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On the comparison of thermal comfort performances in dutch style churches with low ventilation in hot-humid tropical region

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Colonized by the Dutch for a hundred years, Indonesia has many Dutch-style churches in its cities. The uniqueness of the churches is that they have low ventilation in the below part of side-by-side walls to penetrate air movement in buildings. This current research was conducted on two Dutchstyle churches with different heights of low ventilations on their walls. The study aimed to establish correlation modeling between the height of low ventilation and thermal comfort in buildings covering Standard Effective Temperature, Predicted Mean Vote (PMV), and Predicted Percentage Dissatisfied (PPD). The methods used were referred to the ASHRAE Standard 55-2017 and statistically analyzed by using linear regression and Anova of SPSS 24. The measurements were performed at the same three devotional times at similar multiple specified measuring points inside the churches . The results showed that the church with 40 cm height ventilations had 4% higher air velocity than that with 70 cm height ventilations. For PMV, the church with 40 cm height low ventilation has a 'neutral' sensation, while the one with 70 cm height low ventilations has 'slightly cool'. The church with 40 cm height low ventilation has 72% PPD lower significantly than the other. © 2020 by authors, all rights reserved.

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On the Comparison of Thermal Comfort Performances in Dutch Style Churches with Low Ventilation in Hot-Humid **Tropical Region**

Augi Sekatia ¹, Erni Setyowati ²,^{*}, Gagoek Hardiman ²

¹ Doctoral Program of Architecture and Urbanism, Universitas Diponegoro, Semarang, 50275, Indonesia

² Department of Architecture, Faculty of Engineering, Universitas Diponegoro, Semarang, 50275, Indonesia

ABSTRACT

Colonized by the Dutch for a hundred years, Indonesia has many Dutch-style churches in its cities. The uniqueness of the churches is that they have low ventilation in the below part of side-by-side walls to penetrate air movement in buildings. This current research was conducted on two Dutch-style churches with different heights of low ventilations on their walls. The study aimed to establish correlation modeling between the height of low ventilation and thermal comfort in buildings covering Standard Effective Temperature, Predicted Mean Vote (PMV), and Predicted Percentage Dissatisfied (PPD). The methods used were referred to the ASHRAE Standard 55-2017 and statistically analyzed by using linear regression and Anova of SPSS 24. The measurements were performed at the same three devotional times at similar multiple specified measuring points inside the churches. The results showed that the church with 40 cm height ventilations had 4%higher air velocity than that with 70 cm height ventilations. For PMV, the church with 40 cm height low ventilation has a 'neutral' sensation, while the one with 70 cm height low ventilations has 'slightly cool'. The church with 40 cm height low ventilation has 72% PPD lower significantly than the other.

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Artificial Intelligence-based Restoration: The Case of Petra

Aspects of Sustainability in the Design Elements of Traditional Jordanian Houses

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Abstract Architecture reflects the lifestyle and the culture of the society. It shows how people are living in a particular community. One perceives the traditional architecture of any region where one can see the simplicity of this architecture and the smart usage of the surrounding environment materials. This study aims to explore traditional architecture in Jordan by studying building sites, space planning of the interior space, and building materials to understand the sustainability factors implemented in the traditional architecture in Jordan. Three traditional houses in the city of Irbid-Jordan were observed and analyzed through the building site, space planning of the interior space, and building materials used. The analysis has shown that many sustainable factors and methods were implemented in the traditional houses in Irbid city. Considering the age of those buildings, the builder did not have an in-depth knowledge of sustainability concepts, and they were working based on their experience and climate knowledge. This study's results can help create an index of sustainability for traditional architectural heritage, which will enhance the process of creating sustainable buildings without losing the place identity and staying in the same cultural context.

Keywords Traditional Architecture, Sustainability, Interior Design, Design Heritage, Design Identity

1. Introduction

The architecture reflects the lifestyle and the culture of

the society. It shows how people are living in a particular community [1]. One perceives the traditional architecture of any region where it can be seen the simplicity of this architecture and the smart usage of the surrounding environment materials. One can notice that traditional architecture is being demolished and abandoned due to many reasons that affect the world's architectural style.

There is no doubt that Architecture is our most significant physical symbol of the community's idea of our confidant way to express the original form of our belief in the conception of common ground. Buildings also stand as evidence of the power of memory, humanity, and community [2].

Architecture is involved in many life sectors in any society. These sectors are like the environment, economics, and technologies. The sector that reflects any civilization's architecture reflects the culture, tradition, and lifestyle of that civilization. The architecture also makes the diversity of architectural styles worldwide because of the differences between society's cultures [3]. We can see any society's architectural style in every space they created, like houses, stores, and sacred spaces.

Traditional architecture may stay closer to our soul than other types of architecture because it has our mentality and our quality of life. While Jordan still preserves its traditional architecture on a medium-scale. This research investigates and gains insights into these traditional houses in Jordan to better understand this type of architecture and its relationship with sustainability.

As the concept of sustainable design and green building is still developing and trending around the globe, it has been clear that green buildings concepts enhance the chance of creating sustainable and more energy-efficient

Methodological Proposal to Develop Adaptive Thermal Comfort Studies Under Lab Controlled Conditions

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Abstract Thermal comfort studies developed with the adaptive approach are cross-sectional and are carried out at different periods, which make them prolonged and dependent on the current weather conditions. Meanwhile, studies under lab controlled conditions have the advantage of simulating in one single day the hygrothermal and wind conditions of a period, and manipulating them with accuracy periodically in compliance with real climatic. Thus, this paper presents a methodological proposal to develop adaptive thermal comfort studies under lab controlled conditions. The methodology is divided into three stages and fourteen activities that detail the methodological procedure to be applied before, during and after each laboratory test. It is proposed as a generic resource adaptable and reproducible to any case study, so it focuses on providing the key elements for an accurate and effective study; the particularities are defined by the objectives of each study case that adopts this methodology. The experimental procedure allows estimating the results that could be obtained from adaptive approach, since the thermal values obtained with both approaches are close to each other. Some advantages of this methodological proposal are: experimental replica; optimization of material, human, technological, temporary and economic resources; methodological reconciliation of the adaptive and predictive approaches; and the adaptive thermal comfort estimation without the influence of outside environmental.

Keywords Thermal Comfort, Controlled Environment Chamber, Adaptive Approach, Predictive Approach, Hybrid Approach, Experimental Methodology

1. Introduction

The thermal environment and its influence on people's health, comfort and daily performance has been studied since the 20th century [1]. While the environmental conditions of certain days stimulate the activity in people, others repress the physical and mental efforts to carry it out; in climatic zones where heat or cold conditions are excessive, the energy consumption required by biological effort is higher to achieve adaptation [2].

The interaction between the human being and his thermal environment has been studied from different disciplines: the Physiology that investigates the biological processes by which heat is produced or lost internally from the human thermoregulation mechanisms, and the Psychology that attends the psychological, emotional and affective perception of thermal environment [3].

In physiological terms, thermal comfort occurs when the human body is in energy balance with the environment [4] and it depends on the human metabolism and physiological process of thermoregulation in response to the environmental factors [5]. A psychological perspective describes thermal comfort as the "(...) condition of mind which expresses satisfaction with the thermal environment" [6], definition that implies a subjective sensation as result of thermoregulation process.

Different authors [7]-[17] have sought with their research to mediate the influence of both connotations,

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 [Abstract] [Full Text] [Full Article - PDF] pp. 1436 - 1450 DOI: 10.13189/cea.2020.080626 Architectural Design Interventions for Sedentary Behaviour among Workers in Office Buildings in Enugu, Nigeria Austine Ezezue, Eziyi Ibem, Chinwuba Odum, Bons Obiadi [Abstract] [Full Text] [Full Article - PDF] pp. 1451 - 1462 DOI: 10.13189/cea.2020.080627 Fire Emergency Safety Preparedness in the College of Leadership Development Studies Building in Covenant University, Ota, Nigeria Sholanke Anthony Babatunde, Ajonye George Oche, Okpanachi Paul [Abstract] [Full Text] [Full Article - PDF] pp. 1463 - 1480 DOI: 10.13189/cea.2020.080628 Empirically Based Rainfall Threshold for Landslides Occurrence in Cameron Highlands, Malaysia Abdul Muaz Abu Mansor Maturidi, Norhidayu Kasim, Kamarudin Abu Taib, Wan Nur Aifa Wan Azahar, Husna Ahmad Tajuddin [Abstract] [Full Text] [Full Article - PDF] pp. 1481 - 1490 DOI: 10.13189/cea.2020.080629
 [Abstract] [Full Text] [Full Article - PDF] pp. 1436 - 1450 DOI: 10.13189/cea.2020.080626 Architectural Design Interventions for Sedentary Behaviour among Workers in Office Buildings in Enugu, Nigeria Austine Ezezue, Eziyi Ibem, Chinwuba Odum, Bons Obiadi [Abstract] [Full Text] [Full Article - PDF] pp. 1451 - 1462 DOI: 10.13189/cea.2020.080627 Fire Emergency Safety Preparedness in the College of Leadership Development Studies Building in Covenant University, Ota, Nigeria Sholanke Anthony Babatunde, Ajonye George Oche, Okpanachi Paul [Abstract] [Full Text] [Full Article - PDF] pp. 1463 - 1480 DOI: 10.13189/cea.2020.080628 Empirically Based Rainfall Threshold for Landslides Occurrence in Cameron Highlands, Malaysia Abdul Muaz Abu Mansor Maturidi, Norhidayu Kasim, Kamarudin Abu Taib, Wan Nur Aifa Wan Azahar, Husna Ahmad Tajuddin [Abstract] [Full Text] [Full Article - PDF] pp. 1481 - 1490 DOI: 10.13189/cea.2020.080629 Triggered Seismicity in Northern Algeria from a Statistical Modeling

A Study of Passive and Active Strategies through Case Studies for the Composite Climate Zone of India

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Abstract There are only 4500 buildings and about 4.17 billion square feet of the area under green buildings till 2016. It is only around 5% of India's total construction, and there is considerable potential for sustainable design in the Indian market. Sustainable building design requires passive and active techniques. It is vital to design a sustainable building that uses passive strategies to its fullest because they are cheaper and more efficient than active strategies. The designer emphasizes active features and neglects passive features to obtain sustainable building ratings in the current context. The whole purpose of sustainable design has been defeated. To achieve a sustainable design in a real sense, passive strategies should be formed in response to the local climate and given primary importance. Active strategies are only bound to complement passive strategies. This study focuses on understanding the passive design strategies for India's composite climate in response to the local climate through case studies of buildings. This paper deals with passive design strategies such as orientation, fenestration, shading devices, earth touch, roof garden, water, landscaping, and active strategies, often include solar panels, solar water heaters and wind towers. The two studies, i.e., the American Institute of Indian Studies and the Solar Energy Center, use the sunken courtyard, orientation, shading devices, water bodies, a verandah inspired by traditional passive features, and another study, the PEDA Complex, use the southern dome structure, shading devices, water bodies as modern passive features. All studies use active

strategies to complement passive strategies. The study concludes that all three case studies use passive strategies as primary ones, either influenced by traditional architecture or modern perception and that active strategies complement passive strategies.

Keywords PEDA Complex, American Institute of Indian Studies, Solar Energy Center, Passive Strategies, Active Strategies, Sustainable Design

1. Introduction

Sustainable development is a multidimensional concept, and the primary objective is to bring the environment and development together. The concept of sustainable development was first discussed in the Stockholm Declaration of 1972, and then in the Brundtland Commission report in 1987. This report became a benchmark for efforts to align economic development and environmental protection. The definition of sustainable development in this report indicate, "Development meets the needs of the present without compromising the ability of the future generations to meet their own needs." [1]

1.1. Sustainable Design in the Indian Context

Sustainable development in architecture refers to three

Empirically Based Rainfall Threshold for Landslides Occurrence in Cameron Highlands, Malaysia

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Abstract High-intensity rainfall has been recognized as the main factor of the landslide events in Cameron Highlands. Locating at an abrupt altitude with high intensity rainfall annually caused many attempts of slope failures in this area. This catastrophe weakens the socio-economy and situates the people of Cameron Highlands in difficulty since they lost their source of income. The application of the early warning system is one of the effective methods to reduce the losses from this unforeseen circumstance. It could be coordinated by developing a dependable rainfall intensity-duration (I-D) threshold for estimating the shallow landslide. By identifying twelve historical landslides in Cameron Highlands, the important variables from the rainfall intensity-duration parameter can be acquired. The proposed empirical rainfall intensity-duration (I-D) threshold for Cameron Highlands has been figured out as $I = 29.09 D^{-0.075}$ (I = rainfall intensity in mm/hr and D = duration in hour). Furthermore, to identify the formulation of I-D threshold from other regions, a comparison has been carried out by identifying the I-D threshold proposed by various researchers, which shows a reasonably higher value for the I-D thresholds of Cameron Highlands. This trend occurs due to the fact that rainwater requires more time to adequately seep into the thicker layer of soil in order to trigger the slope failure.

Keywords Landslide, Rainfall Intensity-Duration Threshold, Rainfall Threshold, Early Warning System, Cameron Highland, Empirical Correlation

1. Introduction

Surrounded by hilly areas and experience a relatively high amounts of rainfall lays Cameron Highlands at a high risk of a landslide [1]. Located at the coordinate of $4^{\circ}31'26.99"$ N $101^{\circ}20'12.00"$ E in the northwest of Pahang, Cameron Highlands cover the area of 728 km² and the elevation of 1829 m above mean sea level. The geological, geomorphology and hydrological factors significantly contribute to the slope failure. Moreover, having a cold weathering condition gives an opportunity to the local people of Cameron Highlands to make benefits from two primary sectors, which are agriculture and tourism. This leads to the rapid development of this area, which increases the land use and contributes to soil erosion and landslide occurrences [2].

This region experiences a huge variation in climate that is likely to trigger the soil slips episode. Situated in Peninsular Malaysia and experiencing hot and humid weather annually due to close proximity to the equator, Cameron Highlands is susceptible to a high amount of rainfall thus causing many landslide incidents to occur throughout the year [1]. Cameron Highlands recorded the highest daily rainfall in Malaysia for almost 278 days in