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Implementation of the Water Park Concept of Traditional Balinese Architecture in Improvement Comfort Thermal at Captain Mudita Bangli Park

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Abstract—Comfort thermal is absolute thing for body human, therefore human always try conditioning environment to achieve comfort thermal for his body. Outdoor space is one a place where humans operate. Object in This research is environment planned construction with apply element architecture external supported by architectural concepts traditional Balinese. See condition that, there is opportunity and important to learn characteristics comfort thermal water park. This research aims to find out factor comfort thermal and outdoor factors in the Field Captain Mudita Bangli. Field Captain Mudita Bangli chosen as location study Because own characteristic typical separately, as well role very important as support life people in Bangli. The purpose of This research is to find out spread condition thermal, knowing big influence factor external to condition thermal and the influence of water park spatial models according to Balinese traditional concepts. architecture comfort thermal. The results of this research can be become base for architects to build and design water park that can operate optimally. In this research, method comparison and simulation used to visualize condition comfort thermal on the subject research. From the results of this simulation, it can be used to find out influence factor external and architectural concept traditional Balinese towards comfort thermal object research.

Keywords: Water park concept; implementation; environmental design; thermal comfort

1. Introduction

In life on this planet, humans always life side by side and take advantage environment around for desired comfort. Connection between man with environment nature each other adaptive. Man always trying to achieve harmony with environment (Holahan, 1982). Therefore, for the sake of comfort and harmony with environment, humans creatively utilise element nature and make it happen in various form Good art, culture, architecture, etc philosophy behind all his activities.

For a long time, works architecture in various parts of the world always enter element nature into the design and design of buildings landscape. Of course, landscape is work the most visible architecture in its role is to align with landscape. environment nature. The most common landscape is form garden. The park itself Contain components of hard and soft materials that interact with each other support that on purpose designed and produced by humans for use as drink light inside and outside room (Hakim, 2004).

In the area certain conditions such as climate tropical dry, role the water park is not only interesting configuration from corner look aesthetic, but also provide comfort thermal for architectural design. Cooling use mechanism subtraction hot evaporative (Sattwiko, 2009). Based on

understanding that, Got it concluded that the water park is not only offer beauty aesthetic, but also can offer or influence something Comfort thermal needed by humans. Based on description water parks and their existence influence comfort thermal, Subject interesting research. Remember understanding humans at that time probably didn't understand it, then the more interesting to see comfort thermal traditional water park. In this study, researchers intends to identify extent of the condition thermal and role traditional water garden layout pattern influence comfort open space thermal.

Object this research is Field Captain Mudita Bangli, a park city with uniqueness and complexity of diverse functions. Field Captain Mudita Bangli is field located in the heart of Bangli City. This field is one of them field important support life the people of Bangli City start from activity exercise, relax, recreation together relatives, up to activity commerce also takes place in this field.

Based on matter that, how condition comfort thermal Field Captain Mudita Bangli based-standard comfort thermal, what is the architectural concept traditional Balinese and patterns arrangement element external influence comfort thermal Field Captain Mudita Bangli.

2. Method

This research will done with approach quantitative in form observation field as well as method experiment use technique simulation. Observation field carried out to collect data and direct observations of objects research. Whereas method study experiment use method simulation as technique the main research, then the results simulation will used to identify pattern spread condition thermals that are influenced by outdoor space elements and patterns arrangement water park with the concept of Traditional Balinese Architecture.

3. Results and Discussion

In implementing objective end from study This that is optimization architectural water park model concept traditional Balinese for enhancement comfort thermal, especially Formerly discussed in stage analysis its existence with serve potential/ things positive and stuff not enough both applied in the field Captain Mudita Bangli and his relationships with environment in context comfort thermal as well as supporter image area in the Regency Bangli, next things that are lacking Good will corrected and maximized For become positive things.

Condition Thermal Field Captain Mudita Bangli

Object Field Captain Mudita Bangli own location in the heart-city Bangli. There are many activities that occur in the field Captain Mudita Bangli is every the day. More visitors come to this field many in the afternoon start 15.00-18.00 compared Morning day. This is shown by Figures 1 and 2.

To the north of this field there is Monument Struggle Captain Mudita. To the East, West and South of this field there are offices center government Regency Bangli. There is plant shade as well as grass and shrubs that stretch on the East and South sides of the field. However, the North side of the field No lush East and South sides of the field. In the western part of the field, which is the main entrance of the field, there is water pool. This condition is of course will influential big to condition comfort thermal conditions in the field Captain Mudita Bangli. This condition can seen through pictures 3 and 4.

Measurement Comfort Thermal Condition Existing

On research Here, we analyze the condition data comfort thermal gain through observation done straight away for 1 day in the field Captain Mudita. Observation direct This carried out on Saturday, July 15 2023, in the morning, afternoon and evening with range time 30 minutes. Morning starting at 06.00-09.00 WITA. Daytime starting at 11.00-13.00 WITA. And in the afternoon starting at 15.00-18.00 WITA Measured data form four variable covers temperature, speed wind, humidity air and intensity light sun. Condition weather moment observation bright cloudy.

The following data is figure 5, viz measurement temperature. Measurement starting at 6.00 with measurement results temperature of 24°C. Temperature experience increase nor random drop that is range between 23 and 25°C to 8.30, after at 9.00 temp is at 27°C. At 11.00 temperature was at 29°C, and experienced change range between 28 and 32°C to at 13.00. At 15.00 temperature was at 29°C and experienced decrease to 27°C and constant from 15.30 to 16.00. Finally, temperature Keep going experience decline every hour until reaches 24°C when at 18.00. Reviewed from this data, the average temperature in the field Captain Mudita Bangli as of today is of 27°C. This figure shows that in this field the temperature is the temperature comfortable according to SNI T-14-1993-037 because not enough from 28°C.

Next data is Figure 6 shows big measurement to speed wind. Can seen in the picture that speed wind here it changes according to direction motion wind. Plus, speed These changing winds are influenced by barriers form vegetation shade in the field Captain Mudita's. Speed this wind is not too influence the magnitude of the existing temperature. Header existing vegetation will influential as enhancement big humidity air that occurs Because produces O2 during the day day. Therefore, increasingly Lots header planted vegetation, then will the more Lots produces O2 during the day day so that humidity air will the more big and felt more cool.

Next data is Figure 7, namely the measurement results to humidity air. If you pay attention, it's big humidity air that occurs every the time experience decline constant which is not too significant. Started from at 6.00 which has humidity air by 81% and ended at 18.00 with humidity by 82%. There is moisture in this area between 55-86% which is humidity Lowest was at 13.00 at 55 % and humidity the highest on that day was 86% at 08.00. Overall, avg humidity air that occurs in the field Captain Mudita is 73 %.

If you pay attention, humidity this air is comparable backwards with the magnitude of the existing temperature. The more high temperature, then will the more low humidity existing air. Vice versa, increasingly low temperature this temperature, then will the more big humidity the air. As it happened at 13.00, which has temperature of 32°C which has humidity air by 55%.

Data from the latest direct observations is Figure 8, namely the measurement results to intensity light. If you look at the graph, it is shown that intensity light Keep going increase until reach peak of 11400 lux and then experience decline gradually. Amount average intensity this light is 4489 lux, and if seen from condition field almost all parts of object this research is illuminated sun throughout day.

Thermal Conditions of Mudita, Bangli Field Through Envi-met Simulation.

To obtain a comprehensive overview of both variables mentioned above in the Mudita Field object, a simulation was conducted using ENVI-met 5.5.1, as shown in the image below. The image indicates that the areas planted with trees and covered by roofs in the West and East have lower temperatures compared to other areas. This is supported by the high air humidity, as seen in the simulation results on the water surface, which can certainly suppress air temperatures.

In the simulation results at 12:00, the air temperature conditions are almost uniformly distributed across the entire site. Areas dominated by shade-providing plants have lower temperatures. Surfaces covered by pavement, such as sidewalks and parking areas on the west side of the field, have lower temperatures due to being shaded by plants. The area containing a pond on the west side of the field demonstrates the role of water components or the presence of a pond, as well as grass material covering the site, in reducing air temperatures. Pedestrian paths covered by pavement near the pond have lower temperatures and higher humidity compared to paths that are somewhat distant from the pond.

Not only that, but areas covered by denser vegetation canopies also have higher air humidity, resulting in lower air temperatures. As shown in Figure 6, the areas marked in blue have the highest humidity, and the surrounding air temperature is relatively cool compared to the areas marked in red, which are less covered by dense vegetation canopies.

Perception of Comfort in the Concept of Traditional Balinese Water Garden Architecture at Mudita Field.

Based on the comparison of data obtained through direct observation and analysis using the Envi-met application, it is stated that the temperature on Mudita Field indicates an average temperature that is uncomfortably hot (SNI T-14-1993-037). Additionally, humidity is also influenced by the pavement used and the vegetation canopy planted in the research area.

Due to the thermal discomfort on this field, we attempted to optimize thermal comfort through the concept of the Traditional Balinese Water Garden Architecture Model. This concept adapts the Tat Twam Asi concept, with a pattern of water arrangement surrounding the building or the research area. The water introduced here surrounds the field both from the inside and outside.

The planned water garden extends around the central area of the field covered with grass vegetation. This water pond also serves as a boundary between the paved jogging track and the grass-covered field area. In addition to the pond surrounding the field, a circular pond is introduced on the four sides in the middle of the grass field, simultaneously implementing the Tat Twam Asi concept. However, its size is kept relatively small to avoid disrupting activities on the field.

To assess the impact of the presence of this water pond, simulations were conducted using the Envi-met 5.5.1 application. As seen in Figure 16, it is depicted that the blue-colored area, indicating lower temperature, has increased compared to before. The red-colored area is also not as extensive as the existing conditions. The western area of the field, which has pavement and lacks vegetation, still has temperatures that are moderately high. Therefore, the addition of this water pond has an impact on reducing the temperature on the Mudita, Bangli Field, but it does not provide a significant impact. This is due to other supporting factors such as insufficient vegetation and a smaller area covered by water compared to the paved area.

Factors Influencing Thermal Comfort on Mudita Field.

The results shown from the Envi-met simulation on the object indicate that the influencing factors include:

The lowest temperature conditions are almost evenly distributed in the eastern and southern parts of the research area. This is due to the majority of the site being covered by shade-providing plants and building roofs.

The simulation shows that the presence of a water pond can lower the temperature due to the evaporation of pond water, which increases air

humidity and is blown around the pond area by the wind. However, the impact is not very significant.

The presence of a water pond in the middle of the research area does not have a significant impact on reducing air temperatures, especially on the side of the pond opposite to the direction of the wind and on the side perpendicular to the wind direction.

Air temperatures are lower on the surface of grass-covered areas compared to hardscape materials such as concrete, paving, natural stone, and brushed stone pairs.

Vegetation with dense canopies and close spacing can obstruct and alter the flow of the wind.

Vegetation with dense canopies can increase air humidity.

Vegetation with dense canopies can provide shade to the surface of the site covered with hardscape materials, protecting it from direct sunlight exposure that could raise temperatures.

4. Conclusion

When looking at the results of measurements for the four thermal comfort variables, it can be said that Captain Mudita Field already feels comfortable. However, this condition is still subject to change, so it is considered necessary to make design recommendations with the concept of a traditional Balinese water garden to further optimize the thermal comfort in Captain Mudita Field.

Figure 1. The existing condition of Captain Mudita Field in the morning.

Figure 2. The existing condition of Captain Mudita Field in the evening.

Figure 3. The water pond in the existing condition.

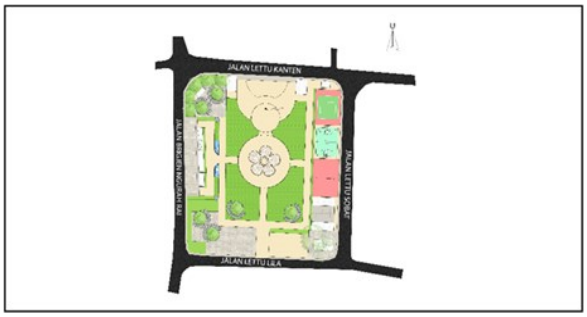

Figure 4. Top view of Captain Mudita Field.

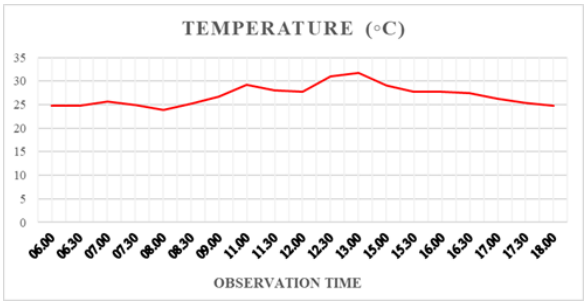

Figure 5. Temperature Measurement Graphich.

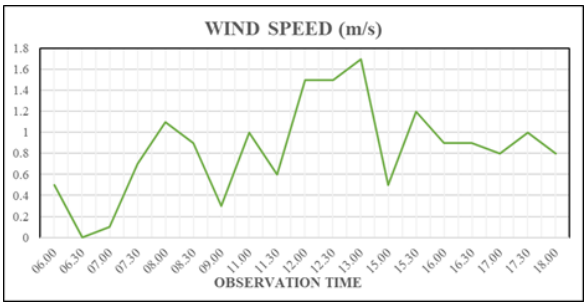

Figure 6. Wind Speed Measurement Graphich..

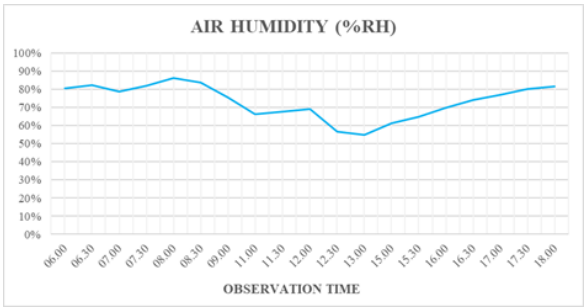

Figure 7. Humidity Measurement Graphich.

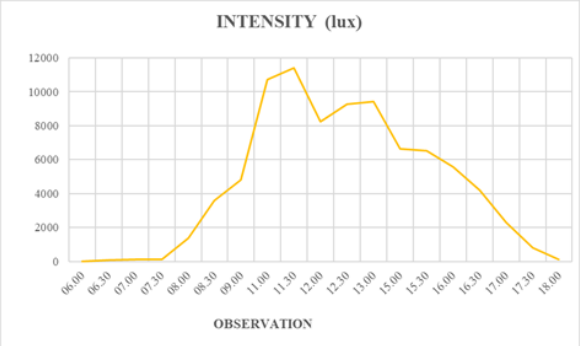

Figure 8. Light Intensity Measurement Graphich**.**

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