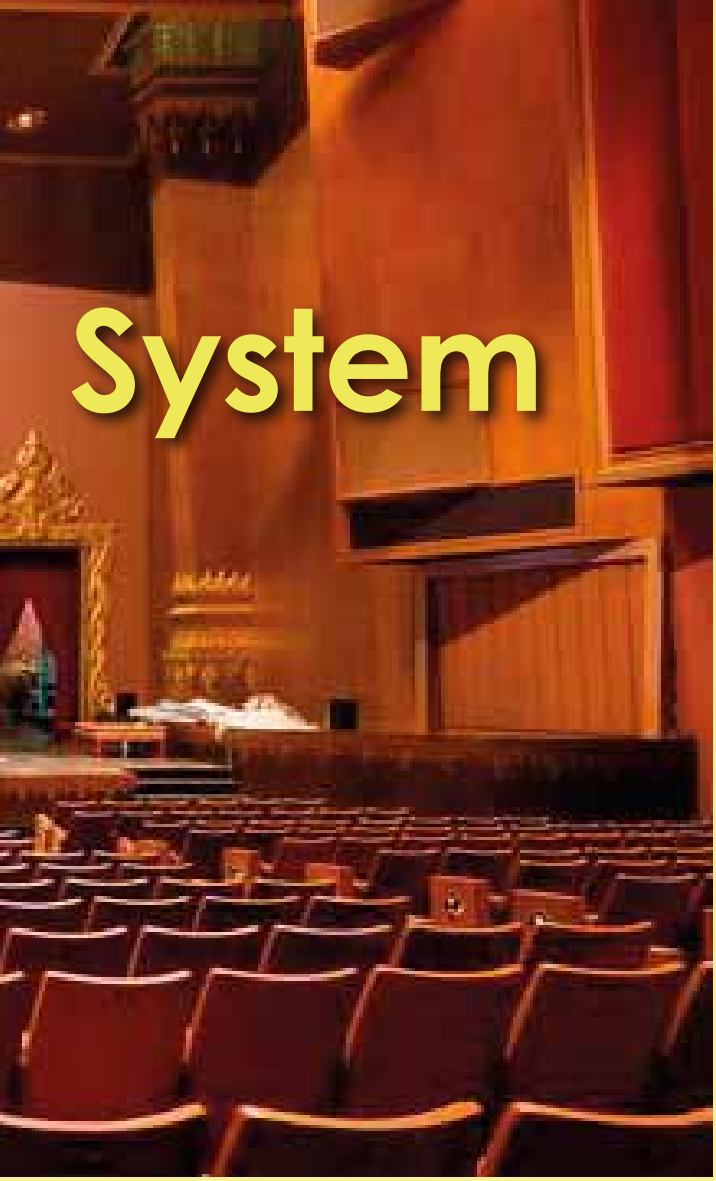
PROJECT

The Study and Design for the National Theater

Bangkok's National Museum, National Theater, and College of Dramatic Arts are affiliated to the Fine Arts Department, Ministry of Culture and located in the area of Baworasathanmongkol Palace known as the Front Palace. This unique area is filled with historical significance that links ancient traditions and ways of life of Thai people from past to present. Recognizing the importance of conserving and developing a site of such historical and architectural significance, the Fine Arts Department appointed **Chula Unisearch** to conduct a study and design the National Theater system in terms of activities and area development.

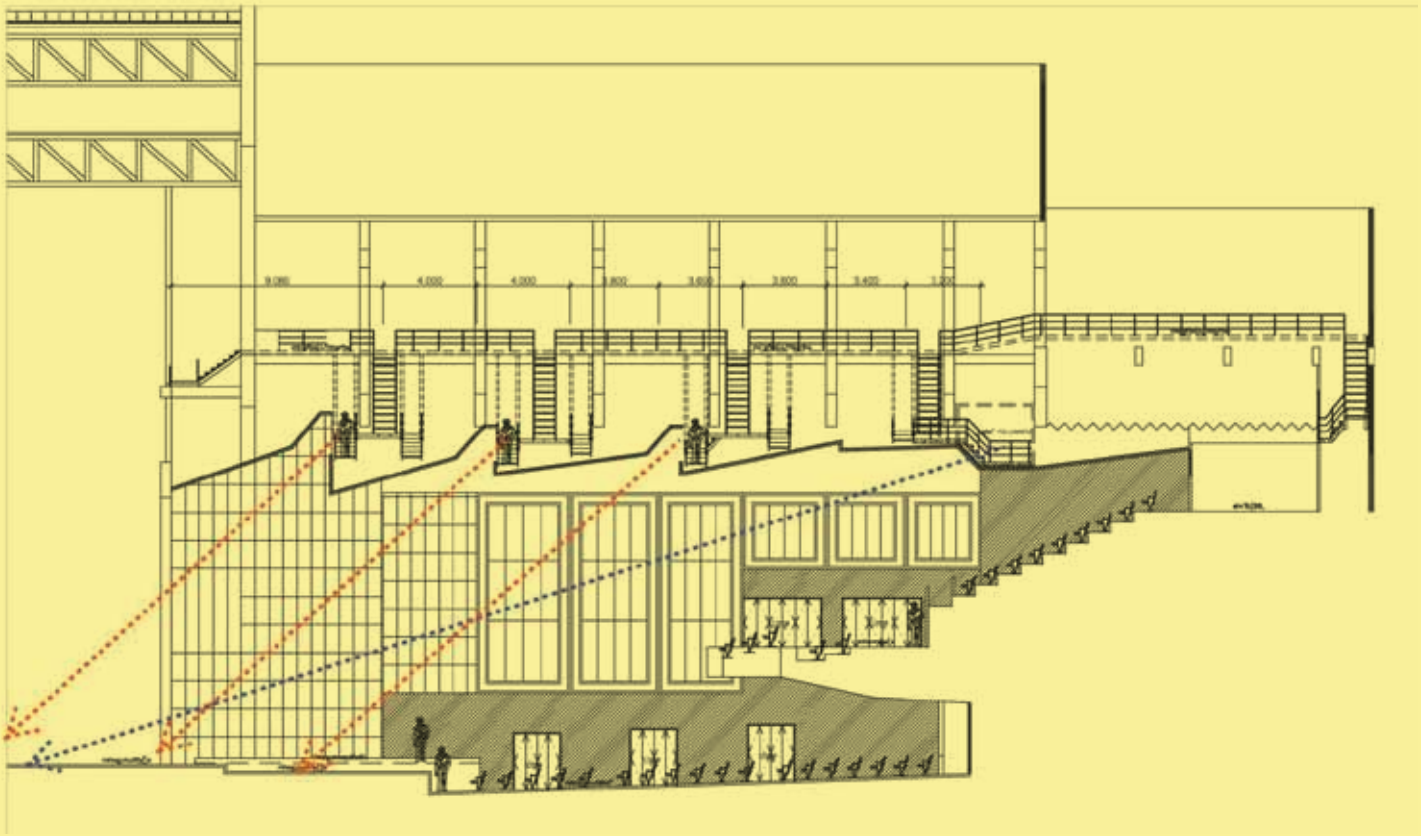
The Fine Arts Department conducted a study and created a design for the national theater system as part of the Baworasathanmongkol Palace (Front Palace) conservation and development project, launched to celebrate His Royal Highness Crown Prince Maha Vajiralongkorn's 60th Anniversary in 2012. The project aims to preserve and develop the National Theater as a key historic site of Rattanakosin. In addition, the National Theater itself plays an important role in preserving Thai traditions and culture and passing them on to the next generation and the world. The Fine Arts Department aims to develop the potential of the National Theater in all its aspects as part of its role in preserving, educating and sharing Thailand's cultural heritage in terms of music, art and dance, as well as preparing for Thailand's entry into the Asean Economics Community (AEC).



System

The study and design of the National Theater system focused on rehearsal rooms, sound equipment, lighting equipment, and machinery. The stage was designed to accommodate musical performances with a state-of-the art acoustic design and modern technology. Following renovation, an evaluation was conducted to assess the technology and efficiency of all systems in providing a world-standard venue to facilitate and showcase the performances of musicians and artists.

Subsequently, the project proposed a concept for optimizing use of space in the National Theater, to establish an exhibition area and performance support area, and audience seating. The design also provided for rehearsal and backstage areas and spaces for mechanical props, the stage-lighting, general lighting, sound and graphic systems. In addition, the project proposed a conceptual design for renovation of some parts of the theater, developed an acoustic model and architectural characteristics for the building, and drafted the construction and verification plans. Finally, the project offered additional recommendations to boost the National Theater's role in preserving, sharing and celebrating the nation's cultural heritage on a regional and global scale.



"Cluster OTOP" Opening Ceremony

The Department of Industrial Promotion, in collaboration with the Department of Creative Arts, Faculty of Fine and Applied Arts, Chulalongkorn University and **Chula Unisearch**, together hosted an opening ceremony for *"Development and Integration of Cluster OTOP Merchants in the Northeastern region and Talent Fashion 2014 Clustering I-San textile crafts and marketing"* on Monday, 15 September 2014, at Siam Square One.

On this occasion, Atchaka Sribunruang, Ph.D., Director General of the Department of Industrial Promotion, presided over the ceremony with Mrs. Sirirat Chitseree, Deputy Director-General, Department of Industrial Promotion, Mrs. Clair Camdessus, Country Director, Ubrifance Thailand and Myanmar, Prof. Tharapong Vitidsant, Ph.D., Vice President of Chulalongkorn University, along with Assoc. Prof. Supakorn Dithapan, Ph.D., Dean, and Asst. Prof. Patcha Uthitwannakool, Deputy Dean, in attendance.

This project aims to study and develop OTOP Clusters for textiles and clothing, tailored to the local situation in selected target areas. It also aims to set directions, goals, and strategies in terms of design and product development, as well as stimulate innovation and creativity. These interventions will help make local products unique, and boost the brand image. Both these factors will increase value added and market competitiveness of OTOP products.

Lecture on "Infrastructure Sharing & Local Loops Unbundling"

On Friday, 31 October 2014, **Chula Unisearch** and the Office of the National Broadcasting and Telecommunications Commission (NBTC) held a lecture on *"Infrastructure Sharing & Local Loops Unbundling"* at the NBTC Convention Hall. Mr. Korkij Danchaivichit, Deputy Secretary General of NBTC presided over the opening ceremony. Mr. Masanori Kondo, representing the Ministry of Internal Affairs and Communications, Japan delivered a keynote lecture to a range of senior representatives of stakeholder groups including NBTC officers, private sector telecommunication entrepreneurs and other public sector agencies. The objective of the event was to increase understanding of infrastructure sharing and the benefits and potential of the Local Loop Unbundling service.

"Business Model Canvas" seminar workshop

From 29-30 October 2014, **Chula Unisearch** held a *"Business Model Canvas"* seminar workshop for senior executives from the National Food Institute (NFI), the Ministry of Industry, Thailand, at the Arnoma Hotel, Bangkok. It was a great honor to have Laphasrada Changkaew, Ph.D., special lecturer from the Faculty of Commerce and Accountancy as the speaker. Petch Chinabutr, Ph.D., Director of NFI, attended the diploma granting ceremony.

The *"Business Model Canvas"* course was designed to enhance knowledge in using the Business Model Canvas for creating effective business strategies. The course also aimed to link service information and other strategic tools to the Business Model Canvas in order to further boost organizational effectiveness.

Round table meeting on the topic of "Risks Analysis concerning floods"

On Monday, 29 September 2014, the Environmental Engineering Association of Thailand (EEAT) and **Chula Unisearch** held a round table meeting on the topic of *"Risk Analysis Concerning Floods"* at the meeting room 201, 2nd Floor of Chulalongkorn University Research Building. Praserd Thapaneeyangkool, Ph.D., President of EEAT, presided over the opening ceremony. Assoc. Prof. Thavivongse Sriburi, Ph.D., Managing Director of Chula Unisearch, Charasroj Bothdamrih, Ph.D., former Advisor to the Prime Minister of the Secretariat of the Cabinet, Mr. Simon Van de Sande of DEME Group (Belgium) and Mr. Preeda Jirisithikorn, Managing Director of Global Solution Provider Limited Partnership attended the meeting. The meeting aimed to exchange knowledge and experience in making risk maps of areas vulnerable to floods, in order to develop a city map of Bangkok, improve public utilities, implement safety measures for natural disasters, dig a water path using high-technology materials and install modern canal lining materials using state of the art techniques.

Inside Chula Unisearch

Chula Unisearch is proud to have been certified as complaint with the ISO 9001: 2008 standard.

Based on its mandate to provide broader access to academic services to business and society, Chula Unisearch recognized the importance of developing its own organizational effectiveness by improving its administration system and Chula Unisearch was recently certified complaint with the ISO 9001: 2008 standard in terms of administration and management by Bureau Veritas Certification (Thailand) Ltd.

Looking ahead, Chula Unisearch aims to further improve its academic services by continuously monitoring and reassessing its operations in order to enhance service quality and client satisfaction, in compliance with international standards. Moreover, Chula Unisearch prioritizes continuous professional development among its human resources, in terms of knowledge, skills and proficiency across a diverse range of academic domains

Making Merit for shared prosperity for 2015

On Tuesday, 6 January 2015, Chula Unisearch executives and staff joined in a New Year merit-making ceremony. The ceremony is organized each year by Chulalongkorn University, and takes place at the Mahabodhi Court, in front of Chamchuri Building 4. The occasion augurs well for the prosperity of Chula Unisearch, its executive and staff throughout the coming year.

Wuhan Optics Vally Bei Dou Holding Group visited Chula Unisearch

On Friday, 3 October 2014, Assoc. Prof. Thavivongse Sriburi, Ph.D., Managing Director of Chula Unisearch and Supichai Tangjaitrong, Ph.D., Director of Industry Collaboration Office, Chula Unisearch, welcomed a visit from Mr. Liu Junyi, General Manager of Wuhan Optics Valley Bei Dou Holding Group Co., Ltd., China, together with the company's management team. Following a briefing on the company's operations, opportunities were discussed on joint research into Global Positioning Systems (GPS) and their applications in terms of disaster management, and management of natural resources and public utilities. Chula Unisearch aims to access detailed spatial demographic data and other data from the Bei Dou satellite.

Personnel Seminar on Organizational Development

On 13-14 November 2014, Chula Unisearch held a *"Personnel Seminar on Development of the Organization"* for the 2015 fiscal year, at the Dusit Thani Hua Hin Hotel in Petchaburi. Approximately 70 participants; including board directors and personnel, participated in the seminar. The seminar offered a unique opportunity for participants to discuss and suggest strategies for organizational development, as well as brainstorming to prepare an administrative manual for the organization. Participants also discussed challenges, constraints encountered, and lessons learned in past projects. This enhanced mutual understanding and shared responsibility across the organization, which in turn contributed to more effective administration and organizational performance.

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