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Acoustic Performance of Al-Muhajirin Mosque semarang

Rizka Tri Arinta[1], Tri Delima Sari SP[1], Ery Ashary[1], Adibah Sulistiyoningsih[1]
[1]Department of Architecture, Faculty of engineering, Universitas 17 Agustus 1945, Semarang, 50133, Indonesia

Abstract:- Al-Muhajirin Mosque Semarang is one of the mosques in Banyumanik District, Semarang City. Al-Muhajirin Mosque, as a building of worship for Muslims, not only functions as a place of worship but also as a forum for community interaction such as mandatory prayers to educational activities from the Ta'lim assembly. Al-Muhajirin Mosque is expected to make people comfortable as a place of worship and educational facilities. One form of comfort can be seen in sound aspects, such as low noise levels and good distribution. The focus of this study is to analyze and provide solutions to the noise problem at the Al-Muhajirin Mosque. Measure sound pressure level using a Sound Meter from inside the mosque room at time intervals of 09.00 - 18.00 WIB. The average measurement using the Sound Meter application is 72 dB and will increase to 75.2 dB during peak hours. The measurement results show that the Al-Muhajirin mosque in Semarang is substantial. Hence, it is necessary to add BioWall to reduce noise and optimize the garden's function by adding a Water Fountain to provide a peaceful sensation for mosque users.

Keywords:- *Accoustic, Performance, Mosque, Noise*

I. INTRODUCTION

The mosque is a place to carry out all activities related to obedience to Allah. Mosques as places of worship are required to prioritize user comfort, so it is expected to make worship more solemn. The acoustics of the mosque or noise level is one factor that affects the comfort level. Acoustic performance is affected by the noise limit of a sound pressure level. A sound can be noisy if it exceeds the noise limit value. The noise limit requirements for religious buildings (mosques) are 25-35 dB (Kinsler, Frey, Coppens, & Sanders, 2000, p. 364).

Acoustics is an essential part of the mosque's design characteristics. High sound quality is required for all worship activities. Poor acoustic design inside the mosque will disturb the concentration of worshipers. Acoustic requirements should be considered in the design phase to ensure good listening conditions(Syamsiyah, n.d.). Not only paying attention to the acoustic needs of the space in the mosque, but the noise factor from outside also triggers solemn activities in the mosque.

The (Othman et al., 2016) research conducted showed a relationship between the acoustic design of the mosque and the comfort of the congregation. The congregation does need a comfortable space to carry out their worship activities such as praying in congregation, listening to lectures or lectures, reading the Koran, and many more.

Lokasi	Noise Criteria (NCB)
Concert hall, recording studio	10-15
Music room, legitimate theater	25-30
Church, courtroom, conference room, hospital, bedroom	25-35
Library, private office, living room, classroom	30-40
Restaurant, movie theater, retail shop, bank	35-45
Gymnasium, clerical office	40-50
Shops, garage	50-60

Table 1:- Rekomendasi nilai bising berdasarkan jenis bangunan
(Source: Kinsler, Frey, Coppens, & Sanders, 2000, p. 364)

Noise can be interpreted as the sound that interferes with hearing or unwanted sound. Guidelines for Corporate Hygiene and Occupational Health-HIPERKES (Suma'mur, 2009) stated that noise could have a negative effect in the form of general disturbances such as disturbing concentration and diverting attention from activities being carried out. Table 1 above shows the recommended noise value based on the type of building classification.

This research is located at the Al-Muhajirin Mosque Semarang in Banyumanik, Semarang. its a grand mosque which is located on Jalan Cemara Raya No. 1 Perumnas Banyumanik Semarang shown on Figure 1. This mosque is located in the school area, next to SMA Negeri 9 Semarang, and close to the college area, making Al-Muhajirin Mosque in an area busy with motorized vehicles. The acoustic or noise aspect cannot be ignored to maintain comfort in the mosque area. Post-pandemic activities have started to return since Ramadan in 2022. Normalization of activities carried out in mosques triggers an increase in user activities. Thus the demands of acoustic needs must be considered. This study was conducted to identify acoustic performance inside and outside the mosque.

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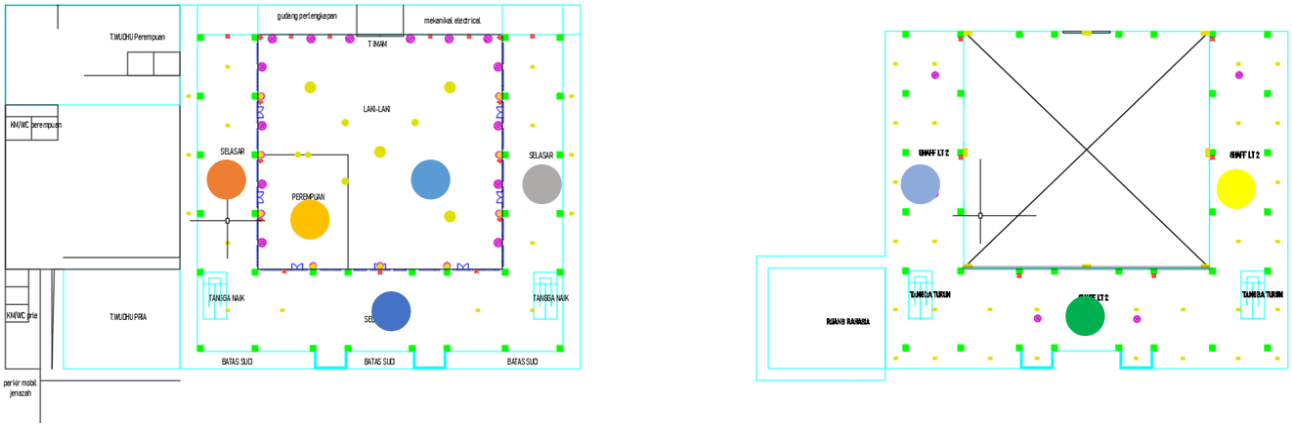
Fig 1:- Research Location Masjid AL-Muhajirin Semarang
(Source : Researcher, 2022)

This study aims to provide a solution to the acoustic performance in an area of the AL-Muhajirin Mosque, which is a busy area for motorized vehicles. This research requires objective measurements by measuring SPL (Sound Pressure Level) using the Sound Meter application, Ecotect application, observations, and physical components of the mosque's landscape while maintaining the characteristics of the Al-Muhajirin mosque, which are visualized on the facade of the mosque.

II. METHOD

Research on the AL-Muhajirin mosque was carried out by comparing the results of direct field observations with simulation results using Ecotect software. (Arinta et al., 2022) said that ecotect not only for daylighting and electrical lighting analysis but also for the acoustic measurement. In real situations and conditions on-site. This study uses a combination method (mixed method), namely quantitative and spatial analysis. Quantitative analysis by calculating the noise level in the worship room of the Al-Muhajirin Banyumanik mosque for data collection and analysis of sound pressure level (SPL), while spatial analysis is the process of checking location, attributes, and feature relationships in the data by mapping noise levels through the proper mater application. To strengthen the measurement objectively result.

Before conducting the research, it is necessary to determine the measurement point based on the mosque environment and the floor plan by producing 8 area points that identified from figure 3a and Figure 3b. The right foyer area is the area that is close to the source of the sound of the speaker's position, and the road is on the right porch. The data from the measurement of the average sound intensity is mapped using a proper mater application.



(a) (b)

Fig 3:- Floorplan Masjid Al-Muhajirin Semarang (a) Lantai 1, (b) Lantai 2
(Source : Researcher, 2022)

Table 2 figured out the classification of the measuring room and coded into color. There are 8 room

Room	Color code
Front Porch	
Left Porch	
Right Porch	
Women's Prayer Area	
Men's Prayer Area	
Front Porch on the second floor	
Left Porch on the second floor	
Right Porch on the second floor	

Table 2:- Description of the Plan of the Al-Muhajirin Mosque in Semarang
(Source : Researcher, 2022)

Data collection was carried out in the morning at 09.00 WIB until the evening at 18.00 after Isha prayer with the reading time of each measuring point for 1 minute. The data from the mapping and the numbers obtained in the field were followed up with simulations using the ecotect program, to see the distribution of the sound formed.

This study uses several tools to facilitate data collection, including;

1. Stationery is used to record the result data from the application, and map noise test points
2. Stopwatch is used to calculate time in research
3. The sound mater application is the application used to get the noise level figures in the Al Muhajirin mosque area, Banyumanik

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4. Sketchup application for modeling the building of the Al Muhairin Banyumanik mosque
5. The ecotect application is used to analyze the noise level in the prayer room of the Al Muhajirin mosque.

The data obtained was then collected and mapped using the Sketch Up application to make 3-D Modeling of the mosque building. The data is then collected again and analyzed using the ecotect application to see the distribution of sound from the sound source to the Al-Muhajirin mosque building. The results of the analysis will be used to think of the most appropriate solution to reduce noise and optimize acoustic performance at the Al-Muhajirin Mosque in Semarang.

III. HASIL DAN PEMBAHASAN

A. Activities and Landscape of the Al-Muhajirin Mosque Semarang

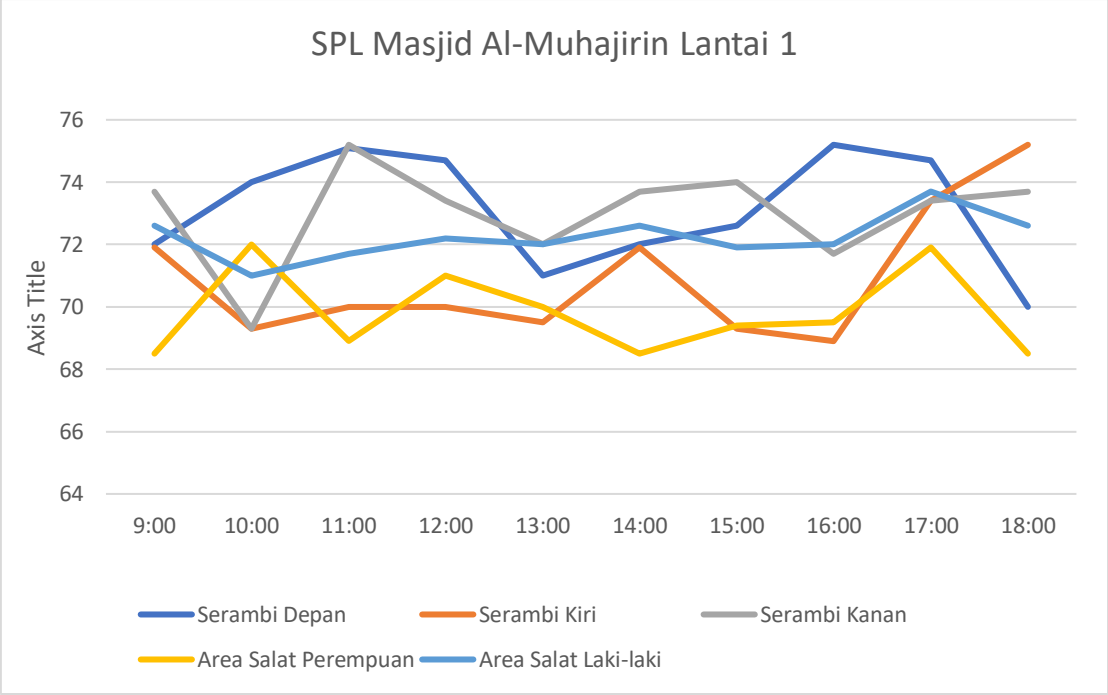
Al-Muhajirin Mosque is a grand mosque located in the school area and located right next to SMA Negeri 9 Semarang and in the college area. Al-Muhajirin Mosque is located on Cemara Raya streets No. 1 Perumnas Banyumanik Semarang. The pattern of activity outside the mosque influences the landscape on a highway located on the front and right sides. The results of the observations found that the acoustic performance of the Al-Muhajirin mosque was strongly influenced by the movement of motorized vehicles passing Jalan Cemara Raya and Jalan Jati Raya.

Fig 4:- Aktifitas Kendaraan Bermotor pada Masjid AL-Muhajirin Semarang
(Sumber: Dokumen Peneliti, 2022)

The movement of motorcyclists in the AL-Muhajirin mosque area forms a noise level that exceeds the noise limit requirements for the mosque building (see table 1). The mosque courtyard is a motorbike and car parking area for mosque visitors.

B. Urban Soundscape on Masjid Al-Muhajirin Semarang

The average value of SST at the Al-Muhajirin Mosque in Semarang is 72 dB. Acoustic interference at the Al-Muhajirin mosque is due to the Al-Muhajirin area in Semarang, located at the intersection of Jalan Cemara Raya and Jalan Jati Raya, which are busy areas of motorized vehicle activity. The highest SPL value reaches 75.2 dB, which is the noise from traffic (see Figure 5)



(a)

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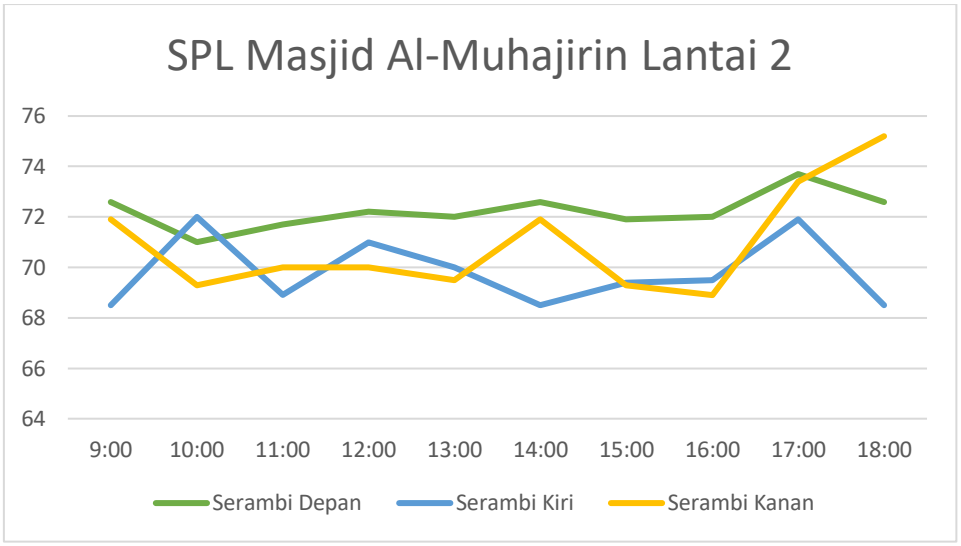
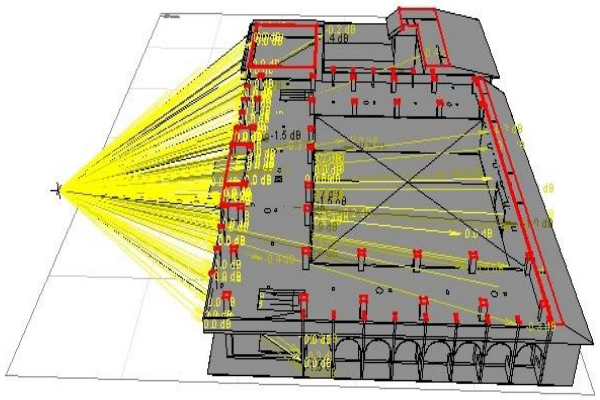
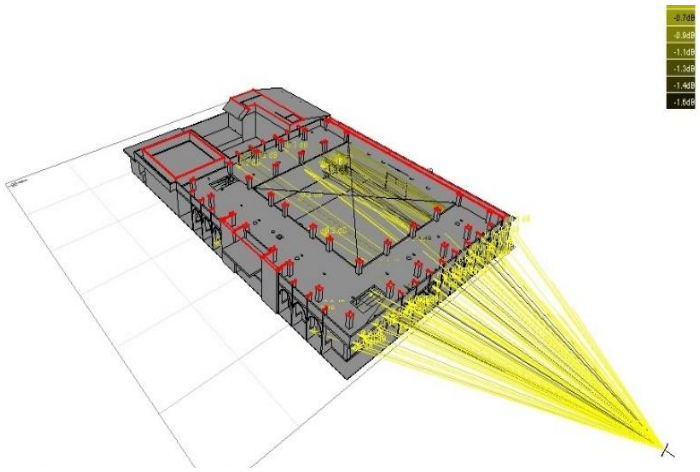


(b)

Fig 5:- Sound Pressure Level on Masjid AL-Muhajirin Semarang (a) 1st floor , (b) 2nd Floor



(a)



(b)

Fig 6:- Simulasi Sebaran Kebisingan pada Masjid AL-Muhajirin Semarang (a) Dari Jalan Cemara Raya, (b) Dari Jalan Jati Raya
(Sumber: Dokumen Peneliti, 2022)

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Figures 5 and 6 illustrate the results of the Ecotect simulation by providing an external sound source. Looking at the character of the Al-Muhajirin Mosque area, Semarang is a busy area because its activities are community traffic. At busy times, the sound amplification occurs on the front and right porch, which directly faces the road.

IV. CONCLUSION

Al-Muhajirin Mosque Semarang has a box geometry shape with slippery and rugged materials that cannot perform well in providing acoustic comfort according to SPL data that exceeds the required standards. Conditions for the acoustic comfort of the congregation were met, and the level of unwanted or distracting noise was at its lowest. Measurement of sound intensity at Masjid AL-Muhijirin averaged 72 dB and during peak hours was 75.2 dB. Meanwhile, the recommended standard for places of worship is 25-35 dB.

Based on the measurement results of the sound pressure level that exceeds the recommended level, it is better to improve the mosque. It is necessary to add a sound-absorbing element to the mosque's exterior in the form of a barrier such as BioWall to reduce noise from outside. Adding a Water Fountain can also be considered to block noise from motorized traffic and give a peaceful impression from the gurgling water.

BioWall can be assumed to be the same as green wall vertical vegetation, vertical garden, and living wall. BioWall is an upright vegetation system that is attached or not attached to the wall (Andadari, 2021). Using plants as a noise barrier on highways as a reference for plants has an aesthetic and functional role in the spread and absorption of noise that is created both in dense urban areas for vertical gardens with its function as diffusing noise compared to surface reflectivity. (Gülçinay BAŞDOĞAN, 2016).

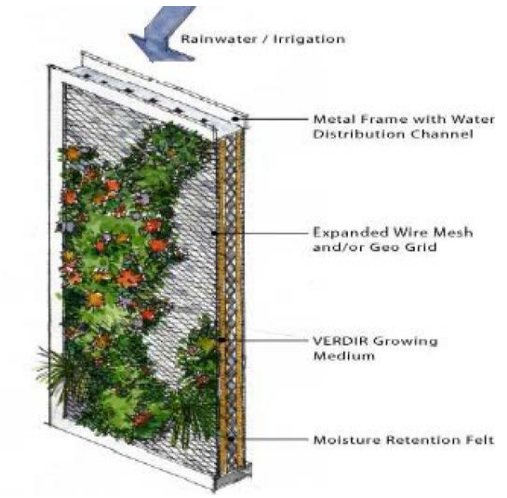

Fig 7:- Detail BioWall sebagai penghalang kebisingan
(Sumber: Gülçinay BAŞDOĞAN, 2016)

Physical elements, such as space, will affect the human psyche. The human psyche is also influenced by the perception of environmental conditions such as colors, lines, fields, textures, and specific materials. This human psychic perception will involve hearing sensors (Suarna, 2019). Natural elements such as water and vegetation are alternatives in building a peaceful space for mosque visitors.

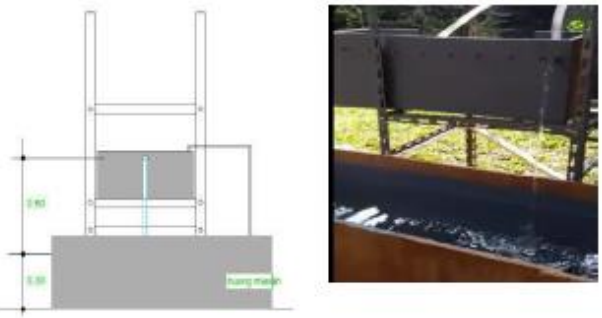

Fig 8:- Water Fountain dengan satu titik tumpahan
(Sumber: Suarna, 2019)

In his research, Suarna found that water spills from 1 point with a diameter of 12mm produced a sound with a sound level of 64.2 and sounded like gurgling water and received the most positive response from 30 respondents. The addition of a water fountain in the garden of the AL-Muhajirin Mosque can be an alternative to creating a peaceful atmosphere and is expected to cover the noise from traffic on Jalan Cemara Raya and Jalan Jati Raya.

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