

Evaluation of Parking Space needs for Marzoeki Mahdi Hospital

Daarul Firmansyah, Rulhendri Rulhendri, Alimuddin Alimuddin

Civil Engineering Departement Ibn Khaldun University Bogor, INDONESIA

E-mail: daarulfirmansyah@gmail.com

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ABSTRACT

Dr. H. Marzoeki Mahdi Mental Hospital (RSJMM) Bogor is a type A mental hospital that is a referral for mental health and drug services located at Jalan dr. Sumeru No. 114, Bogor City. RSJMM has a land area of 56 hectares and a building area of 79,238 m². RSJMM has a total of 590 beds and is supported by 944 employees as of May 2020 consisting of 64 medical personnel, 415 nursing staff, 66 other health workers and 310 non-medical personnel. RSJMM as a referral hospital has a wide coverage area covering the Bogor area and the western part of West Java Province. Its implementation as a Public Service Agency (BLU) hospital has an important role as one of the spearheads in public health development, has the task and responsibility to improve services to the community in order to advance public welfare and educate the nation's life with flexibility in financial management based on economic principles, productivity, and the implementation of healthy business practices. To realize these goals, the hospital refers to the principles of accountability, transparency, effectiveness, and efficiency. Of course, visits to the hospital will also increase, therefore it is necessary to have supporting facilities such as adequate parking areas so that visitors feel safe and comfortable when parking their vehicles. In this study using the SRP characteristic method (Volume, Accumulation, Duration, Over Turn Over, Index), in this study is the Evaluation of Parking space needs. Data collection was carried out using a survey method with a time of 10 hours and running for seven days with the aspects taken being the data on vehicle entry and exit times to determine parking characteristics. The results of this study indicate that the need for parking space cannot accommodate motorcycles, an area of 168m² has a parking capacity of 74 SRP. In this analysis study, the results of the largest accumulated static capacity were 147 vehicles with an average parking duration of 09:48 hours on the peak day, namely Wednesday, February 11, 2025. During the seven days of the survey, it was found that the maximum parking volume was 169 vehicles with a maximum vehicle parking accumulation of 100 vehicles which occurred on Monday, February 17, 2025. The highest motorcycle parking turnover at Marzoeki Mahdi Hospital reached 234.75%, this shows that motorcycle parking performance is very high. The capacity of motorcycle parking space at Karya Bhakti Pratiwi Hospital cannot meet existing parking needs. This is indicated by looking at the parking index exceeding capacity.

Keywords: Parking, Parking Space Unit (SRP), Parking Space Needs, Parking Capacity, Hospital.

INTRODUCTION

A hospital is an organization that through organized professional medical personnel and permanent medical infrastructure provides medical services, continuous nursing care, diagnosis and treatment of diseases suffered by patients [1, 2]. One of the public facilities in a hospital is the provision of parking facilities in a hospital is very important because in addition to the high traffic level, hospitals are usually located in locations that are easily accessible to the public. With the increasing number of patients and health services offered, hospitals often face a surge in the number of visitors, both patients, families, and staff [3-5]. This increases the need for adequate parking. Adequate parking service facilities are needed in the hospital so that the flow of vehicles in and out does not cause chaos in the hospital area or on the surrounding roads. Therefore, the construction of a hospital requires parking facilities to support the comfort and safety of vehicle owners who park their vehicles [6-8].

Parking is an important component of transportation systems because it provides temporary spaces for vehicles when they are not in use. Parking facilities are commonly found in public areas such as shopping centers, offices, hospitals, schools, train stations, airports, and residential areas. Proper

parking management helps reduce traffic congestion, improves accessibility, and supports the orderly movement of vehicles and pedestrians [9-11]. Parking areas can be located on-street, along road shoulders, or off-street in dedicated parking lots and parking buildings. The design of parking facilities must consider safety, circulation patterns, vehicle capacity, environmental impacts, and user convenience. Adequate parking spaces, clear markings, lighting, and security systems are necessary to create efficient and safe parking environments. In urban areas, parking management also plays an important role in controlling private vehicle use and encouraging the use of public transportation [12-14].

Paid parking is a parking system in which users are charged fees for using parking facilities. This system is widely applied in commercial areas, city centers, transportation terminals, and other high-demand locations. The main purpose of paid parking is to regulate parking demand, prevent illegal parking, and increase the turnover of parking spaces [15-16]. Parking fees may be calculated based on duration, vehicle type, or parking zone. Paid parking systems can operate manually using attendants or automatically through ticket machines, electronic gates, sensors, and digital payment technologies [17].

RESEARCH METHOD

Research Location

The location of this research was conducted at Marzoeki Mahdi Hospital, Jl dr. Sumeru No. 114 The research was conducted for 1 week, starting from February 17, 2025 to January 23, 2025 in 1 week conducting research in 7 days, namely Monday, Tuesday, Wednesday, Thursday, Friday, Saturday and Sunday at 07:00–17:00 WIB, the following is the research location shown in Figure 1 below.



Figure 1. Location map

Data Collection Method

At this stage, data collection is carried out in the following ways:

1. Literature study
This literature study is carried out by collecting, identifying, and processing written data obtained.
2. Observation study
A study conducted by means of a direct survey in the field. The survey study conducted is a recording of the number of vehicles and the duration of parking in the parking area of the Marzoeki Mahdi Hospital that enter and exit.

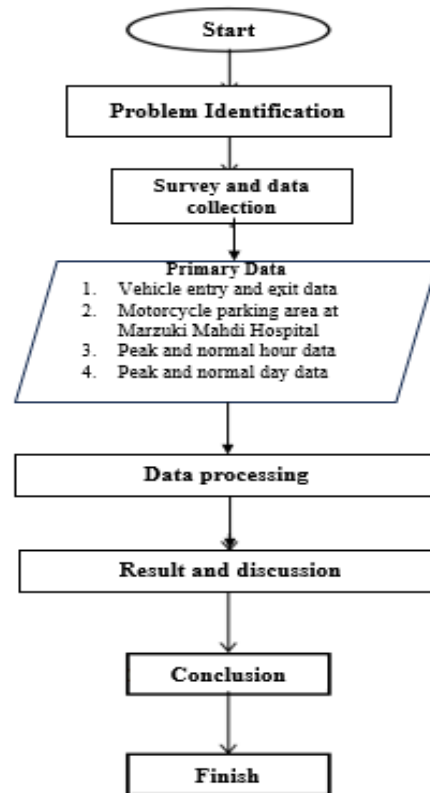


Figure 2. Flowchart

Data Analysis Method

In conducting a study, a series of research steps will be needed first to make it easier to analyze. In this study, it is necessary to plan the steps taken so that the research process can be carried out effectively. The following are the steps in the study:

1. Primary data in the form of vehicle license plate data and the time matched between entering and exiting vehicles using the formula approach equation will obtain the results of parking characteristics and parking space requirements.
2. The data above is then grouped per time unit group, namely 30 minutes, then calculate the number of vehicles according to the time interval group and to obtain the right parking space requirement figure for Marzoeki Mahdi Hospital, find the long parking time interval group that has the-most number of motorcycles parked. The selected and appropriate parking space requirement figures are used to calculate the Parking Space Unit (SRP) [18].
3. Primary data, namely the number of vehicles in a day and the number of parking spaces available and secondary data, namely the area of parking space at the Marzoeki Mahdi Hospital [18] produces parking problems and capacity.
4. Data processing with the Microsoft Excel program.

RESULTS AND DISCUSSION

Vehicle Recording When Entering and Exiting Parking volume

Parking volume is the number of vehicles parked at the study location during a certain period of time, in this case the calculation is grouped every 15 minutes. By knowing the volume of parking vehicles from a parking facility, the amount of parking space needed can be determined to accommodate the volume of parking vehicles that occur. The greater the volume of vehicles, the greater the need for parking space will be. Furthermore, an analysis of the survey data was carried

out to obtain the parking volume at the study location during 10 hours of observation as presented in Table 1 and Figure 3 below:

Table 1. Motorcycle Parking Volume

No	Day/Date	Time	Number of Vehicles
1	Monday, February 17, 2025	07:00 - 17:00	169
2	Tuesday, February 18, 2025	07:00 - 17:00	150
3	Wednesday, February 19, 2025	07:00 - 17:00	143
4	Thursday, February 20, 2025	07:00 - 17:00	128
5	Friday, February 21, 2025	07:00 - 17:00	126
6	Saturday, February 22, 2025	07:00 - 17:00	151
7	Sunday, February 23, 2025	07:00 - 17:00	145

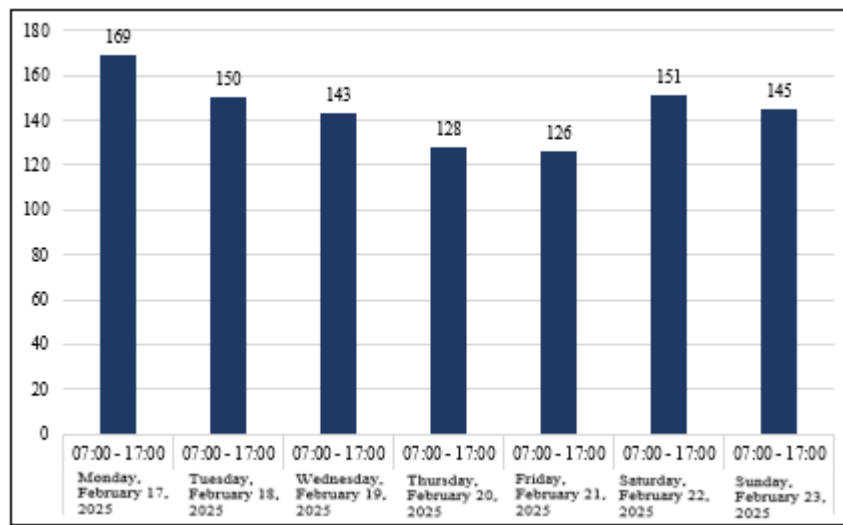


Figure 3. Motorcycle parking volume

Based on Table 1 and Figure 3, the maximum motorcycle parking volume occurred on Monday, February 17, 2025 with a total of 169 vehicles.

Peak vehicle entry hour

The peak vehicle entry hour is the period of time when most drivers enter the parking area. In this case, the peak vehicle entry hour is grouped based on the largest number in a period per day as presented in Table 2 and Figure 4 below:

Table 2. Peak vehicle entry hour

No	Day/Date	Time	Number of Vehicles
1	Monday, February 17, 2025	08:00 - 08:15	13
2	Tuesday, February 18, 2025	09:15 - 09:30	12
3	Wednesday, February 19, 2025	07:45 - 08:00	9
4	Thursday, February 20, 2025	10:45 - 11:00	9
5	Friday, February 21, 2025	07:00 - 07:15	12
6	Saturday, February 22, 2025	11:30 - 11:45	9
7	Sunday, February 23, 2025	10:00 - 10:15	11

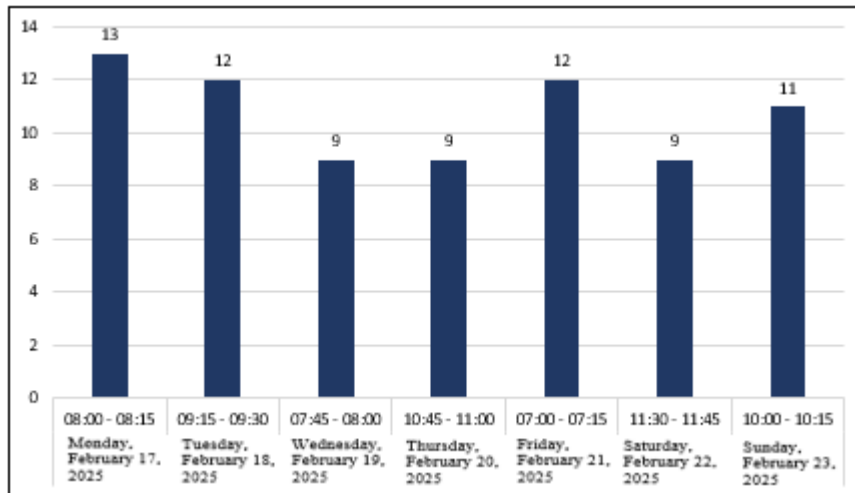


Figure 4. Peak vehicle entry hours

Based on Table 2 and Figure 4 above, it can be seen that the highest peak vehicle entry hour period occurred on Monday, February 17, 2025 with a total of 13 vehicles.

Peak vehicle exit hour

The peak vehicle exit hour is the period of time when drivers exit the parking area. In this case, the peak vehicle exit hour is grouped based on the largest number in a period per day as presented in Table 3 and Figure 5 below:

Table 3. Peak vehicle exit hour

No	Day/Date	Time	Number of Vehicles
1	Monday, February 17, 2025	16:30 - 16:45	11
2	Tuesday, February 18, 2025	15:30 - 15:45	10
3	Wednesday, February 19, 2025	16:30 - 16:45	10
4	Thursday, February 20, 2025	15:45 - 16:00	11
5	Friday, February 21, 2025	16:30 - 16:45	10
6	Saturday, February 22, 2025	16:00 - 16:15	13
7	Sunday, February 23, 2025	16:30 - 16:45	10

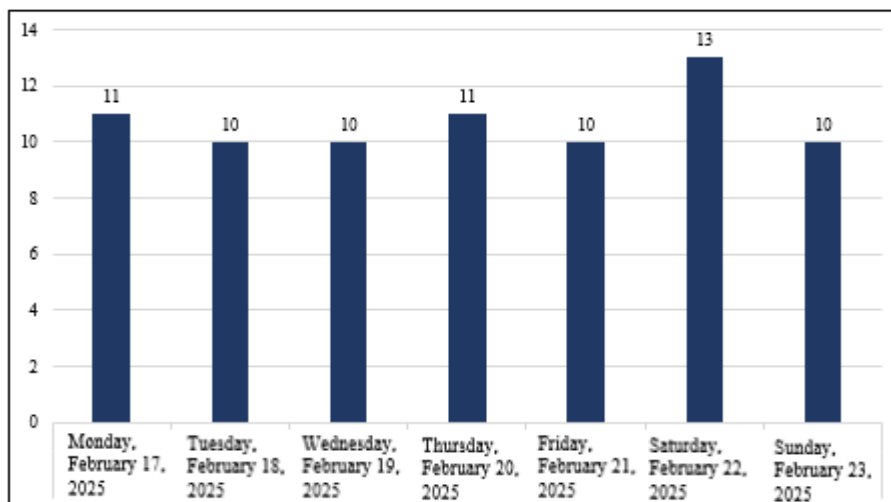


Figure 5. Peak vehicle exit hours

Based on Table 3 and Figure 5 above, it can be seen that the highest peak vehicle exit hour period occurred on Saturday, February 22, 2025 with a total of 13 vehicles.

Matching Vehicle Data Entering and Exiting Parking accumulation

Parking accumulation is the number of vehicles parked in a place at a certain time and can be divided according to the category of type and purpose of travel. Peak parking time and the number of parked vehicles can be obtained from the results of parking accumulation. Data obtained for seven days recorded the number of vehicles entering and exiting and then grouped into 15-minute time intervals, so that the percentage of distribution of vehicles entering and exiting and parking accumulation figures were obtained. Based on the parking accumulation table and the number of motorcycles entering and exiting at the Marzoeki Mahdi Hospital, the distribution of the number of vehicles for each 15-minute survey interval can be seen. The following is the maximum parking accumulation presented in Table 4 and Figure 6.

Table 4. Maximum accumulation

No	Day/Date	Peak Hour (WIB)	Maximum Accumulation (vehicles)
1	Monday, February 17, 2025	11:15 - 11:30	100
2	Tuesday, February 18, 2025	12:00 - 12:15	88
3	Wednesday, February 19, 2025	11:45 - 12:00	86
4	Thursday, February 20, 2025	11:45 - 12:00	79
5	Friday, February 21, 2025	10:30 - 10:45	70
6	Saturday, February 22, 2025	13:00 - 13:15	88
7	Sunday, February 23, 2025	13:15 - 13:30	86

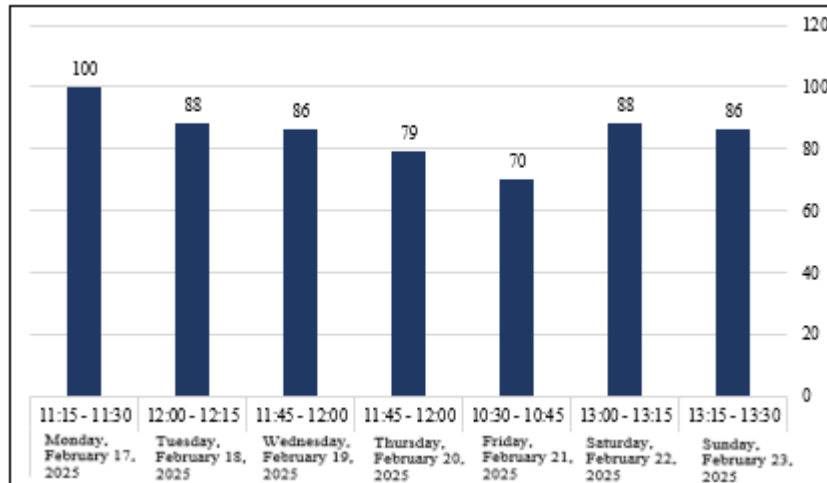


Figure 6. Maximum parking accumulation

Parking duration

Parking duration is the time span of a vehicle parked in a place (in hours). Based on the results of the study above, it was obtained that the average parking duration with a time interval of 15 minutes, as presented in Table 5 and Figure 7 as follows:

Table 5. Parking duration

No	Day/Date	Observation Time (WIB)	Maximum Duration (Hours)	Minimum Duration (Hours)	Average Duration (Hours)
1	Monday, February 17, 2025	07:00 - 17:00	8:09	0:04	3:57

2	Tuesday, February 18, 2025	07:00 - 17:00	7:50	0:07	3:34
3	Wednesday, February 19, 2025	07:00 - 17:00	9:16	0:11	4:35
4	Thursday, February 20, 2025	07:00 - 17:00	9:16	0:11	4:58
5	Friday, February 21, 2025	07:00 - 17:00	8:45	0:07	4:41
6	Saturday, February 22 2025	07:00 - 17:00	8:27	0:06	4:48
7	Sunday, February 23 2025	07:00 - 17:00	7:53	0:12	4:34
			Max	9:16	
			Average	4:27	
			Min	0:04	

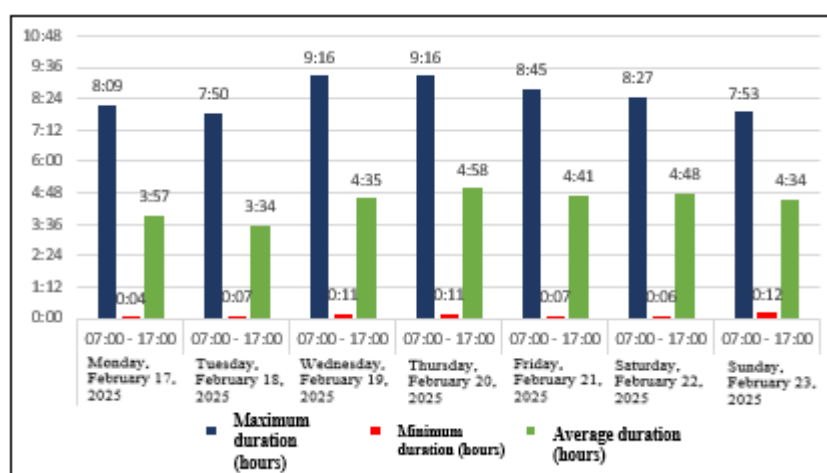


Figure 7. Parking duration

Based on Table 5 and Figure 7 above, the maximum duration occurred on Wednesday, February 19, 2025, at 9:16 hours. The average maximum duration occurred on Saturday, February 22, 2025, at 4:48 hours, and the minimum duration occurred on Monday, February 17, 2025, at 0:04 hours.

Parking turnover

Parking turnover is the level of parking space usage and is obtained by dividing the parking volume by the number of parking spaces for a certain period. By knowing the parking turnover value, the level of parking space usage can be determined as presented in Table 6 and Figure 8 below:

Table 6. Parking turnover

No	Day/Date	Parking Capacity (SRP)	Parking Volume (Vehicles)	Parking Turn Over
1	Monday, February 17, 2025	72	169	234.72
2	Tuesday, February 18, 2025	72	150	208.33
3	Wednesday, February 19, 2025	72	143	198.61
4	Thursday, February 20, 2025	72	128	177.78
5	Friday, February 21, 2025	72	126	175.00
6	Saturday, February 22 2025	72	151	209.72
7	Sunday, February 23 2025	72	145	201.39
			Max	234.72
			Average	200.79
			Min	175.00

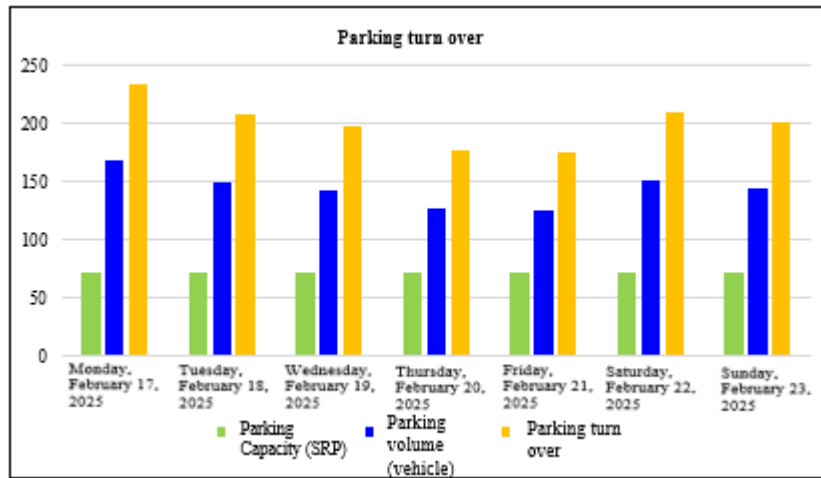


Figure 8. Parking turnover

Based on Table 6 and Figure 8 above, it can be seen that the highest motorcycle parking turnover rate is 234.72%, the average value is 200.79%, and the minimum value is 175.00%. This shows that motorcycle parking performance is quite high, exceeding 100%.

Parking index

Parking performance can also be seen based on the parking index figure. The motorcycle parking index value at Marzoeki Mahdi Hospital which is based on the maximum parking accumulation. The parking index after going through the calculation stage is presented in Table 7 and Figure 9 as follows:

Table 7. Parking index

No	Day/Date	Parking Capacity (SRP)	Parking Accumulation (Maximum)	Parking Index (%)
1	Monday, February 17, 2025	124	210	169.35
2	Tuesday, February 18, 2025	124	190	153.23
3	Wednesday, February 19, 2025	124	188	151.61
4	Thursday, February 20, 2025	124	220	177.42
5	Friday, February 21, 2025	124	188	151.61
6	Saturday, February 22, 2025	124	141	113.71
7	Sunday, February 23, 2025	124	142	114.52
		Max		177.42
		Average		147.35
		Min		113.71

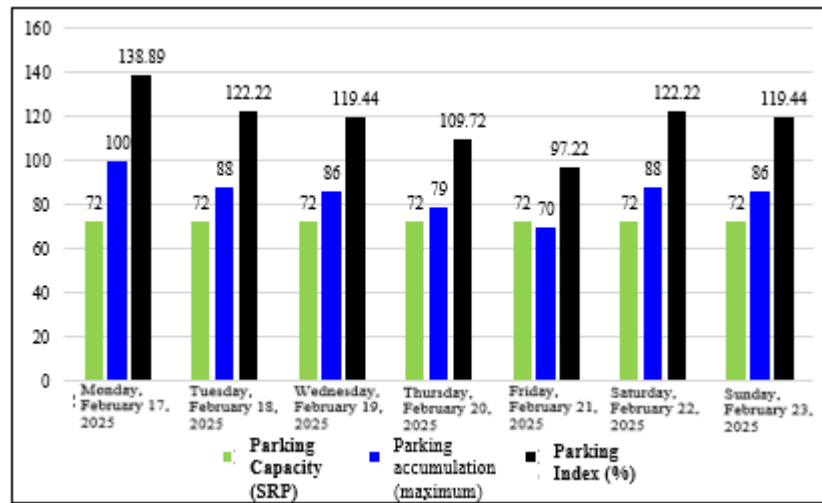


Figure 9. Parking Index

Based on Table 7 and Figure 9 above, the motorcycle parking index that occurs at the maximum value is 138.89%, for the average value is 147.35%, and the minimum value is 113.71% (based on the maximum accumulation). From the parking index value obtained, it is stated that the demand for parking space is greater than the parking capacity because it has an index value of more than 100%.

Parking Space Needs Analysis
Parking space needs

A recapitulation of parking space needs (Z) at Marzoeki Mahdi Hospital is obtained as presented in Table 8 and Figure 10 as follows:

Table 8. Parking space needs

No	Day/Date	Survey Duration (Hours)	Parking Volume (Vehicles)	Average Duration (Hours)	Parking Space Needs
1	Monday, February 17, 2025	10	169	3:57	66
2	Tuesday, February 18, 2025	10	150	3:34	55
3	Wednesday, February 19, 2025	10	143	4:35	65
4	Thursday, February 20, 2025	10	128	4:58	63
5	Friday, February 21, 2025	10	126	4:41	59
6	Saturday, February 22, 2025	10	151	4:48	72
7	Sunday, February 23, 2025	10	145	4:34	66
				Max	72
				Average	64
				Min	55

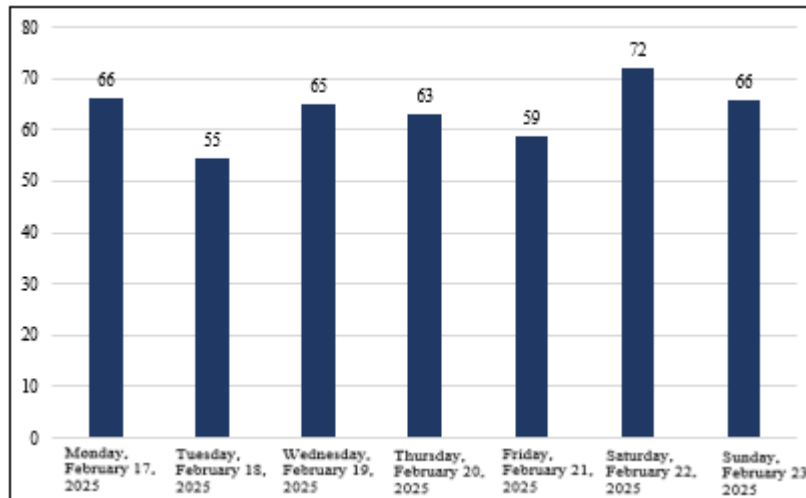


Figure 10. Parking space requirements

Based on Table 8 and Figure 10 above, it shows that the largest parking space requirement for motorbikes at Karya Marzoeki Mahdi Hospital occurred on Thursday, February 13, 2025, amounting to 72 SRP.

Parking space capacity requirement standards

Based on the data analysis carried out, the available parking capacity and parking space requirements can be determined by analyzing the number of vehicles parked against the number of parking spaces available, if the parking space requirements are greater than the available parking capacity, it means that the number of parking spaces available is insufficient. If the parking space requirements are smaller than the available parking capacity, it means that the number of parking spaces available is still able to accommodate vehicles that will park in the parking area. The need for parking space based on the largest Z formula approach is determined as the value of the parking space requirements that must be met by Marzoeki Mahdi Hospital. If the need for parking space is determined based on the results of field research, then the value of the parking space requirement taken is when the maximum accumulation occurs. The following is a comparison of the need for parking space to the existing parking space capacity [18], which is presented in Table 9 and Figure 11.

Table 9. Parking space capacity requirement

No	Day/Date	Parking Space Needs	Parking Space Capacity	Parking Space Capacity Difference (+/-)
1	Monday, February 17, 2025	66	63	-3
2	Tuesday, February 18, 2025	55	63	8
3	Wednesday, February 19, 2025	65	63	-2
4	Thursday, February 20, 2025	63	63	0
5	Friday, February 21, 2025	59	63	4
6	Saturday, February 22, 2025	72	63	-9
7	Sunday, February 23, 2025	66	63	-3
			Max	8
			Average	-1
			Min	-9

Description: (+) = Parking Space Capacity is still sufficient
(-) = Parking Space Capacity is not sufficient

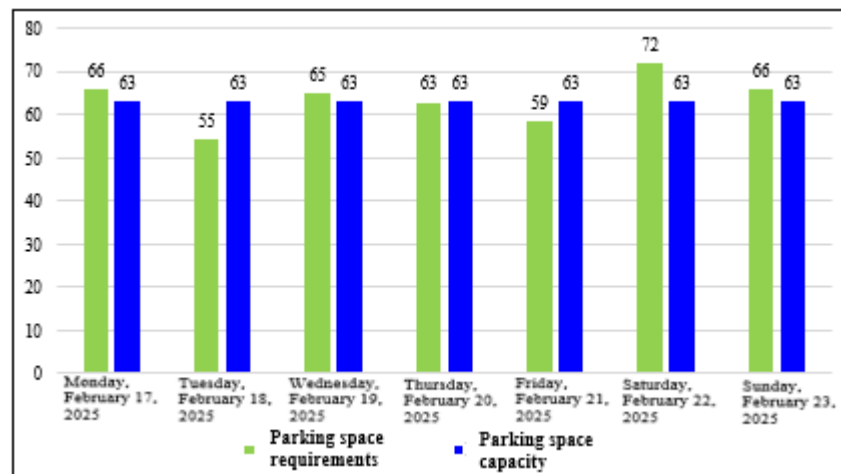


Figure 11. Parking space capacity requirements

Based on Table 9 and Figure 11 above, the parking space requirement value, approach is greater than its static capacity. If the parking space requirement value is determined based on the maximum accumulation that occurs (field survey results), then the parking space requirement for static capacity requires additional space for the parking area.

CONCLUSION

Based on the survey results and data analysis obtained, namely the existing parking conditions, secondary data was obtained using the survey method, resulting in existing data of 168m² of motorcycle parking area with a capacity of 74 SRP (Parking Space Units) with a slope angle of 90° at the Marzoeki Mahdi Hospital. In this analysis study, the results of the largest accumulated stasis capacity were 100 vehicles with an average parking duration of 11:15 hours on the peak day, namely Monday, February 17, 2025. During the seven days of the survey, it was found that the maximum parking volume was 169 vehicles with a maximum vehicle parking accumulation of 88 vehicles which occurred on Tuesday, February 18, 2025. The highest motorcycle parking turnover at Marzoeki Mahdi Hospital reached 234.72%, indicating that motorcycle parking performance is quite high. The capacity of motorcycle parking space at Karya Bhakti Pratiwi Hospital cannot meet existing parking needs. This is indicated by looking at the parking index exceeding capacity.

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