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Analysis of Pedestrian Circulation Comfort at the Great Mosque of Central Java

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ABSTRACT

The Great Mosque of Central Java, in Semarang is one of the most well-known places of worship and religious tourism destinations, attracting many visitors for both prayer and the enjoyment of its beauty. This study aims to analyze the comfort of pedestrian circulation within the Great Mosque of Central Java, particularly focusing on the path leading to the main prayer room. The research examines the impact of circulation patterns on visitor activities and how vehicle parking influences pedestrian movement around the mosque. Additionally, climate factors such as temperature, humidity, and solar radiation play a role in determining visitor comfort when entering the mosque. This study provides an overview of how these factors contribute to the thermal comfort of visitors in the mosque area.

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1. INTRODUCTION

Semarang is home to many immigrants, including students and tourists, as it serves as the capital of Central Java province. One of the notable tourist attractions in Semarang is the Great Mosque of Central Java, which is both a Muslim place of worship and a significant religious tourism site. Visitors come to the Great Mosque of Central Java for various reasons beyond simply worshiping. Several factors influence the decisions of these visitors. One of the key factors that prospective tourists consider when choosing a destination is the quality of infrastructure, particularly accessibility (Wakyudi et al., 2020) According to Mathiesen and Wall (Fandeli, 1995), some of the factors that guide visitors' decisions regarding their travel experiences include the desire to travel, evaluating different information about the destination, making decisions about the trip, and assessing the overall experience.

The beauty of the Great Mosque of Central Java attracts visitors, whether they come to worship or simply enjoy its splendor. One of the key factors for visitors when choosing a location to visit is comfort and aesthetic appeal. To enhance visitor comfort, pedestrian pathways within tourist facilities are designed to facilitate the movement of pedestrians toward their intended destinations (Hantono, D et al., 2024).

In this study, the researcher conducted observations aimed at assessing the comfort of pedestrian circulation as individuals moved toward the main prayer hall. In tropical climates, such as the location of this study, pedestrians generally experience thermal comfort when walking along shaded pathways, particularly during the daytime. Conversely, thermal discomfort is commonly felt when walking in open, unshaded areas where the body is exposed to direct sunlight for extended periods. In addition to solar exposure, thermal comfort is also influenced by wind conditions and air humidity. A gentle breeze can enhance comfort by facilitating the evaporation of sweat from the skin's surface. The research problem focuses on how much influence circulation has on visitor activities within the area, as well as the impact of vehicle parking on pedestrian spaces (Sangaji et al. 2015).

A place of worship (mosque) must be designed to facilitate the movement of visitors, allowing them to enter and exit the building with ease. In light of various potential issues that may arise in mosque buildings, the problem addressed in this study is to analyze the impact of the pedestrian areas as circulation pathways, focusing on their effectiveness in facilitating the ease of movement for worshippers.

The problem under study is the circulation of visitors across various pedestrian paths and how visitors respond when entering the courtyard of the Great Mosque of Central Java during the day, prior to the Dhuhur prayer, when the weather is extremely hot. By observing the circulation patterns of visitors, it is possible to identify which paths are most frequently used by those walking to the main prayer hall. Additionally, the impact of car and vehicle parking in pedestrian areas is also a key topic of discussion, as it affects the movement of pedestrians.

Local climate factors are the primary determinants of a person's comfort level, whether inside a room (building) or outdoors. Thermal comfort can be experienced both indoors and outdoors, including in areas such as pedestrian paths or walkways, where environmental factors such as temperature, humidity, and air circulation play a significant role in ensuring a comfortable experience for users (Polawati 2019). These climate factors influence comfort levels in both enclosed spaces and open environments (Lippsmeier, 1994), including air temperature, humidity, solar radiation, air movement speed, lighting levels, and the distribution of light on the view wall.

In general, thermal comfort refers to the state of feeling comfortable with the surrounding temperature conditions. Thermal comfort is always related to the climate (Sangkertadi, 2013). According to Peter Hoppe (as cited in Sugini, 2004), there are three perspectives on thermal comfort: the thermophysiological approach, the heat balance approach, and the psychological approach.

Psychological factors, such as a sense of security and comfort, also influence the quality of pedestrian pathways. Security refers to protection from vehicular traffic as well as the safety of the path itself. Comfort, on the other hand, is shaped by the presence of supporting elements, including the surrounding atmosphere, visual appeal, smooth circulation in accordance with standards, and the availability of complete supporting facilities (Iswanto. D. 2006).

As a thermophysiological process, thermal comfort depends on the activation and deactivation of thermal receptor signals in the skin and brain. In the heat balance approach, the heat flow to and from the human body is balanced, keeping skin temperature and sweating levels within a comfortable range. In the psychological approach, thermal comfort is defined as a state of mind that reflects a person's satisfaction with their thermal environment.

2. METHOD

2.1. Location and Timing

The research was conducted in Semarang City, specifically in the area surrounding the Great Mosque of Central Java, located on Jalan Gajah Raya, Sambirejo Village, Gayamsari District, Semarang City. Observations were carried out in the front area (outer space) of the mosque, focusing on the circulation of visitors as they approached the mosque. The person-centered mapping method was employed to analyze the circulation within both the interior and exterior spaces. Using this method, observations were made for each respondent or subject during a recorded period, with repetitions conducted until consistent results were obtained. The research was carried out between the time before and after the Dhuhur prayer, specifically from 11:00 AM to 1:00 PM WIB.

2.2. Data Analysis

Data analysis was conducted through observation, comprehension, and in-depth explanation of the research findings. The understanding of the data involved examining the routes chosen to reach the main prayer hall. Consequently, this analysis can serve as a reference for assessing the comfort of the pathways during midday, when the weather is extremely hot.

3. RESULTS AND DISCUSSION

The results of this observation were obtained by analyzing photographs of visitor circulation as they entered the mosque. To access the mosque from the front parking lot, there are three possible routes to reach the main prayer hall: the pedestrian path on the right side of the mosque courtyard, the pedestrian path within the mosque courtyard area, and the pedestrian path on the left side of the mosque courtyard.

Figure 1. The parking area for two wheeled vehicles is located right in front of the mosque (source: author)

Figure 2. Parking for four wheeled vehicles is located right in front of the mosque (source: author)

The pedestrian paths on both the right and left sides are lower than the courtyard path and are characterized by a shaded atmosphere, as they are flanked by supporting buildings and the courtyard. In contrast, the courtyard is expansive, and visitors are required to remove their footwear before entering the area. Additionally, the courtyard is equipped with six electric umbrellas, which are deployed only on specific days, such as during Eid prayers and Friday prayers. These umbrellas serve as sun protection for the congregation beneath them. On regular days, these umbrellas are not opened, which results in the courtyard being directly exposed to sunlight.

(a) (b) (c)

Figure 3. (a) Pedestrian path on the left side of the mosque. (b) Pedestrian path in the front area of the mosque. (c) Pedestrian path on the right side of the mosque. (source: author)

The following presents the results of observations conducted on pedestrian circulation at the Great Mosque of Central Java, both before and after the Dhuhur prayers.

To facilitate this discussion, I have classified the routes into three categories: Route 1 (left-side route), Route 2 (middle route/yard area), and Route 3 (right-side route).

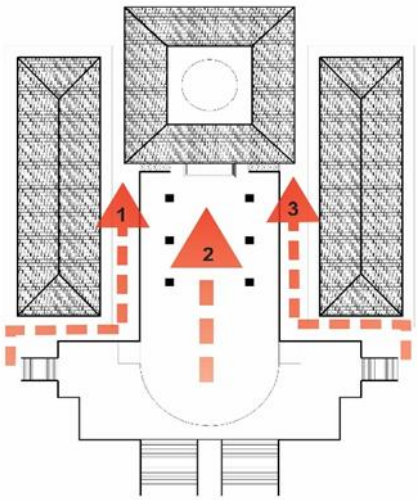
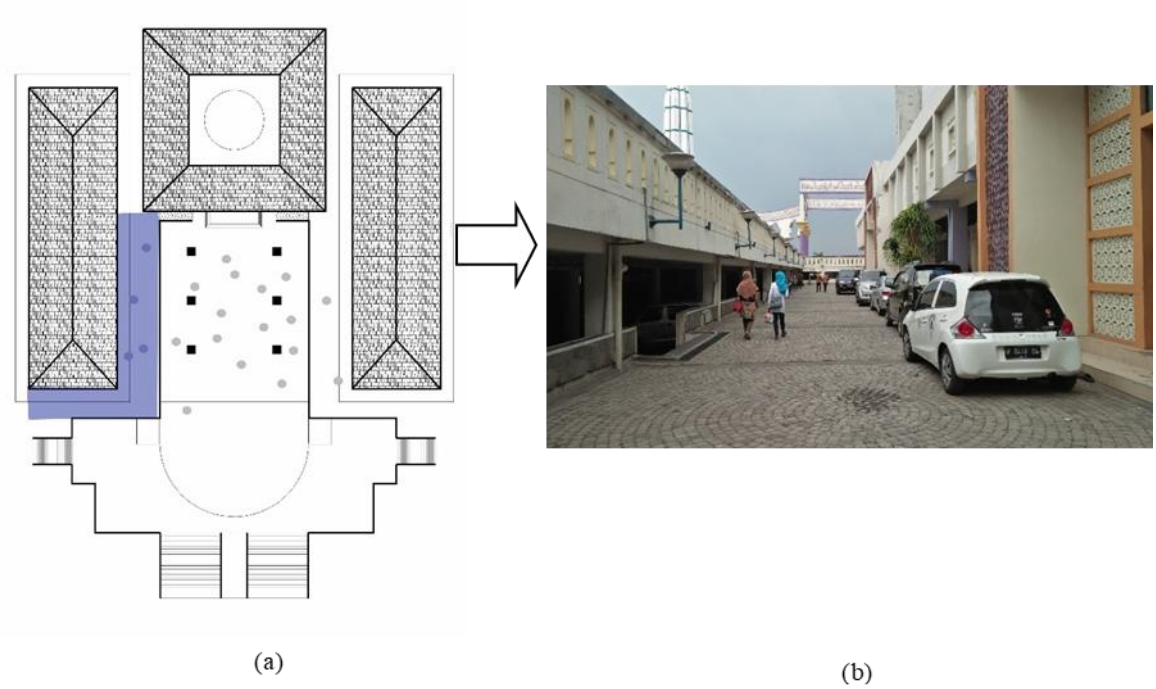


Figure 4. Pedestrian path in front of the Great Mosque of Central Java (source: author)

3.1. Circulation on Route 1

Pedestrian circulation on Route 1 is located on the left side of the mosque and is flanked by the Convention Hall building and the mosque courtyard. This route experiences relatively low foot traffic, with only a few visitors passing through. The visitors appear to walk leisurely and are not in a rush to reach the prayer hall. Additionally, there are vehicles parked in areas not designated for parking, which is likely to impact the comfort of pedestrians in this area.



(a) (b)

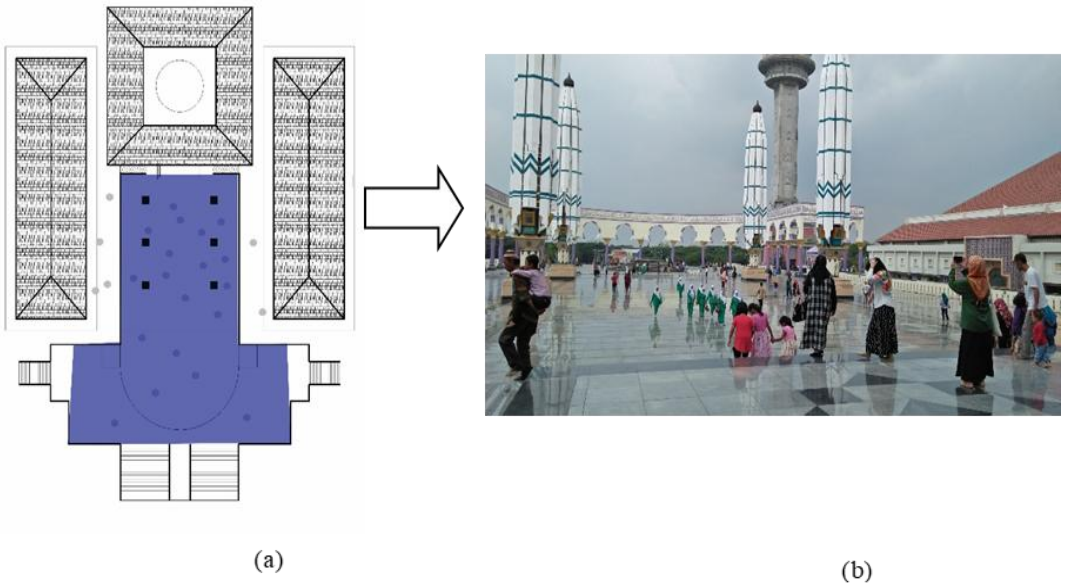
Figure 5. (a) Pedestrian analysis in Pedestrian Area route 1. (b) Pedestrian area in Pedestrian Area route 1 (source: author)

Route 1 exhibits the characteristics of a pedestrian circulation path that is less than optimal in supporting both comfort and movement efficiency. Its location—on the left side of the mosque and flanked by the Balai Sidang building and the mosque courtyard—creates the impression of an enclosed and visually restricted space. This spatial configuration may influence pedestrians' perception, particularly in terms of safety.

Overall, although Route 1 is still used by some visitors, its potential to serve as an integral part of an effective pedestrian circulation system has not been fully realized. A reorganization is necessary, including the provision of parking barriers, enhancement of visual quality, and the addition of supporting elements such as lighting, signage, and seating, in order to improve the functionality and overall comfort of the path.

3.2. Circulation on Route 2

Pedestrian circulation on Route 2 is located directly in front of the mosque, within the mosque's courtyard area. This circulation area experiences heavy foot traffic, despite the floor conditions being very hot during the day. Generally, the visitors in this area are predominantly teenagers. Many of these visitors are seen walking quickly toward the mosque, although a significant number also walk leisurely while taking photos and enjoying the view of the mosque's magnificent front.



(a) (b)

Figure 6. (a) Analysis of pedestrians in the pedestrian area of route 2. (b) Pedestrians in the courtyard of the mosque (source: author)

Route 2 serves as the main pedestrian circulation path located in the front courtyard of the mosque, making it a strategic point in the overall flow of visitor movement. Its position naturally attracts a high volume of pedestrian traffic, as it provides direct access to the mosque's main building. The high intensity of foot traffic along this route highlights its vital role in the site's circulation system.

Despite its frequent use, Route 2 presents a significant thermal challenge—specifically, the high surface temperature of the flooring during midday. This condition has the potential to reduce pedestrian thermal comfort, particularly during peak sunlight hours. Nevertheless, the continued heavy use of this route suggests a strong visual and symbolic appeal, especially due to the grand view of the mosque that serves as its backdrop.

The presence of predominantly teenage visitors—some moving briskly toward the mosque, others strolling leisurely while taking photographs and enjoying the surroundings—illustrates that this route functions not only as a transit corridor but also as a social and visual space. Such behavior reflects the recreational and aesthetic significance of Route 2.

From a planning and design perspective, it is important to evaluate the choice of paving materials to mitigate excessive heat—such as using light-colored or textured surfaces that absorb less solar radiation. Additionally, incorporating shading elements like trees or lightweight canopies could enhance thermal comfort without obstructing the area's visual appeal.

In conclusion, while Route 2 has proven effective in facilitating pedestrian movement and enhancing the visitor experience, improving its physical attributes is essential to achieve a balanced integration of function, comfort, and aesthetics.

3.3. Circulation on Route 3

Pedestrian circulation on Route 3 is located to the right of the mosque, with the pedestrian area flanked by office buildings and the mosque courtyard. The circulation on Route 3 appears to be very quiet.

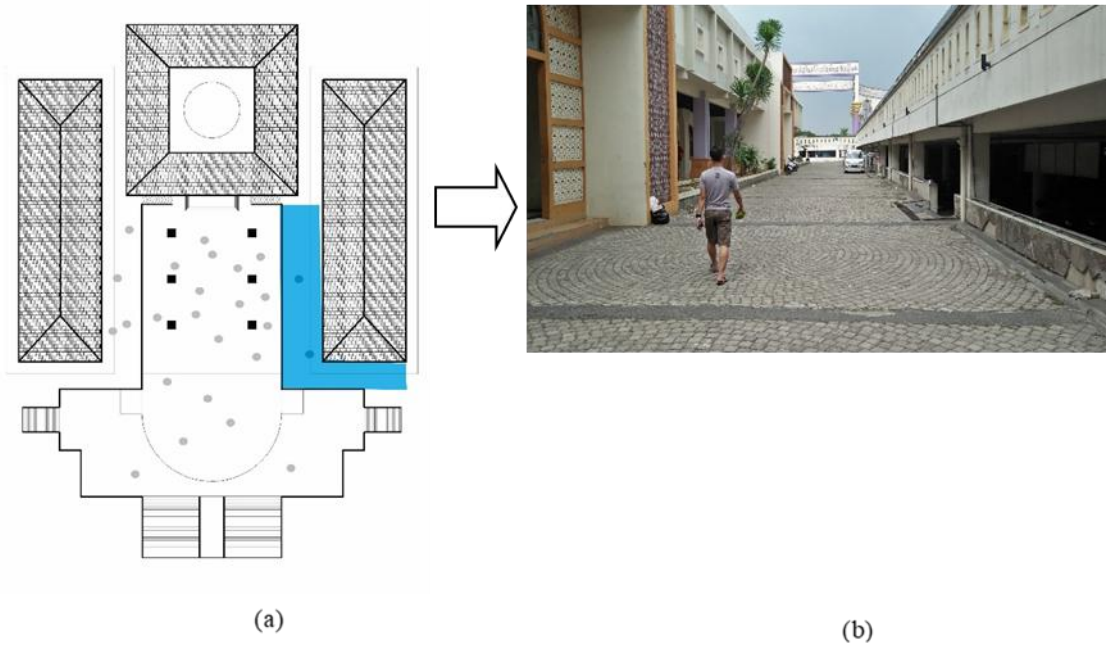


Figure 7. (a) Pedestrian analysis in Pedestrian Area route 3. (b) Pedestrian area in Pedestrian Area route 3. (source: author)

Route 3 is a pedestrian pathway located on the right side of the mosque, flanked by office buildings and the mosque courtyard. Although this route has spatial potential as an alternative path for visitors, its usage appears to be very low. This condition raises questions regarding the factors contributing to the minimal pedestrian activity in the area.

The quiet nature of this route may also suggest a lack of integration with the main pedestrian circulation network, prompting pedestrians to opt for more direct or functional pathways. This is a critical issue in the context of spatial planning, as suboptimal circulation can reduce the overall efficiency of the pedestrian movement system within the area.

Therefore, a reevaluation of the function, design, and supporting elements of Route 3 is necessary. Enhancing the route with visual features, adequate lighting, and facilities such as seating, shade-providing plants, and directional signage could improve its attractiveness and enhance the sense of safety for users.

4. CONCLUSION

Based on the observations conducted during the Dhuhur prayer time, pedestrian circulation on the right and left sides of the mosque, although shaded, was not heavily trafficked by visitors passing through these lanes. This contrasts with the pedestrian movement within the mosque courtyard, where many visitors were seen walking quickly or even running toward the main prayer hall. This suggests that visitors may feel uncomfortable due to the hot conditions in the courtyard area during the day, particularly before the Dhuhur and Asr prayers. Despite this, many visitors prefer to pass through the courtyard rather than the two shaded lanes on the left and right, which are cooler. This preference could be attributed to several factors:

1. Visitors tend to prefer the shortest route to reach their destination.
2. Visitors seek to directly experience and appreciate the beauty of the mosque.
3. The presence of crowds in the courtyard area piques visitors' curiosity, prompting them to pass through this area.
4. Vehicles parked in the pedestrian areas of the left and right lanes obstruct pedestrian movement and activities.

Table 1. Advantages and disadvantages of pedestrian access to the mosque (source: author)

Pedestrian	Advantages	Disadvantages
Route 1 (Left side of the mosque)	This path is bordered by two buildings, which partially block the sunlight during the day, creating a shaded atmosphere on the pedestrian path.	From the front, visitors must first descend the stairs to access this path. Vehicles parked along this pedestrian path disrupt the comfort of pedestrians.
Route 2 (Mosque courtyard area)	This path is located directly in the center of the mosque and faces the main entrance of the mosque.	During the day, the floor tiles in the pedestrian area become very hot, causing visitors to walk quickly in order to avoid prolonged exposure to the heat.
Route 3 (Right side of the mosque)	Similar to Route 1, Route 3 is also flanked by buildings, which partially block the sunlight during the day, creating a shaded atmosphere for pedestrians.	Climbing this pedestrian path requires a slightly longer distance, as visitors must first descend the stairs. The presence of parked vehicles and traffic along this pedestrian path disrupts the comfort of pedestrians.

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