

Evaluation of Parking Space Needs at Medika Dramaga Hospital

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ABSTRACT

Medika Dramaga Hospital is located in Margajaya Village, West Bogor District, Bogor City. This hospital is owned by a private party, has obtained an operational permit for health services since 2010. With the increasing population density of West Bogor, 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 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 285m² has a parking capacity of 70 SRP. In this analysis study, the results of the largest accumulated static capacity were 75 vehicles with an average parking duration of 09:23 hours on the peak day, namely Thursday, February 6, 2025. During the seven days of the survey, it was found that the maximum parking volume was 171 vehicles with a maximum vehicle parking accumulation of 120 vehicles which occurred on Monday, February 3, 2025. The highest motorcycle parking turnover at Medika Dramaga Hospital reached 244.29%, indicating that motorcycle parking performance is quite high. The capacity of motorcycle parking space at Medika Dramaga Hospital cannot meet existing parking needs. This is indicated by looking at the parking index exceeding 100%.

Keywords: parking, parking space units (SRP), parking space needs, parking capacity, hospital.

INTRODUCTION

Hospitals are an important element in health services for the community and hospitals are also the center of many people's activities, such as medical staff and patients seeking treatment. Hospitals must provide the best service to the community, such as decent buildings, good service, and provide parking for visitors. Therefore, adequate parking facilities are an important element so that vehicle owners who visit the hospital feel comfortable and safe when parking their vehicles. Parking is one of the elements of facilities that cannot be separated from the overall highway transportation system. The increasing population of a city will increase the need to carry out various activities. Most residents in big cities travel using private vehicles so that indirectly an adequate amount of parking space is needed [1], [2].

Parking facilities in train station areas are important elements of transportation systems because they support passenger mobility and encourage the integration of private and public transport. Train stations usually attract large numbers of passengers, commuters, employees, and service vehicles every day [3-4]. Therefore, parking areas at stations must be designed to provide efficient circulation, safety, and accessibility for users. Station parking generally includes spaces for cars, motorcycles, bicycles, taxis, buses, and ride-sharing vehicles. In many urban areas, park-and-ride facilities are developed around train stations to encourage travelers to leave private vehicles and continue their journeys using rail transport. Effective parking management at stations helps reduce traffic congestion, improves passenger convenience, and supports sustainable transportation systems. Adequate lighting, pedestrian pathways, signage, and security systems are also essential components of station parking design to ensure user comfort and safety [5-8].

Hospital parking areas are essential components of healthcare facilities because they support accessibility, operational efficiency, and patient safety. Hospitals experience high traffic volumes

from patients, visitors, medical staff, ambulances, and service vehicles. Therefore, parking areas must be carefully planned to accommodate different user groups while ensuring smooth circulation and minimal congestion. Hospital parking facilities are usually divided into several zones, including emergency parking, outpatient parking, inpatient visitor parking, staff parking, motorcycle parking, and loading areas for logistics and medical supplies [9-12]. Proper parking management helps reduce delays, improves emergency response times, and enhances the comfort and convenience of hospital users. In addition, hospitals often require accessible parking spaces for disabled patients and elderly visitors, located close to entrances in accordance with accessibility standards [13-16].

Parking refers to a parking system where access and exit are controlled using barriers, gates, or electronic systems. Vehicles entering the parking area receive tickets, smart cards, or digital registrations, and payment is usually calculated based on parking duration. Closed parking systems are commonly used in hospitals because they improve security, monitor vehicle movements, and reduce unauthorized parking. These systems also help hospital management regulate parking capacity and increase operational efficiency through automated monitoring technologies such as CCTV and sensors. Furthermore, closed parking can reduce traffic conflicts and vehicle theft risks within hospital environments [17]. The integration of closed parking systems with modern technologies, including automatic payment systems and parking guidance information, contributes to better service quality and more organized transportation management within hospital facilities [18].

RESEARCH METHOD

Research Location

The location of this research was conducted at the Medika Dramaga Hospital, Dramaga District, Bogor Regency. The research was conducted for 1 week, starting from February 3, 2025 to February 9, 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. 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 Medika Dramaga Hospital that enter and exit.
2. Literature study
This literature study is conducted by collecting, identifying, and processing written data obtained.

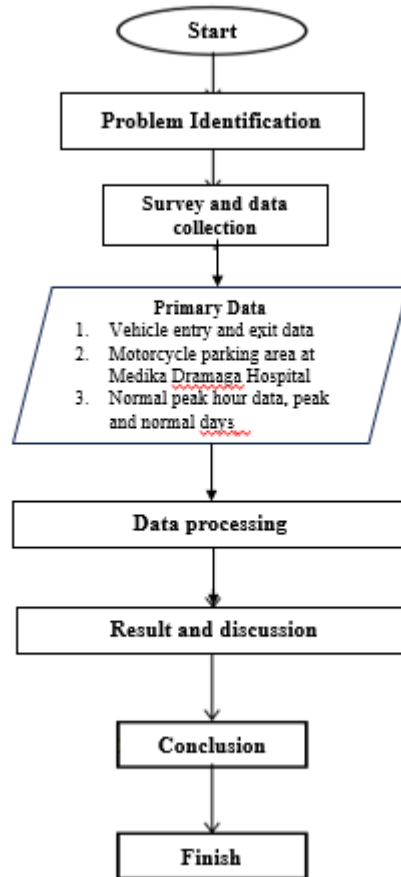


Figure 2. Flowchart

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 15 minutes, then calculate the number of vehicles according to the time interval group and to obtain the right parking space requirement figure for the land at the Medika Dramaga Hospital, find the long parking time interval group that has the most number of parked motorbikes. The selected and correct parking space requirement figure is used to calculate the Parking Space Unit (SRP) requirement.
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 Medika Dramaga Hospital [2] produces parking problems and capacity.
4. Data processing with the Microsoft Excel program.

RESULTS AND DISCUSSION

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, it can be determined the amount of parking space needed to

accommodate the volume of parking vehicles that occur. The greater the volume of vehicles, the greater the need for parking space. Furthermore, an analysis of the survey data was carried out to obtain the parking volume at the study location for 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 3 2025	07:00 - 17:00	171
2	Tuesday, February 4 2025	07:00 - 17:00	159
3	Wednesday, February 5 2025	07:00 - 17:00	154
4	Thursday, February 6, 2025	07:00 - 17:00	162
5	Friday, February 7, 2025	07:00 - 17:00	151
6	Saturday, February 8 2025	07:00 - 17:00	145
7	Sunday, February 9 2025	07:00 - 17:00	148

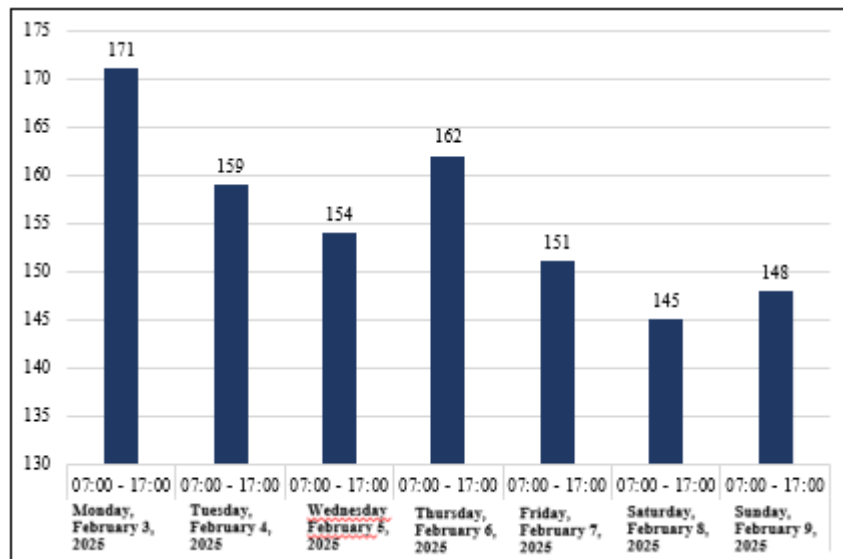


Figure 3. Motorcycle parking volume

Based on Table 1 and Figure 3, the maximum motorcycle parking volume occurred on Monday, February 3, 2025 with a total of 171 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 3 2025	07:00 - 07:15	10
2	Tuesday, February 4 2025	07:00 - 07:15	12
3	Wednesday, February 5 2025	07:30 - 07:45	13
4	Thursday, February 6, 2025	07:30 - 07:45	11
5	Friday, February 7, 2025	08:00 - 08:15	12
6	Saturday, February 8 2025	07:30 - 07:45	10
7	Sunday, February 9 2025	07:30 - 07:45	11

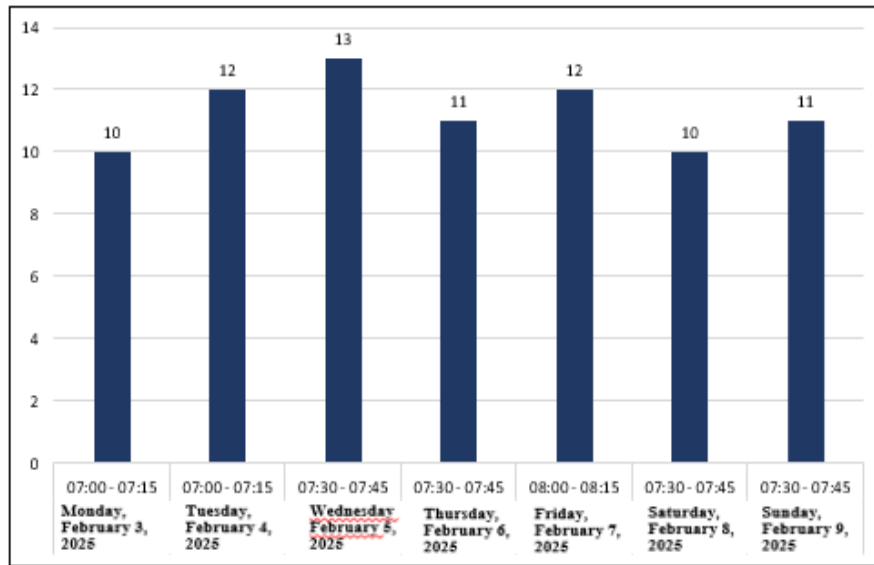


Figure 4. Peak vehicle entry hours

Based on Table 2 and Figure 4 above, it can be seen that the highest peak vehicle entry hour period occurred on Wednesday, February 5, 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 3 2025	16:45 - 17:00	12
2	Tuesday, February 4 2025	16:45 - 17:00	13
3	Wednesday, February 5 2025	16:30 - 16:45	12
4	Thursday, February 6, 2025	16:30 - 16:45	14
5	Friday, February 7, 2025	16:45 - 17:00	16
6	Saturday, February 8 2025	16:30 - 16:45	9
7	Sunday, February 9 2025	16:15 - 16:30	10

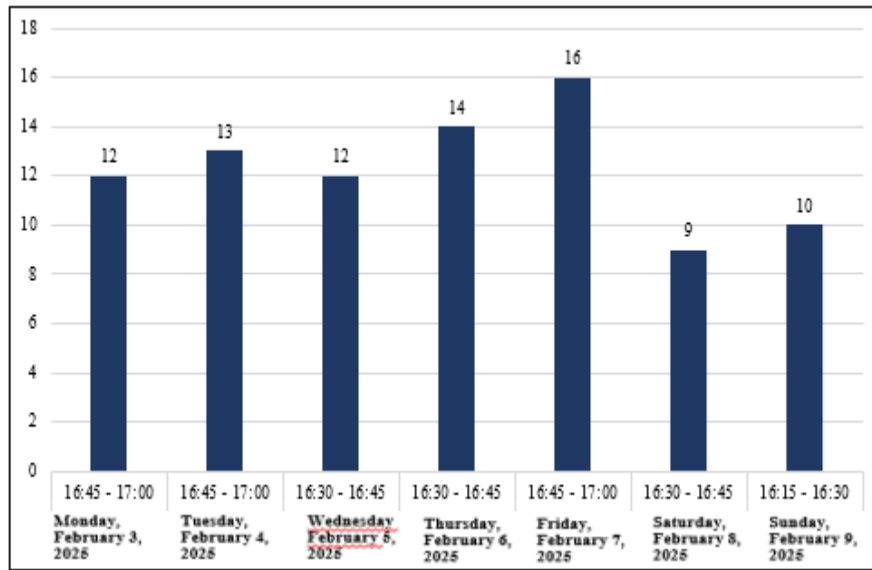


Figure 5. Peak vehicle exit hours

Based on Table 3 and Figure 5 above, it can be seen that the highest peak vehicle exit hour period occurred on Friday, February 7, 2025 with a total of 16 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 Medika Dramaga 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 3 2025	11:15 - 11:30	120
2	Tuesday, February 4 2025	12:00 - 12:15	111
3	Wednesday, February 5 2025	10:45 - 11:00	111
4	Thursday, February 6, 2025	12:00 - 12:15	110
5	Friday, February 7, 2025	11:15 - 11:30	107
6	Saturday, February 8 2025	12:00 - 12:15	101
7	Sunday, February 9 2025	13:15 - 13:30	104

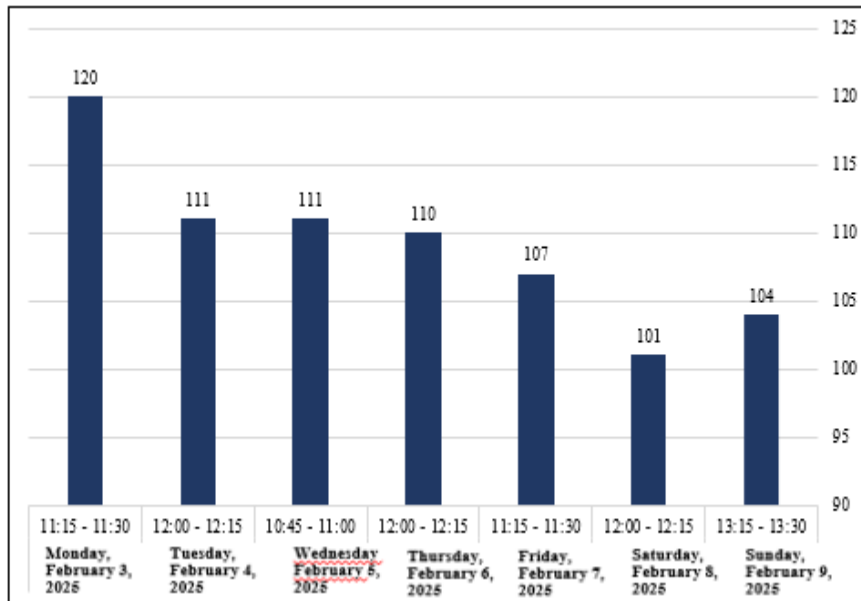


Figure 6. Maximum parking accumulation

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 3 2025	07:00 - 17:00	07:34	02:10	04:21
2	Tuesday, February 4 2025	07:00 - 17:00	08:21	00:28	04:44
3	Wednesday, February 5 2025	07:00 - 17:00	09:22	01:37	04:39
4	Thursday, February 6, 2025	07:00 - 17:00	09:23	00:48	04:37
5	Friday, February 7, 2025	07:00 - 17:00	08:45	00:53	04:42
6	Saturday, February 8 2025	07:00 - 17:00	09:23	00:10	04:21
7	Sunday, February 9 2025	07:00 - 17:00	07:25	00:17	04:33
	Max			09:23	
	Average			04:34	
	Min			00:10	

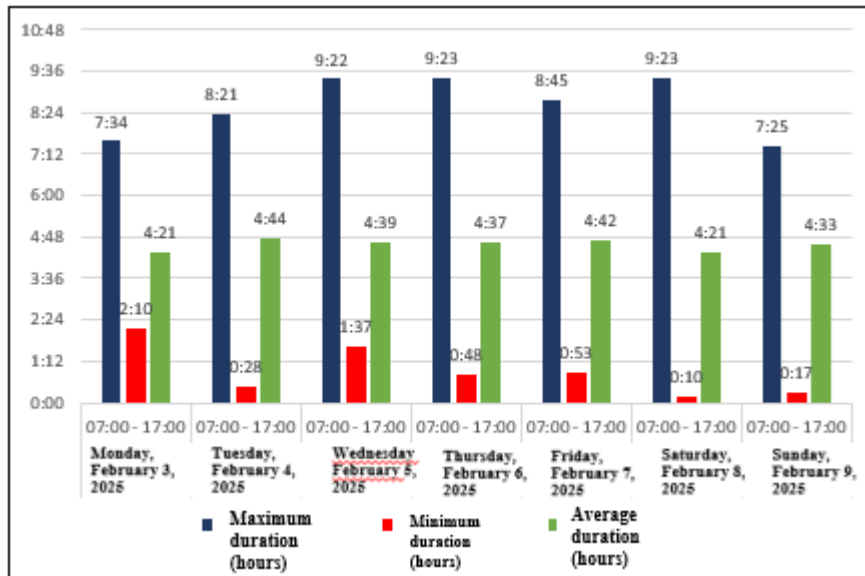


Figure 7. Parking duration

Based on Table 5 and Figure 7 above, the maximum duration occurred on Saturday, February 8, 2025, which was 9:23 hours. The average maximum duration occurred on Thursday, February 6, 2025, which was 04:37 hours, and the minimum duration occurred on Saturday, February 8, 2025, which was 0:10 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 3 2025	70	171	244.29
2	Tuesday, February 4 2025	70	159	227.14
3	Wednesday, February 5 2025	70	154	220.00
4	Thursday, February 6, 2025	70	162	231.43
5	Friday, February 7, 2025	70	151	215.71
6	Saturday, February 8 2025	70	145	207.14
7	Sunday, February 9 2025	70	148	211.43
		Max		244.29
		Average		222.45
		Min		207.14

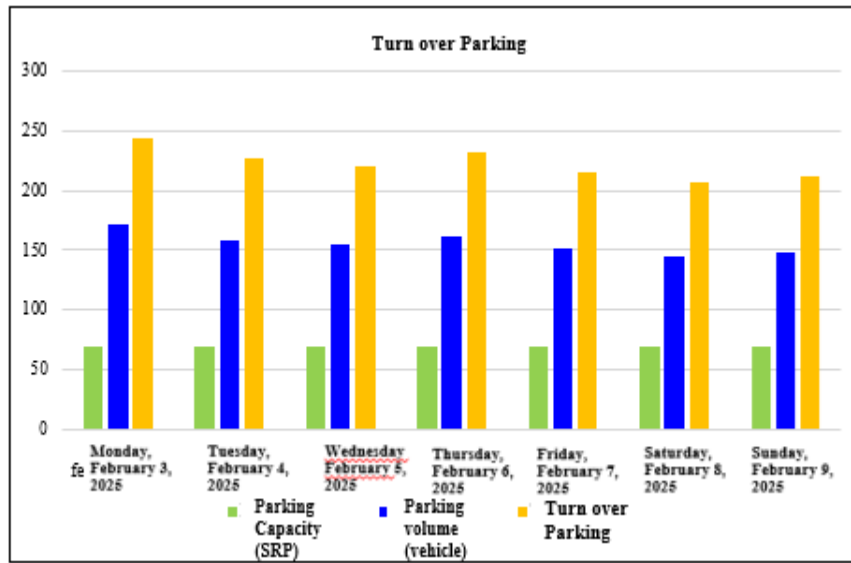


Figure 8. Parking turnover

Based on Table 6 and Figure 8 above, it can be seen that the highest motorcycle parking turnover rate is 244.29%, the average value is 222.45%, and the minimum value is 207.14%. 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 Karya Bhakti Pratiwi Hospital 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 3 2025	70	120	171.43
2	Tuesday, February 4 2025	70	111	158.57
3	Wednesday, February 5 2025	70	111	158.57
4	Thursday, February 6, 2025	70	110	157.14
5	Friday, February 7, 2025	70	107	152.86
6	Saturday, February 8 2025	70	101	144.29
7	Sunday, February 9 2025	70	104	148.57
		Max		171.43
		Average		155.92
		Min		144.29

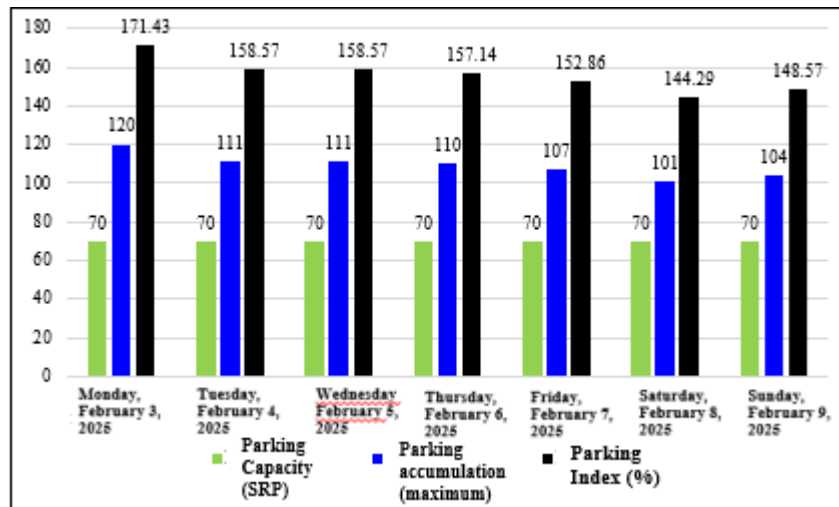


Figure 9. Parking Index

Based on Table 7 and Figure 9 above, the motorcycle parking index that occurs at the maximum value is 171.43%, for the average value is 155.92%, and the minimum value is 144.29% (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

From the calculation results using equation 2, a recapitulation of parking space needs (Z) at Karya Bhakti Pratiwi Hospital is obtained as presented in Table 8 and Figure 10 as follows:

Table 8. Parking space requirements

No	Day/Date	Survey Duration (Hours)	Parking Volume (Vehicles)	Average Duration (Hours)	Parking Space Needs
1	Monday, February 3 2025	10	171	04:21	74
2	Tuesday, February 4 2025	10	159	04:44	75
3	Wednesday, February 5 2025	10	154	04:39	72
4	Thursday, February 6, 2025	10	162	04:37	75
5	Friday, February 7, 2025	10	151	04:42	71
6	Saturday, February 8 2025	10	145	04:21	63
7	Sunday, February 9 2025	10	148	04:33	67
		Max			75
		Average			71
		Min			63

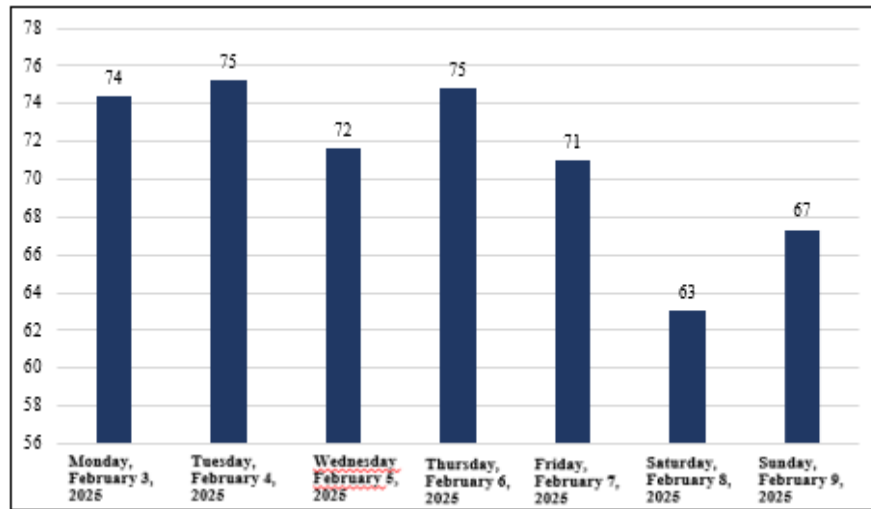


Figure 10. Parking space requirements

Based on Table 8 and Figure 10 above, it shows that the highest parking space requirement for motorbikes at Medika Dramaga Hospital occurred on Monday, February 3, 2025, amounting to 75 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 requirement is greater than the available parking capacity, it means that the number of parking spaces available is insufficient. If the parking space requirement is 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 parking space requirement based on the largest Z formula approach is determined as the value of the parking space requirement that must be met by Medika Dramaga Hospital. If the parking space requirement is determined based on the results of research in the field, then the parking space requirement value taken is when the maximum accumulation occurs. The following is a comparison of parking space requirements to parking space capacity presented in Table 9 and Figure 11.

Table 9. Parking space capacity requirements

No	Day/Date	Parking Space Needs	Parking Space Capacity	Parking Space Capacity Difference (+/-)
1	Monday, February 3 2025	74	70	-4
2	Tuesday, February 4 2025	75	70	-5
3	Wednesday, February 5 2025	72	70	-2
4	Thursday, February 6, 2025	75	70	-5
5	Friday, February 7, 2025	71	70	-1
6	Saturday, February 8 2025	63	70	7
7	Sunday, February 9 2025	67	70	3
	Max			7
	Average			-1
	Min			-5

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

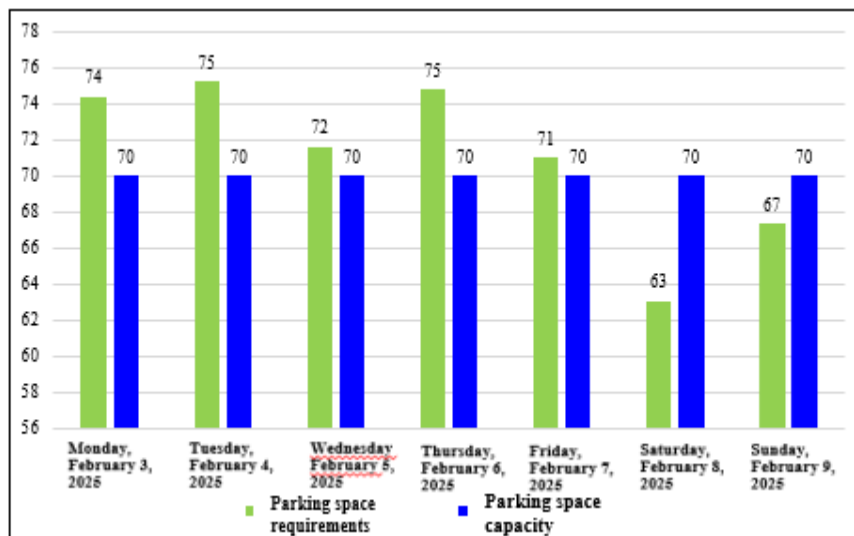


Figure 11. Parking space capacity requirements

Based on Table 9 and Figure 11 above, it shows that the parking space requirement value based on the equation 2.6 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 285m² of motorcycle parking area with a capacity of 70 (Parking Space Units) SRP and a slope angle of 90° at the Dramaga Medika Hospital. In this analysis study, the results of the largest accumulated stasis capacity were 251 vehicles with an average parking duration of 9:23 hours on Thursday, February 6, 2025. During the seven days of the survey, it was found that the maximum parking volume was 171 vehicles with a maximum vehicle parking accumulation of 120 vehicles which occurred on Monday, February 3, 2025, the highest motorcycle parking turnover at the Medika Dramaga Hospital reached 244.29%, this shows that motorcycle parking performance is quite high. The capacity of motorcycle parking space at the Medika Dramaga Hospital cannot meet existing parking needs. This is indicated by looking at the parking index exceeding 100%.

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