

# Green tropical design essay



**ASSIGN  
BUSTER**

This paper argues that climatic responsive design could directly be seen as significant architectural language for defining local architecture by research and design. The tropical principle illustrated an accurate prediction of controlling, filtering and responding to outdoor climate. This paper explains two research about traditional house to continuously sustain the fundamental nature that is the language of climatic understanding into contemporary solution. In the green architecture research must be evaluated local principle and purpose new tropical principle.

Also in the green architecture design just be developed, Justify, predicted and evaluated of design alternative with scientific reason. Keywords: Green tropical architecture research. The common debate on traditional and nation architecture is always about projecting local Identity on built form. The architecture solution for achieving Nation identity In contemporary era commonly uses significant of cultural elements and Local artifacts to produce building as symbolic identity.

The attempts are applauded especially against the western borrowed style, but the idea of architecture as befitting to the local climate is in question. This paper argues that climatic responsive design could directly be seen as significant architectural language for defining local architecture. Architecture can be described from various perspectives. The environmentalists see architecture from the environmental and bio-climatic angles.

If one traces the evolution of architecture of a country that include change due to external influence, the architecture is still chiefly manifesting response to climate than the foreign cultural influence. In understanding ‘

local architecture, we can look from both the explicit and the implicit language. The explicit is easily understood as manifestation of shapes, patterns and forms whilst the Implicit Is about the soul, the spatial quality and the enjoyment of the whole architecture. Traditional architecture cleverly appreciate climate which in turn become part of the cultural understanding in creating built form.

The construction technology depicted the available technology at that time but somehow illustrated an accurate prediction of controlling, filtering and responding to outdoor climate. We can put Traditional architecture into a frozen state or place into a protected Inheritance for future generation to appreciate. But what is more important is to continuously sustain the fundamental nature that is the duplicate, copy and blow-up the traditional scale into what we desire. It will not work. Architecture must be translate of some principle design from traditional building to modern building (Table 1).

Table 1 Design Principle of Local Tropical Architecture

Local Tropical Architecture Design Principle	Traditional building	Modern Architecture
use lightweight construction of wood and natural materials (low thermal capacity)	Traditional houses are randomly his ensures that wind velocity in the houses in the latter path of the mind will not be substantially reduced	Roof space in the traditional house are properly ventilated by the provision of ventilation Joints and panels in the roof construction
The use of coconut trees and other tall trees not only provides good shade but also does not block the passage of winds at house level	Large overhangs and the low exposed vertical area (wall, window) provide good shading	Lighting level give the psychological effect of coolness

\*Corresponding Author: Gung Marti  
<https://assignbuster.com/green-tropical-design-essay/>

Negro, Department of Architecture, Faculty of Engineering, University of Breakaway, Mammal, Indonesia. Email: [email protected] O. Id 492 Negro, 2011 Indonesian Traditional House The field study is a Been and Wagon traditional house in Floors Island, NASA Teenager Timer, Indonesia. The wagon traditional architecture is usually located at the foot of mountains (Fig. 1). Mountains have a great effect on the local climate. Through a suitable relation with mountains, architecture has been able to control the effect of climate. Wagon traditional architecture has utilized the effects of mountains and responded to the seasonal climate changes.

Selecting the envelope material of buildings to utilize solar energy has been one of the most important elements in controlling the architectural environment. The wall of Wagon traditional architecture have had a variable and complex function so that the architectural space might have variability and adaptability. The spaces room to room, room to outside, could be easily divided as well as combined into one. This characteristic has made Wagon traditional architecture responsive of climate. As the wall of house are composed of double facade, on the outside made from bamboo trees and on the inside made from wood pairs. In Wow's traditional architecture, a room accommodates everyday life, including sleep.

Figure 1 The Wagon housing at the foot of Mountains Figure 2 Bamboo Wall of a Wagon Traditional House Malaysian Traditional House The field study is a Atman Troika House with overall size of mm length and 5 m width. The wall plate is about 3 m and the ridge plate at the center of the roof is about 4. 2 m high from the floor surface. The Atman Troika House represents a single space room without internal partitions. The house is surrounded by lush

landscaping and lake at the rear of the house and the building envelope component providing shelter from external climatic forces, such as solar radiation, rain and wind. Timber frames are used as roof structure covered with clay tile and timber panel underside of the tiles. The eave of the roof extends about 2.8 m from the external wall thus controls the solar penetration even at low solar angles.

The middle zone is enclosed with 25 mm thick wooden horizontal louver panels and 12 mm thick solid timber walls. The wooden horizontal louver panels cover 80% of the wall area and positioned in all four cardinal orientations. The ventilation gaps between the horizontal louvers are about 25 mm and each panel is about 2.9 m high from floor surface. The design intentions of these horizontal louver panels are to provide cross ventilation while the openings are closed and for night ventilation. The floor is constructed with 25 mm and 150 mm wide wooden stripes. The height between the natural ground and the raised floor of the building differed from 1.4 m to 0.8 m. 493 J. Apple. Environ. Bill. Sic. 2011 Figure 3: A Atman Troika House used for field measurements The effectiveness of these horizontal louvers and the elevated floor in reducing the internal air temperatures needs to be explored before applying them in contemporary architectural design. METHODOLOGY Research Method of Indonesian Traditional House The Wagon traditional house is surrounded by lush landscaping and the longitudinal axis of the house is oriented east-west. The roof component is providing shelter from external climatic forces, such as solar radiation, rain and wind. The eave of the roof extends about 1 m from the external wall thus controls the solar penetration even at low solar angles.

The middle zone is enclosed with 80 mm bamboo horizontal louver panels and 12 mm thick solid timber walls.

The wooden horizontal panels cover 80% of the wall area and positioned in all two cardinal orientations. The design intentions of these horizontal bamboo louver panels are to provide secondary skin for passive heating. The floor is constructed with 25 mm and 150 mm wide bamboo stripes. The height between the natural ground and the raised floor of the building differed from 1 m and 0.8 m. The authors carried out a survey to determine the thermal parameters of a Wagon traditional timber house in Flores Island. The measurements were collected starting from 1 July to 2 July 2010. The instrumentation consisted of sensors with a data logger system.

The sensors were setup to monitor outdoor and indoor climatic conditions. Fig. 4 shows the positions of the instrument installation within and outside the investigated house. B Figure 4: The positions of thermal data logger (O) a is plan and b is section data loggers. The temperatures for both internal and external were recorded at every 60 minutes interval. The data were averaged for every hour to obtain the hourly values. The temperature accuracy of the loggers ranged between 0.1°C to 0.1°C. The positions and the measured variables of the data loggers are described in table 2. The building was occupied during this period. Table 2 The Measurement items and

Method of Indonesian Traditional House Position	Middle of the space	Outdoor
Data Type	Air temperature, humidity and air velocity	Air temperature, humidity and air velocity
Equipment	Litton data logger	Litton data logger

Height 900 mm above the floor 900 mm above the floor 494 Indonesian modern architecture ignores the natural material of building envelope. Therefore, modern architecture has a lower capacity to control its architectural environment arising from change in climate. However, all contemporary wall are different from the traditional wall, which consist of both bamboo and wood wall. A bamboo wall is not used. Therefore, there is less variability and adaptability than in traditional architecture. Research Method of Malaysian Timber Traditional House The authors carried out a survey to determine the thermal parameters of a prototype Indonesian traditional timber house in Universities Ethnology Indonesia, Juror Barr.

The measurements were collected starting from 20 September to 10 October 2007. The instrumentation consisted of sensors with a data logger system. The sensors were setup to monitor outdoor and indoor climatic conditions. Fig. 5 shows the positions of the instrument installation within and outside the investigated house. 0 5 5 5 3, 52 1, 71 2 Figure 5 the positions of thermal data logger (O) a is plan and b is section data loggers and surface temperature data loggers. The temperatures for both internal and external were recorded at every 10 minutes interval. The data were averaged for every hour to obtain the hourly values. The temperature accuracy of the loggers ranged between 0.1°C to 0.2°C.

The positions and the measured variables of the data loggers are described in table 3. The building was not occupied during this period. Table 3 The Measurement items and Method of Malaysian Traditional House Position Middle of the space on the floor surface Middle of the room space Middle of the room space Data Type Equipment Height floor surface temperature

Dickson CAL mm on the floor air temperature & humidity 1. Mm above the floor mm above the floor Outdoor 495 RESULTS AND DISCUSSION Indonesian Traditional House The purpose of this paper is to assess the responsive wall technology for comfortable traditional house in Wagon Traditional House.

The results are analysed by comparing the internal and external temperatures by the wall element. Figures 6 illustrate the results of the internal imperatives obtained at 0.9 m height from the floor level over the period of one temperature over one period a day (24 hours). Figure 6. Comparison of internal-external temperature and relative humidity at 0.9 m height from floor level - 14 to 15 April 2009 at Wagon Traditional House The indoor temperature showed higher value during night time, while lower value during daytime compared to the outdoor temperature. The review of maximum and minimum temperature data on each day indicated that the air temperature vary little between the day and night.

The comparatively smaller temperature differences indicate that building envelope can cool down sufficiently in the day and warm up in the night therefore the responsive wall constructions are recommended. Both relative humidities indicated a higher value compared to outdoor and indoor in the night. During the daytime the indoor relative humidity measured higher temperature than the outdoor. The maximum relative humidity was indicated at 07: ah and 08: ah on respective days. However, the maximum indoor relative humidity was measured at 09: ah on both days. This means the indoor relative humidity measured high over 80% of hours within a day. This indicates that the irradiating temperature from the wall surface not influence on the indoor humidity especially during the daytime.



The use of bamboo as wall element had more effect on reducing the heat transfer from outside to inside during daytime compared to timber pairs. The elevated floor reduced the heat gains from the ground surface to the interior during daytime. However, the stored heat from the floor influenced the indoor air temperature to be higher than the outdoor air temperature during the night time. One of the design problems of recent houses is embodied in the space formation which neglects the environmental conditions [1]. In fact, the reinforced concrete structures reflect the general design approach in terms of the unawareness of material characteristics and the inappropriate solutions of materials in general.

The interactions between the building materials and the climatic constraints are not properly interpreted. Together with correct precautions such as additional insulation materials and necessary constructional decisions, the climatic response of the new materials can be improved in comparison with the current ones. Additionally, the local traditional materials, such as bamboo, can be developed and adapted for today's conditions by considering their sustainable features. Today's modern building materials and techniques are being used in new architectural practices with the eclectic compositional character of past images. The consequent image conveys the ambiguity of the formal expressions.

Series of reinforced concrete arches with different styles and dimensions are commonly observed in the modern built environments of Flores island. The buildings have to be designed according to the nature of the building materials for reflecting the structural honesty. At this point, the role of architecture can be emphasized in terms of providing livable and peaceful

habitats. Proposing new buildings that are in harmony with the existing traditional environment is as important as the rehabilitation of the old fabric. The new buildings or contemporary additions in the historical settings should include cultural values in the new design concept.

This can be achieved by using new technology and materials environments can only be realized by fulfilling current requirements by using today's tools and methods without losing the local original character and spirit. 496

Malaysian Timber Traditional House As illustrated in fig. 7, 30th September and 5th October were selected to analyse the internal and external temperatures. These two days were selected as they indicated the minimum and maximum external temperatures respectively, during the experiment period. The external and internal temperatures illustrate a similar pattern during day and night time. Figure 7: The external and internal temperature profile for the selected days. Similarly, the roof zone (mm height) and middle zone (1.5 m height) of the internal space indicated insignificant temperature difference.

This may be due to the exposed nature with louvers of the external walls of the Atman Troika House. This means that the effect of the wall design for cross ventilation with louvers had influence on the internal temperature to be similar as the external temperature during the day time. Further, the roof does not include any insulation materials. Therefore the heat transfer through the roof element is high. It is important to reflect or re-radiate the heat to outdoors as much as possible before entering to the space inside. Thus, the use of insulation material is inevitable with the roofing material.

Use of dark color reface for roof, wall, louvers and the floor also may have influenced on the high internal temperature.

The external maximum temperatures were recorded as 32. ICC (14: ah) and 33. CHIC (1 5: ah) on 30th September and 5th October respectively. The maximum internal temperatures at 1. 5 m height were recorded as 32. ICC (14: ah-16: 00h) and 34. 1 co (1 5: ah) on respective days. The internal temperature recorded above the comfort range (28. ICC) between on both days. This emphasizes that during daytime Atman Troika House is uncomfortable with louver openings. The minimum external and internal temperatures were indicated t 06: ah on both days. On 30th September, the minimum internal temperature indicated below the comfort limits at 1. 5 m height between 03: ah - 08: ah.

Although, the internal temperature increased above the external temperature during night hours (between 20: ah to 07: ah), the house is under comfort range between 20: ah at night to 09: ah next morning. Thus, uses of louvers are inadequate to control the hot air during daytime although it may control the glare and direct radiation. But during night time the louvers may help to reduce the internal air temperature through stack effect. Hence, the design principles for cross ventilation need to rethink considering the time of day and especially in areas with minimum ventilation. Further, the results emphasis the importance of the use of night ventilation in hot and humid climate.

Modification of tropical opening design had been undertaken on selected climate condition (on 19 September) within same and the different design

configuration due to similar climatic conditions used. However, general and subjective conclusions were formulated. In the field study, the louver of the Atman Troika House is used as a ventilation controller. A combined peeing modification between full opening (100% open), no opening (close) and small louvers (0. Mm) should be employed and tested for same field study design elements (roof, wall, floor). Figure 8 shows the indoor temperature and outdoor temperature of the Atman Troika House with different sizes of opening. Generally, decrease of the opening size will decrease the indoor temperature.

Further, closed opening with good insulation and wall material can make indoor temperature cooler than outdoor temperature 34 33 32 31 Temperature (co) 30 29 28 27 26 25 24 23 22 3 4 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 Time outdoor Field study full opening close opening louvers. 05 Figure 8: Indoor temperature in relation to the opening modification 497 opening size of the Atman Troika House model. Thus, the amount of indoor temperature without opening would be lower than that with full opening. Therefore, to anticipate the heat gain by the user (human body and equipment), the size of the opening should be smaller than Atman Troika House louvers size. Figure 9 shows that the average indoor temperature was achieved for each correspondence of opening modifications and the upper target of neutral temperature (28. C) was achieved during all day except at 11: ooh until 18: ah. 4 3 25 2 1 0-0, 5-1 -3, 5-4 Temperature Differences (co ) 23 78 Field study close opening full opening Figure 9: Temperature differences in relation to the opening modification From Fig. 9, it is clear that when the sun is visible, the temperature reduction is higher

when the opening size is minimal. The results are similar with Rosella [3] and Variant [4]. There is no requirement for much larger opening for the climatic conditions considered. Opening type and size should be chosen in accordance with the building passive cooling (lesser than outdoor temperature) for diurnal building operations.

Small opening are advisable for night operation while for the building day operation, louver opening type should be adopted. The study is paralleled to Variant [4] who examined various types of louver as having significant effect on the indoor comfort level. Further, Rosella [3] also found that smaller opening for weighting construction provided better performance of indoor temperature Indonesian traditional architecture has been based on the vision that it should coexist with nature. Natural phenomena were accepted and used. Therefore, the climate of the seasons and mountainous ground. In contrast, Indonesian anthropometry architecture ignores the natural surroundings and relies solely on contemporary technology, which consumes a great deal of energy.

Consequently, contemporary architecture has lost its ability to control its environment, and its environment is not necessarily better. Therefore, there is need for another direction for architecture. Architecture should coexist with nature. This does not mean that contemporary conveniences should be abandoned, but that they need to coexist with nature. For this purpose, there is a need to make architecture control its environment according to the natural environment. Indonesia traditional architecture and its architectural environment responsive can be applied to contemporary architecture. It is

hoped that this paper will be useful to architects whose aim is to improve the architectural environment.

The aim of the first research is to assess the responsive wall technology for comfortable traditional house in Wagon Traditional House with the actual data on a selected date. The Wagon Traditional House is within the comfort range during night time when the external environment is cooler. During the day time, efficiency of the wall and louver bamboo panels are high in order to reduce the indoor air temperature in the day and to increase air temperature in the night. Louver bamboo panels provide required night ventilation to bring the temperature within comfort range at night. The elevated floor reduced the heat gains from the floor surface to the interior during daytime.

However, the stored heat from the wall and floor influenced the indoor air temperature to be higher than the external air temperature during the night time. The heat gain from the wall surface especially bamboo material enabled to maintain the internal temperature within the comfort temperatures. The responsibility of designers is to find the ways of analyzing and interpreting the rural Wagon housing tradition for the continuity of the tried, developed and evolved design principals in the Indonesia traditional architecture. Hence, climatically responsive and environmentally sensitive can be created. Instead of merely copying the traditional architectural elements without questioning the concept behind them, the new designs have to surpass the existing ones in the light of a new understanding.

The re-interpretation and re-use of shared images and values can transfer the regular houses to Wagon house. The aim of the second research is to evaluate thermal performance of Atman Troika House as prototype Malaysian traditional timber house with the actual data on a selected date. The thermal conditions were also studied based on the climatic conditions on a selected date comparing the measured and simulated results. The study also emphasizes that modification of an opening tropical design can affect the indoor thermal condition in a hot humid climate.