

Typology of building shading elements on Jalan Sudirman corridor in Pekanbaru

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Abstract. In 2013, temperature in Pekanbaru was between 22.60°C and 34.6°C with humidity 79.14 percent. This condition has increase the concern of energy utilization to building comfort. Buildings have the biggest energy consuming due to the use of air conditioner in Pekanbaru. One effort to reduced energy is shading devices application. Application of air conditioner need huge energy, replaced natural circulation with architecture elements to reduced building thermal. This research study about system and building shading devices types that influence building thermal in Pekanbaru so that knowing characteristics and elements form. This study aims to determine and identify of systems and building elements types in Pekanbaru, which the element forms to conquer in climate condition. Qualitative method with rationalistic-paradigm has used to identify typology of building shading devices on Jalan Sudirman corridor. The research orientation on typology theory, thermal theory, and building shading device to identification of building shading device types on Jalan Sudirman corridor. Based on the survey result, there are 2 type of building shading devices on Jalan Sudirman Pekanbaru which is based on forms and quantity of shading. The types are building shading devices based on shading quantity and building shading devices based on shading forms.

1. Introduction

Pekanbaru is the biggest city in Riau Province According to [1] temperature in that city was between 22.60° and 34.6° with humidity 79.14 percent. While Rainfall was 256.45 mm with the highest in December reached 614 mm. The high temperature has in impact to increase of energy utilization for building comfort.

Air Conditioner is the largest contributor in energy consumption. So are buildings in Pekanbaru almost entirely using air-conditioner. Energy efficient architecture is the architecture with the lowest possible energy requirement can be achieved by reducing the amount of resources that makes sense [2]. Thus, energy-efficient architecture is based on the idea to minimize energy use without limit or alter the building function, comfort, and productivity of its users. One effort to reduce energy use is the utilization of the thermal shading elements of the building. *Air Conditioner* takes a lot of energy can be replaced by natural air using architectural elements that can reduce building heat.

This study will discuss about how the system and the type of building shading elements that affect the thermal building in Pekanbaru, so that we determine the character and shape of the elements used. This study aims to determine and identify the system and the type of building elements in Pekanbaru, which those elements are ways of building climate conditions.



1.1 Identify of Problems

1. What types of building shading elements on Jalan Sudirman's corridor in Pekanbaru?
2. What kind of shading elements shape and function that affect building thermal comfort on Jalan Sudirman corridor in Pekanbaru?

1.2 Study Purposes

The purpose of this study is to identify, learn and study shading elements usage, in terms of both form and function. In addition, this study aims to observe of usage shading elements building on Jalan Sudirman corridor in Pekanbaru as reducing energy for building thermal comfort used.

2. Typology

Typology derived from the word "type" which defined as a concept to describe a group of objects that have similar characteristics of formal structure [3]. Typology is the study of the types of elements that are not reducible anymore. The word in the context of the type of architecture into Architype and then the typology which is an order of paradigms and tools owned by the architecture to put the position of architecture as a science [4]. Meanwhile, according to [5] typology is an activity or activities generating the same type to classify and categorize. According to [6] typology is an approach that separates attributes of coherence architectural, and to identify it as a characteristic, in an aim to comparing with attributes abstracts from other contexts, and to define similarities or differences. [7] in *Pr'ecis of the Lectures on Architecture* in architectural typology divides into three, namely: traditional typology, modern typology and functional typology.

While [8] argues, the typology is a concept describing the object groups based on imilarity of the basic properties that are trying to sort or classify the diversity and similarity of species. In this case, the typology is the elaboration result of architectural characteristics, which is composed of various local and foreign cultural elements specific to a classification structure, either functions, geometric, or style or styles classification.

Furthermore, [9] said that, typology studies in architecture world means studies in an effort to sorting, classification, to be revealed the diversity and similarities in architectural products with one another. Basically, the typology is a concept that describes the object groups on the basis of the basic properties similarity.

Therefore, it was concluded that the typology is a science or a method which involves the study of grouping or classifying an observation object that based on certain criteria to produce specific types of the observed objects.

3. Shading Device

Solar radiation adjustment which entered into building is a major step in passively cooling process to get thermal comfort condition. Sunlight modulation in setting process can be achieved with regard: Orientation and aperture ometry; Shading devices; Property of opaque and transparent surfaces. [10].

A strategy in passive design of building envelope which can be applied in order to reduce the external heat gain in buildings is shadow elements usage. Shadow elements are many variations. Principally, external shading element divided into horizontal type (*overhang*), vertical (*side fin*), and *an eggcrate*. Despite having different characteristics, the core of shadow elements usage is to minimize the angle of solar radiation that hits the glass field.

Orientation and aperture are closely related aspects in controlling the thermal comfort of the building. Building with sunlight radiation high levels requires needs aperture and orientation. Instead of building with sunlight radiation low levels requires needs to avoid aperture and direct sun orientation. By arranging the shape and orientation towards direct solar radiation can be adjusted in accordance with the position of the equator location.

Shading devices usage is the next step after controlling the orientation and aperture. If the orientation and aperture cannot be tolerated because of design needs, then the shading devices are very important

elements. Shading devices can be designed in accordance with the position and direction of solar radiation arrival so that aperture can be shielded from direct radiation.

According to [10], there are two classifications of shading devices namely fixed shading elements and adjustable/retractable shading elements. Fixed shading devices categories are external form position, overhangs, vertical fins, horizontal and vertical combinations (egg-crate type), and balcony. Among other internal position are light-shelves form and louvre above the window. While adjustable shading elements categories are element external position, tents, awning, blinds, pergola, and the internal ones such as curtains, rollers and venetian blinds. There are external factors of the building that can serve as shading devices, namely vegetation around buildings. Vegetation near a window can provide shading effect and reduce sunlight's direct radiation.

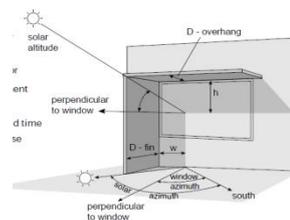
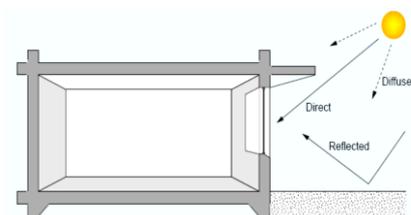


Figure 1. Direct and Indirect Solar Radiation **Figure 2.** Shadowing area by overhang and side fin

Shading device is able to block direct solar radiation and reduce the influence of indirect illumination that is the sky reflection and the ground level. The position of the sun determines the sunlight's angle of incidence on the glass surface (*penetration*). When the sunlight's angle of incidence equals the angle of the shadow which formed shading device that direct sunlight can be driven effectively. Therefore, sunlight's position and the depth of shading device becomes a very important factor.

According to [11], shading devices divided into two types based on application, internal shading and external shading.

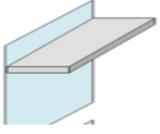
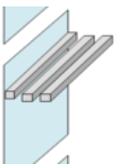
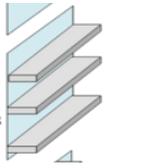
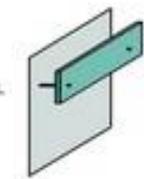
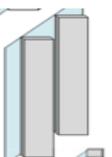
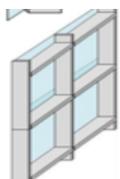
- Internal shading is interior element on inside windows. Internal shading devices generally can adjustable. Thus shading can be blinds, curtains and others.
- External shading is the shading element which is placed on building external. External shading devices can reduced thermal energy effectively to anticipate and reduced radiation before glass surfaces.

External shading devices divided into 2 types, Fixed Devices and Adjustable Devices.

- Adjustable Devices generally used indoor or outdoor or between inside and outside of windows (double glazing system) and generally used in internal shading systems.
- Fixed Devices generally used outdoor and influence façade building. Building orientation was the point.

Some of shading devices were generally used is explained on Table 1

Table 1. External Shading Devices

	<i>3D-View</i>		<i>Best Orientation</i>
<i>Overhang</i>			south, west, east
<i>Overhang Horizontal Louvers</i>			south, west, east
<i>Overhang Multiple Blades</i>			south, west, east
<i>Overhang Vertical panel</i>			south, west, east
<i>Vertical Fin</i>			west, east, north
<i>Slanted Vertical Fin</i>			west and east
<i>Eggcrate</i>			west and east

4. Method

This research used qualitative method with rationalistic-paradigm. According to [12], the purpose of this method was to identification of government building shading device types on Jalan Sudirman, Pekanbaru. The research orientation on typology theory, thermal theory, and building shading device to identification of building shading device types on Jalan Sudirman. The object of this research was building on Jalan Sudirman corridor. Observation, interview, documentation, and document study was used for data collection. And deductive-qualitative was used to data analysis.

5. Results and Analysis

Observation research divided into 3 segments area and each segment divided into 2 parts, west and east, namely segment 1A and 1B, segment 2A and 2B, and segment 3A and 3B. Total of buildings in west segments were 70 buildings which are consists of 23 buildings on segment 1A, 20 buildings on segment 2A, and 27 buildings on segment 3A. Whereas total buildings in east segments were 102 buildings which are consists of 34 buildings on segment 1B, 36 buildings on segment 2B and 32 buildings on segment 3B.

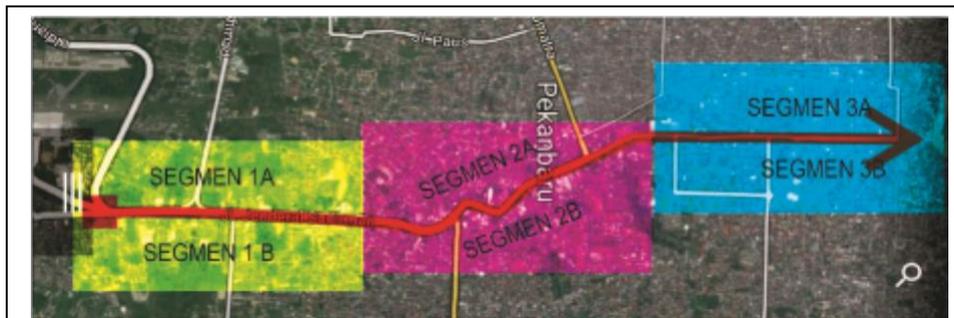


Figure 4. Observation Segments



Figure 5. 1A Observation Segment



Figure 6. 2A Observation Segment



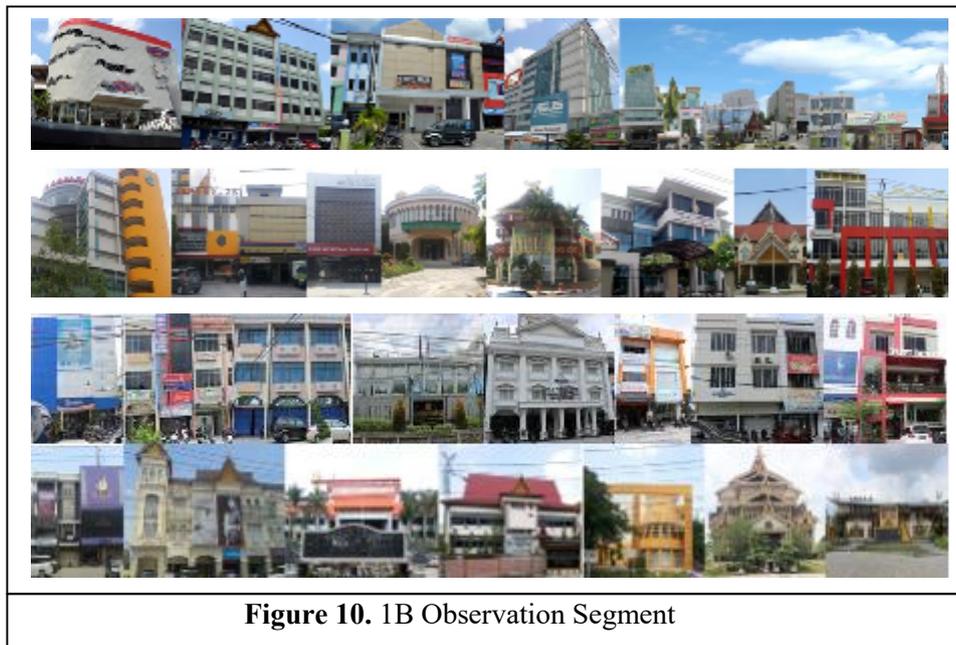
Figure 7. 3A Observation Segment



Figure 8. 3B Observation Segment



Figure 9. 2B Observation Segment



Based on research results, there were 2 types of building shading devices on Jalan Pekanbaru, as follow:

1. Building shading devices based on quantity shading device.
 - a. 1st type, shading devices with 1 form of shading element (71 samples or 41%)
 - b. 2nd type, shading devices with 2 forms of shading elements (52 samples or 30%)
 - c. 3rd type, shading devices with 3 forms of shading elements (33 samples or 19%)
 - d. 4th type, shading devices with 4 forms of shading elements (8 samples or 5%)
2. Building shading devices based on shading device type.
 - a. Overhang type (136 samples or 44%)
 - b. Vertical Finn type (49 samples or 16%)
 - c. Eggcrate type (51 samples or 16%)
 - d. Vegetation type (67 samples or 21%)

In this research, a few of samples were reduction. Reductions reasons consist of the shading was in the building (Light Shekves type), 7 samples building without shading element, 1 sample building with 5 form of shading elements and 8 samples building used water as shading elements.

6. Conclusion and Recommendation

There were two types of building shading device on Jalan Sudirman in Pekanbaru:

1. Building shading devices according to quantity of shading device: 1st type with 1 form of shading device, 2nd type with 2 forms of shading device, 3rd type with 3 forms of shading device, and 4th type with 4 forms of shading device.
2. Building shading device according to shading type, consist of overhang, vertical-finn, eggcrate and vegetation.

Re-arrange building shading device elements which is one of solving aspect in climate condition issues and alternative design of shading device for energy saving efforts.

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