

Characteristics Analysis of Parking Space Requirements an Integrated Cluster Residential Mosque

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Abstract: The mosque is a vital public facility for community activities and Islamic worship. The An-Ni'mah Mosque, Citra Gran Cibubur Housing, Bekasi, Indonesia, serves numerous worshippers. However, inadequate vehicle parking arrangements can lead to traffic congestion around the mosque. This study aims to evaluate the parking facilities at the An-Ni'mah Mosque and assess the performance of the access road to the mosque. Data on parking characteristics, such as parking volume, accumulation, duration, space needs, index, turnover, and capacity, are collected and analyzed. Road performance is assessed using the Q/C ratio to determine the level of service of the access road, utilizing traffic data from Jl. Transyogi Cibubur. The analysis reveals that the parking facility at the An-Ni'mah Mosque supports short parking durations, typically less than 2 hours, influencing the overall parking dynamics and user satisfaction. The study concludes that while the An-Ni'mah mosque's parking facility is adequate for short-term parking, there is a need to consider further improvements to prevent traffic congestion and enhance user satisfaction, providing insights that can inform future planning and management of public parking facilities.

Keywords: Characteristics Analysis, Parking Space Requirements, Integrated Cluster.

INTRODUCTION

Islam is one of the religions that the world has recognized. According to reports, Islam is the second largest religion in the world after Christianity. Every religion has a comfortable and well-conceptualized house of worship so its worshippers can be calm in prayer. In Islam, there is a house of worship, namely a mosque, according to which informal and open places of worship are commonly called mashallah, while mosques are places of worship used for Friday prayers (BBC NEWS, 2017) (Khan & Kamal, 2022). At least 100 vehicles are parked during Friday prayers unless held in an office building. In Muslim-majority countries, it is common for some activities to be carried out in mosques. Therefore, mosques are not only places of worship but also public facilities for the community, such as places for recitation, weddings, and study.

Most of the population of Indonesia is an adherent of the Islamic religion, of which there are 229,000,000, with a percentage of 87.2%. In major cities in Indonesia, various large housing estates have mosques for Muslim worshippers in residential neighborhoods. (World Population Review, 2022). In worshipping Allah, some things can be done alone at home, such as sunnah prayers, but some must be done in congregations in mosques, such as regular prayers and Friday prayers. (Abdullah, 2020) Departing from this concern, the Ministry of Religion formulated a series of mosque empowerment strategies, with the aim that mosques in Indonesia return to their original function of established mosques, namely not only the function of worship (mandala) but also carrying out other functions of social worship (chair mandala) such as education, health, social, cultural, economic and other public affairs. Mosques are also expected to be pockets of economic community empowerment that can contribute to national development targets (Goddess, 2019).

The large number of Muslims in Indonesia will cause problems related to existing mosque facilities, such as parking problems. The growth of vehicles has had a negative effect, increasing the number of vehicles and creating a parking shortage. Inadequate mosque parking facilities will cause parking outside the mosque area, interfering with the performance of road sections in the mosque environment (Radwan, 2020).

In this regard, the author has surveyed the An-Ni'mah Mosque in the Citra Grand housing estate. Many mosque worshippers came to perform congregational prayers, both residents of the housing complex and residents outside the housing complex. At the same time, it causes the mosque parking lot to be complete, and many residents also park their vehicles on the shoulder of the road, which can interfere with the performance of the road section. The development of urban centers, superblocks, and others that will be widely carried out today will directly impact traffic movement in the road network system. Following the Regulation of the Minister of Transportation of the Republic of Indonesia Number 75 of 2015, the development of a new area that is expected to have an impact on traffic around the area by the established criteria, it is mandatory to conduct a traffic impact analysis (Andalalin) (Pradana, 2019). Law Number 22 of 2009 concerning Road Traffic and Transportation states that parking is defined as the condition of a vehicle in a stopped or immobile condition for a while and abandoned by its driver.

Problems in the An-Ni'mah Mosque can be identified, especially in parking spaces, namely some inadequate parking space conditions and disruption of road performance by worshippers who park vehicles on the side of the road. Then, it will review the peak time the parking space is used, namely in studies held or at the implementation of Friday prayers and its effect on-road performance. This paper aims to discover the characteristics of vehicle parking and discuss traffic around housing, namely on the Transyogi Road Section. Then, the wishes of the pilgrims will be found through input suggestions regarding parking spaces to increase service satisfaction and performance when using parking facilities.

RESEARCH METHOD

The author surveyed conditions in the mosque to determine the dimensions of the parking space and the capacity of worshippers. According to the head of the DKM, the mosque can accommodate 1500 worshippers. The total building area of the mosque is 2500 m². Data collection is an essential step in conducting research. Several methods have been used to collect data, including the number of vehicles and traffic volume. Observation is a direct observation activity in conducting research at the location to be reviewed.

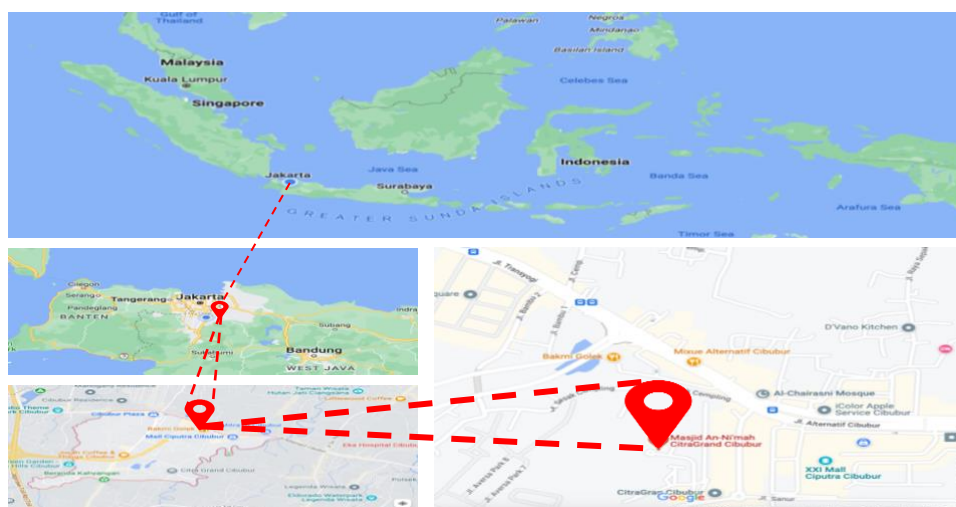


Figure 1. Location Maps

The condition of this location is included in the number of Parking Space Units based on the available parking area at the An-Ni'mah Citra Grand Cibubur Mosque. Motorcycles coming in and out of the parking area with time to exit and enter in one day. The Transyogi road section performance data is obtained by recording each vehicle that passes every 15 minutes and the number of vehicles that pass. The author classifies motorcycles into light vehicles and heavy vehicles. The surveying time is 11.00 to 20.00.

The parking needs survey data will then be analyzed to determine the characteristics of the parking space, including parking accumulation, parking index, average parking duration, and parking turnover figures. This parking characteristic data is essential for analyzing and planning the future development of the An-Ni'mah Citra Grand Cibubur Mosque parking area.

RESULT AND DISCUSSION

An-Ni'mah Mosque Layout and Situation

According to the management of the An-Ni'mah Mosque, this mosque has a capacity of about 1500 worshippers and a floor area of 2500 m² divided into two floors. According to the situation plan, the Al Qalam mosque is the closest, with 2 km to be precise, at the back entrance of the housing, while the An-Ni'mah Mosque is at the main entrance of Citragran Cibubur Housing. An-Ni'mah Mosque, located on Brentwood Citragran Street, can be seen in Figure 2.

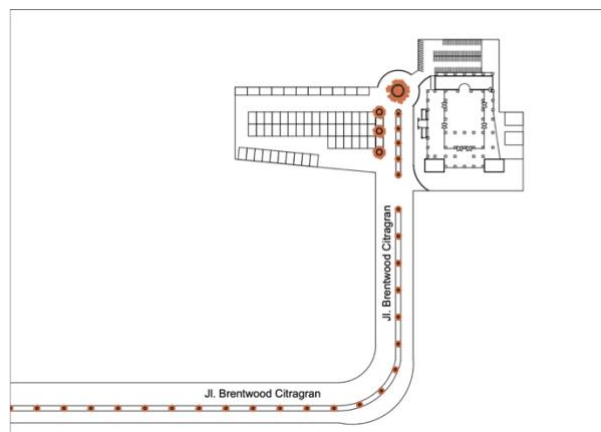


Figure 2. Mosque Situation Plan

Parking Facility Plan and Situation

According to the situation plan, the number of SRP (Parking Space Units) totals 195 SRP, with motorbike parking 136 SRP and vehicle parking 59 SRP. That capacity could surge more at Friday prayers due to the addition of vehicles to parking on both sides along Brentwood Street. Then parallel vehicle parking increases to 2-3 lines. Therefore, the author assumes that after the addition, it can reach 89 SRP for vehicles, and the addition of the motor parking space is the same in the vehicle's characteristics, which is 156 SRP.

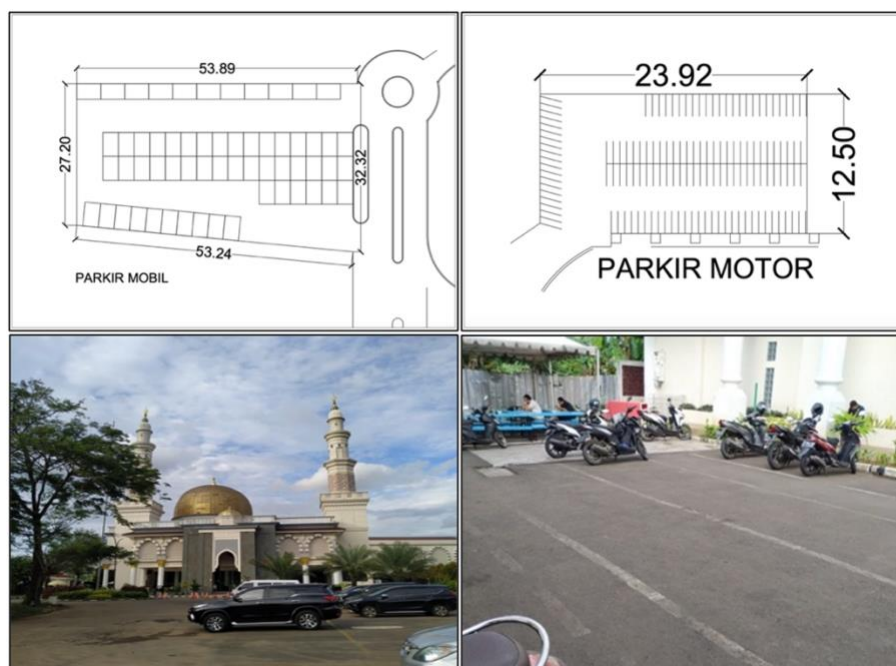


Figure 3. Vehicle & Motorcycle Actual Parking Situation Plan

Parking Characteristics

Technical data regarding attached parking spaces then become material for evaluating parking space characteristics, with calculations to obtain the value of parking volume, parking accumulation, parking index, average parking duration, parking time, parking turnover, and parking analysis from the evaluation of parking space characteristics.

Parking Volume

The results of the research site survey on Wednesday, Friday, and Saturday obtained the following data on parked vehicles on the table. Based on the parking entry table, it shows that when entering the prayer time, namely Dzuhur Prayer, Ashar Prayer, and Maghrib Prayer, precisely at 11.00-12.00, 15.00-16.00, and 17.00-18.00. In contrast, the intensity of exiting vehicle parking tends to be gradual one hour after congregational prayers are held. The time of the Isya Prayer did not occur because some worshippers remained in the mosque and had been waiting after the Maghrib Prayer. On Wednesday, the author recorded the highest number, namely 25 vehicles & 51 motorcycles.

Friday's study of vehicles entering mosque parking spaces experienced a surge in volume exceeding standard capacity, at 59 SRP for vehicle parking and 136 SRP for motor parking. In actual condition on Friday, the figures are 139 SRP for vehicles and 216 SRP for motorcycles, exceeding the author's assumptions already mentioned in chapter 4.3. The author can describe the addition of vehicle parking along the Brentwood Road body, motorcycles in the roundabout area, and buildup in the motor parking area.

On Saturday, during the Maghrib Prayer, a ba'da maghrib study was carried out until the isya prayers. There was an increase in vehicle entry charts because the pilgrims followed the study routine, with figures reaching 33 vehicles and 76 motorcycles. In the graph, the exit of the vehicle occurred after the study was completed; in other words, after the implementation of the isya prayer, the vehicle began to leave the mosque; even the author observed that there were vehicles that were still parked until the author's last deadline.

Accumulated Parking

Accumulated parking is a number that shows the number of vehicles parked in a place at a specific interval of time. Accumulated parking is a benchmark for the need for parking spaces at the

An-Ni'mah Mosque. Based on the Directorate General of Land Transportation and recorded vehicle data, parking accumulation can be calculated using the following formula:

$$Accumulation = E_i - E_x + X$$

Table 1. Friday Parking Accumulation Data

| Time | Vehicle | | | Motorcycle | | |
|---------------|---------|-----|--------------|------------|-----|--------------|
| | In | Out | Accumulation | In | Out | Accumulation |
| < 11.00 | 15 | 7 | 8 | 19 | 5 | 14 |
| 11.00 – 12.00 | 139 | 0 | 147 | 216 | 1 | 229 |
| 12.00 – 13.00 | 5 | 80 | 72 | 3 | 170 | 62 |
| 13.00 – 14.00 | 3 | 30 | 45 | 3 | 17 | 48 |
| 14.00 – 15.00 | 4 | 17 | 32 | 12 | 21 | 39 |
| 15.00 – 16.00 | 23 | 9 | 46 | 47 | 25 | 61 |
| 16.00 – 17.00 | 3 | 21 | 28 | 9 | 29 | 41 |
| 17.00 – 18.00 | 27 | 8 | 47 | 56 | 3 | 94 |
| 18.00 – 19.00 | 15 | 30 | 32 | 12 | 36 | 70 |
| 19.00 – 20.00 | 12 | 15 | 29 | 9 | 45 | 34 |
| Total | 246 | 217 | 486 | 386 | 352 | 692 |

Wednesday's accumulation of parking between vehicle and motorbike parking was a significant difference in graphics because motorbike parking showed a drop in numbers at 14.00-15.00, but both experienced the highest chart equation during the study, namely before maghrib prayer time at 17.00-18.00 to the highest accumulation rate of vehicle and motorcycle parking.

During the study, namely 11.00-20.00 on Friday, the accumulation of parking showed that 147 vehicles and 229 motorcycles were recorded before the implementation of Friday prayers, namely 11.00-12.00. Then, the chart increased again during Maghrib prayer time, but less than during Friday prayer time.

Saturday's parking accumulation is different from other days because there is, after a maghrib prayer time study, affecting the accumulation chart figures that did not drop significantly and recorded the number of vehicles parked at 44 vehicles & 89 motorcycles. According to records, in maghrib time until Saturday, isya is the highest number of accumulated parking on other days.

Parking Duration

According to Beaward J.G. in the Traffic Engineering book, there are three parking groups: Short Parkers (short-time parking), which is vehicle parking that uses a parking space between 5 minutes and 2 hours; Middle Parkers (medium-time parking), which is parking that uses a parking space for more than 2 - 4 hours; and Long Parkers (long-time parking), which is parking that uses a parking space for more than 4 hours.

Table 2. Friday Parking Duration

| Duration | Vehicle | | Motorcycle | |
|----------|---------|----------|------------|----------|
| | Volume | Duration | Volume | Duration |
| 1 | 203 | 203 | 294 | 294 |
| 2 | 23 | 46 | 48 | 96 |
| 3 | 3 | 9 | 12 | 36 |
| 4 | 6 | 24 | 15 | 60 |
| 5 | 4 | 20 | 5 | 25 |
| 6 | 2 | 12 | 4 | 24 |
| 7 | 3 | 21 | 3 | 21 |
| 8 | 2 | 16 | 5 | 40 |
| Total | 246 | 217 | 386 | 596 |

The average duration of vehicle parking in the An-Ni'mah Mosque area on Wednesday, December 14, 2022, for vehicles is 2.13 and 2.27 hours. Friday, December 1, 6, 2022, for vehicles, 1.42 and 1.54 hours. Saturday, December 1, 7, 2022, for vehicles, 2.36 and 2.22 hours. These three data are the pinnacle of parking facilities used because, in addition to those days, pilgrim vehicles are considered less frequent.

Parking Space Needs

Next is to enter the results of the calculation of parking duration into an equation to determine the parking space needs of each vehicle, carried out on Wednesday, December 14, 2022, namely the number of parking space units (SRP) for four-wheeled vehicles (vehicles) is 59 SRP, and for two-wheeled vehicles (motorcycles) = 136 SRP

Short Time Parking

Short time parking = 77 vehicles
 Total vehicle parking = 96 vehicles
 Thus, short-time SRP = $(77/96) \times 59 = 47.32$ SRP
 Percentage = $(77 /96) \times 100 \% = 80.2 \%$

Parking When You're in A vehicle

Medium time parking = 6 vehicles
 Total vehicle parking = 96 vehicles
 Thus, medium time SRP = $(6/96) \times 59 = 3.68$ SRP
 Percentage = $(6/96) \times 100 \% = 6.25 \%$

Long Time vehicle Parking

Long time parking = 13 vehicles
 Total vehicle parking = 96 vehicles
 Thus, the old-time SRP = $(13/96) \times 59 = 7.98$ SRP
 Percentage = $(13/96) \times 100 \% = 13.54 \%$

Table 3. Parking Space Needs

| TYPES OF VEHICLES | SURVEY TIMING | SHORT TIME PARKING (SRP) | % | MEDIUM TIME PARKING (SRP) | % | LONG TIME PARKING (SRP) | % | TOTAL |
|-------------------|---------------|--------------------------|-------|---------------------------|------|-------------------------|-------|-------|
| Vehicle | 14/12/22 | 47,32 | 80,21 | 3,69 | 6,25 | 7,99 | 13,54 | 59 |
| Motorcycle | 14/12/22 | 114,89 | 84,47 | 8,07 | 5,94 | 13,04 | 9,59 | 136 |

Parking Index

The parking index is the accumulation of vehicles at a given time divided by the number of available parking spaces. Calculating the parking index determines the percentage of parking space usage at each specific time. If the parking index exceeds 1, the used parking area exceeds the available parking spaces. The formula for parking accumulation can be used based on the Directorate General of Land Transportation and recorded vehicle data.

$$Parking\ Index = \frac{Parking\ Accumulations}{Capacity} \times 100\%$$

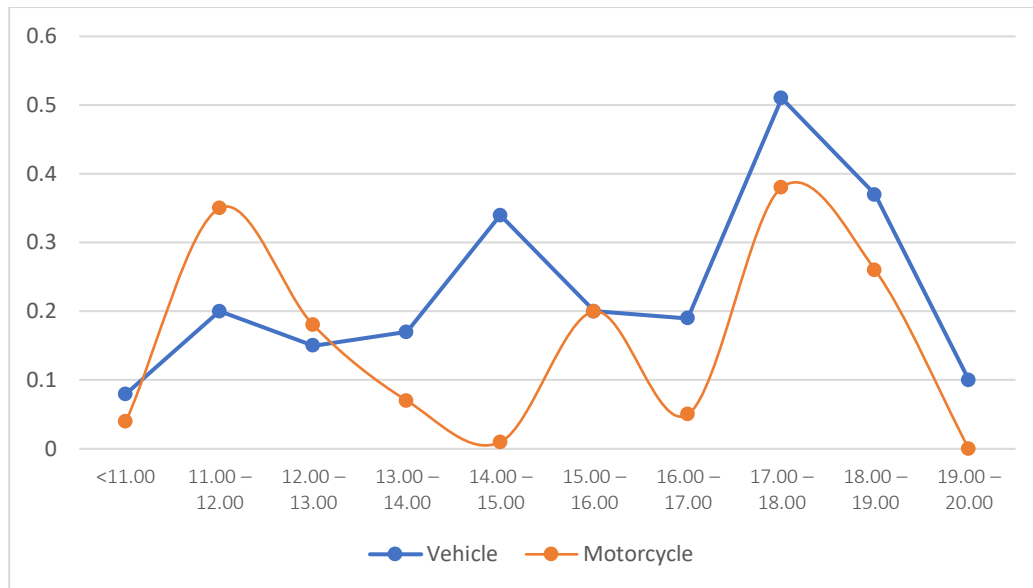


Figure 4. Vehicle & Motorcycle Parking Index

Parking Turn Over

Parking Turnover is a parking space usage rate calculated from the number of vehicles entering the parking area within a certain period (the volume of parking vehicles) divided by the number of parking spaces available at a given time. The A-Ni'mah Mosque has a total parking space capacity for vehicles of 59 SRP and a motorbike parking space capacity of 136 SRP.

$$PTO = \frac{N_t}{S \cdot T_s}$$

PTO calculation on Wednesday, December 14, 2022

Vehicle PTO 07:00 – 22:00 WIB

$$PTO = \frac{96}{59} \times 100\% = 1.62 \approx 2 \text{ vehicles/ SRP}$$

PTO Motor at 07:00 – 22:00 WIB

$$PTO = \frac{219}{136} \times 100\% = 1.61 \approx 2 \text{ vehicles/ SRP}$$

Parking Capacity

Parking capacity is the number of vehicles a parking lot serves during the study. The An-Ni'mah Mosque has a total parking space capacity of 59 SRP for vehicles and motorbikes of 136 SRP.

$$KP = \frac{S}{P}$$

Parking Capacity Wednesday, December 14, 2022

KP Vehicle = 59/1.62 = 36 vehicles/hour

KP Motor = 136/1.61 = 84 vehicles/hour

Parking Capacity Friday, December 16, 2022

KP Vehicle = 59/4.16 = 14 vehicles/hour

KP Motor = 136/2.83 = 48 vehicles/hour

Parking Capacity Saturday, December 17, 2022

Vehicle KP = 59/1.86 = 32 vehicles/hour

KP Motorcycle = 136/1.62 = 84 vehicles/hour

Road Section Performance Results

From the calculation of road capacity, the average result is that it has an index LOS (Level of Service) A, meaning Free flow, low volume, and high speed; the driver can choose the desired speed. and B, The current is stable, the speed is slightly limited by traffic, and the driver can still be free in choosing his speed.

CONCLUSION

Several conclusions can be drawn from the results of the analysis that the author has carried out. An-Ni'mah parking occurred during peak hour on Friday, December 16, 2022, with as many as 139 vehicles and 216 motorcycles, namely during the implementation of Friday prayers but with typical short-time parking, and this number includes parking on the street along Brentwood Street CitraGran Housing. Graphically, the parking index has no problems with either signs or officers; it is recorded according to the index that all days other than Friday are at most the number 1, which indicates that parking capacity can meet the number of pilgrim vehicles. The performance results of the Transyogi Street Section, held on Wednesday and Friday during Dzuhur Ashar time, and Maghrib obtained a peak hour volume capacity of 941 vehicles. This number occurred on Friday at 18.30 – 18.45 WIB, according to the author's note obtained the results of the A and B levels of service index; thus, the event or study carried out at the An-Ni'mah Mosque was not significant and did not have a direct impact on the Transyogi Street section.

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