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Evaluation of Parking Space Needs for Karya Bhakti Pratiwi Hospital

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ABSTRACT

Karya Bhakti Pratiwi Hospital is located in the Dramaga area of Bogor Regency. This hospital is owned by an individual, namely PT Karya Bhakti Pratiwi, built on 4,715 square meters of land, Karya Bhakti Pratiwi Hospital has obtained an operational permit for Health services since 2012. 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 310m2 has a parking capacity of 120 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 274 vehicles with a maximum vehicle parking accumulation of 220 vehicles which occurred on Thursday, February 13, 2025. The highest motorcycle parking turnover at Cilebut Station reached 220.97%, this shows 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 100%.

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

INTRODUCTION

A hospital is an organization that through organized professional medical personnel and permanent medical infrastructure organizes medical services, continuous nursing care, diagnosis and treatment of diseases suffered by patient. 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. 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 [1-4].

Parking on hospital and campus land is an essential component of transportation management because it supports accessibility, mobility, safety, and traffic circulation within public service areas. Hospitals and campuses are activity centers that attract large numbers of vehicles, including private cars, motorcycles, public transportation, ambulances, service vehicles, and bicycles. Therefore, proper parking planning is necessary to prevent traffic congestion and maintain operational efficiency [5-7].

In hospital areas, parking facilities must prioritize accessibility, emergency movement, and user convenience. Hospitals require organized parking systems to accommodate patients, visitors, medical staff, and emergency vehicles. Special parking spaces should be provided for ambulances, disabled users, doctors, and hospital employees to ensure efficient circulation and rapid emergency

response. Poor parking management in hospitals may cause vehicle accumulation, traffic conflicts, and delays in emergency services. Therefore, hospitals commonly implement parking zoning systems, entry-exit management, and smart parking technologies to improve efficiency and safety [8-10].

On campus land, parking management is important to support academic activities and reduce traffic congestion around educational environments. University and school campuses generally experience high vehicle demand during peak hours when students, lecturers, and staff arrive or leave simultaneously [11-13]. Parking concepts on campuses emphasize traffic circulation, pedestrian safety, environmental sustainability, and efficient land use. Many campuses apply parking area classification, parking permits, and integrated transportation systems to manage parking demand effectively. Some universities also encourage sustainable transportation by providing bicycle parking, pedestrian facilities, and shuttle bus services. [14-15]

Modern parking concepts for hospitals and campuses increasingly use smart transportation technology such as IoT-based parking sensors, CCTV monitoring, automatic ticketing systems, and digital parking information systems. These technologies help improve parking efficiency, reduce searching time for parking spaces, minimize congestion, and enhance user comfort. Therefore, effective parking management on hospital and campus land plays an important role in supporting sustainable transportation systems, operational performance, and the quality of public services [16].

RESEARCH METHODS

Research Location

The location of this research was conducted at Karya Bhakti Pratiwi Hospital, Dramaga District, Bogor Regency. The research was conducted for 1 week, starting from February 10, 2025 to February 16, 2025 in 1 week the research was conducted 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 Karya Bhakti Pratiwi Hospital parking area that enter and exit.

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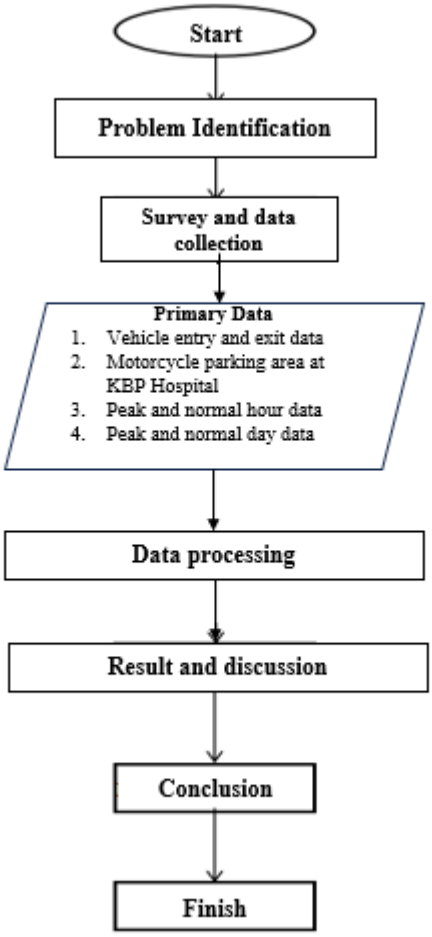

Figure 2. Flowchart

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 parking in the Karya Bhakti Pratiwi Hospital, find the long parking time interval group that has the most number of parked motorbikes. The selected and appropriate parking space requirement figures are used to calculate the Parking Space Unit (SRP) requirement using a formula approach from the [17].
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 parking in the Karya Bhakti Pratiwi Hospital, are calculated using the equation and the produces parking problems and capacity [17].
4. Data processing with Microsoft Excel program.

RESULTS AND DISCUSSION

Vehicle Recording When Entering and Exiting

1. 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. 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 10, 2025	07:00 - 17:00	263
2	Tuesday, February 11, 2025	07:00 - 17:00	255
3	Wednesday, February 12 2025	07:00 - 17:00	253
4	Thursday, February 13, 2025	07:00 - 17:00	274
5	Friday, February 14, 2025	07:00 - 17:00	252
6	Saturday, February 15, 2025	07:00 - 17:00	237
7	Sunday, February 16 2025	07:00 - 17:00	228

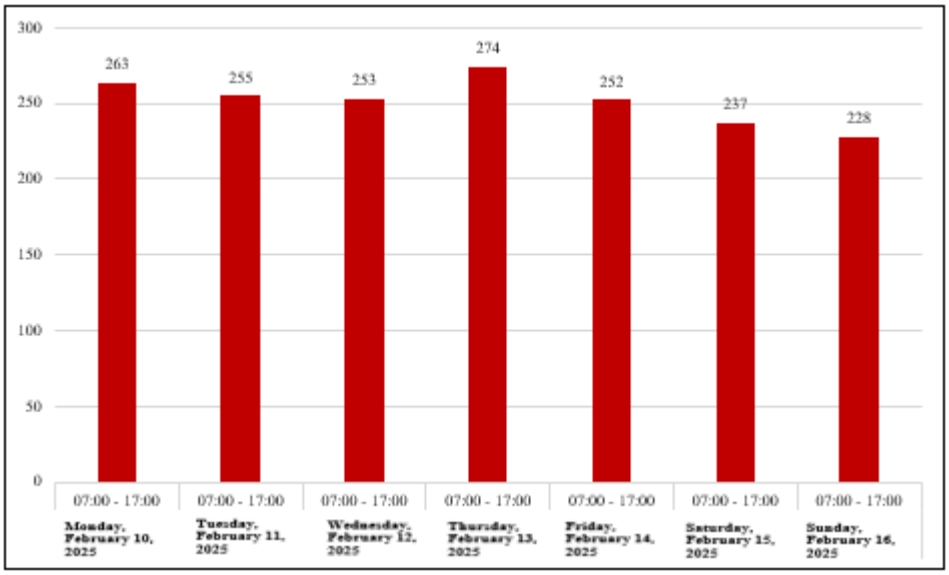

Figure 3. Motorcycle parking volume

Based on Table 1 and Figure 3, the maximum motorcycle parking volume occurred on Thursday, February 13, 2025 with a total of 274 vehicles.

2. 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 10, 2025	07:15 - 07:30	23
2	Tuesday, February 11, 2025	07:00 - 07:15	22
3	Wednesday, February 12 2025	07:15 - 07:30	23
4	Thursday, February 13, 2025	07:45 - 08:00	24
5	Friday, February 14, 2025	07:00 - 07:15	20

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No	Day/Date	Time	Number of Vehicles
6	Saturday, February 15, 2025	07:30 - 07:45	21
7	Sunday, February 16 2025	08:00 - 08:15	16

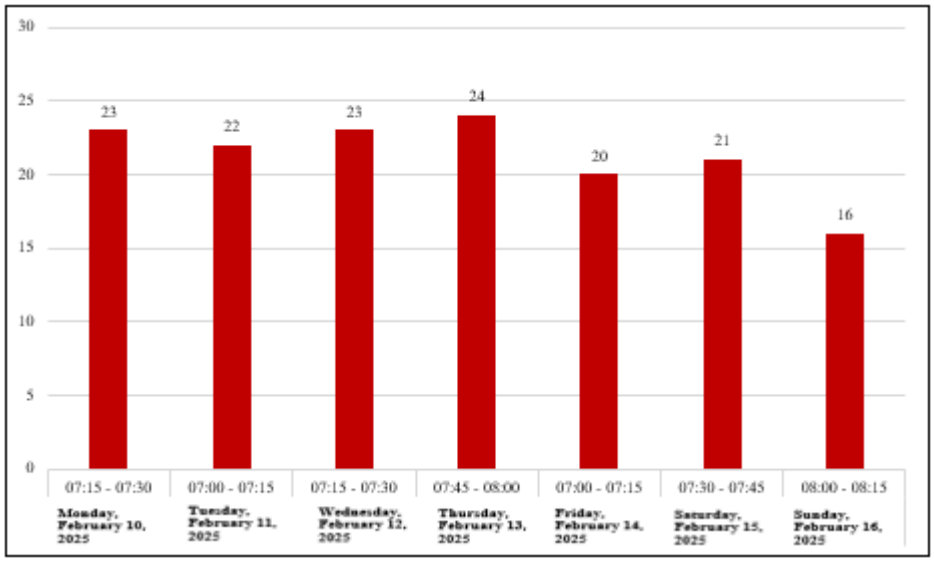

Figure 4. Peak vehicle entry hours

Based on Table 2 and Figure 4 above, it can be seen that the highest peak vehicle entry hour period occurred on Thursday, February 13, 2025 with a total of 24 vehicles.

3. Peak vehicle exit hours

The peak vehicle exit hours are the time periods when drivers exit the parking area. In this case, the peak vehicle exit hours are 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 hours

No	Day/Date	Time	Number of Vehicles
1	Monday, February 10, 2025	16:30 - 16:45	29
2	Tuesday, February 11, 2025	16:45 - 17:00	25
3	Wednesday, February 12 2025	16:00 - 16:15	26
4	Thursday, February 13, 2025	15:45 - 16:00	26
5	Friday, February 14, 2025	16:30 - 16:45	23
6	Saturday, February 15, 2025	16:45 - 17:00	18
7	Sunday, February 16 2025	16:15 - 16:30	20

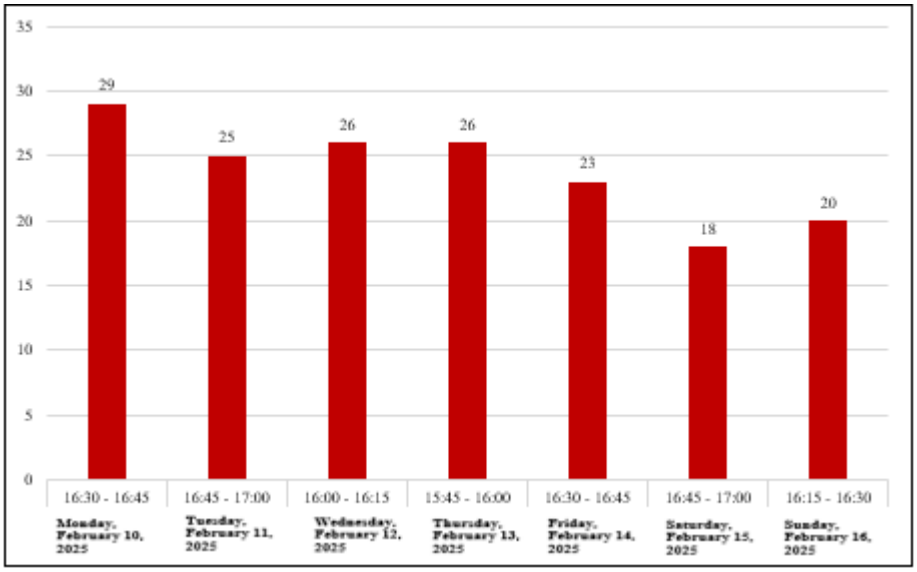

Figure 5. Peak vehicle exit hours

Based on Table 3 and Figure 5 above, it can be seen that the highest peak vehicle exit hour period occurred on Monday, February 10, 2025 with a total of 29 vehicles.

Matching Vehicle Data Entering and Exiting

1. 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 drivers at the Karya Bhakti Pratiwi 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 10, 2025	11:00 - 11:15	210
2	Tuesday, February 11, 2025	11:00 - 11:15	190
3	Wednesday, February 12 2025	11:00 - 11:15	188
4	Thursday, February 13, 2025	12:00 - 12:15	220
5	Friday, February 14, 2025	11:45 - 12:00	188
6	Saturday, February 15, 2025	12:45 - 13:00	141
7	Sunday, February 16 2025	12:30 - 12:45	142

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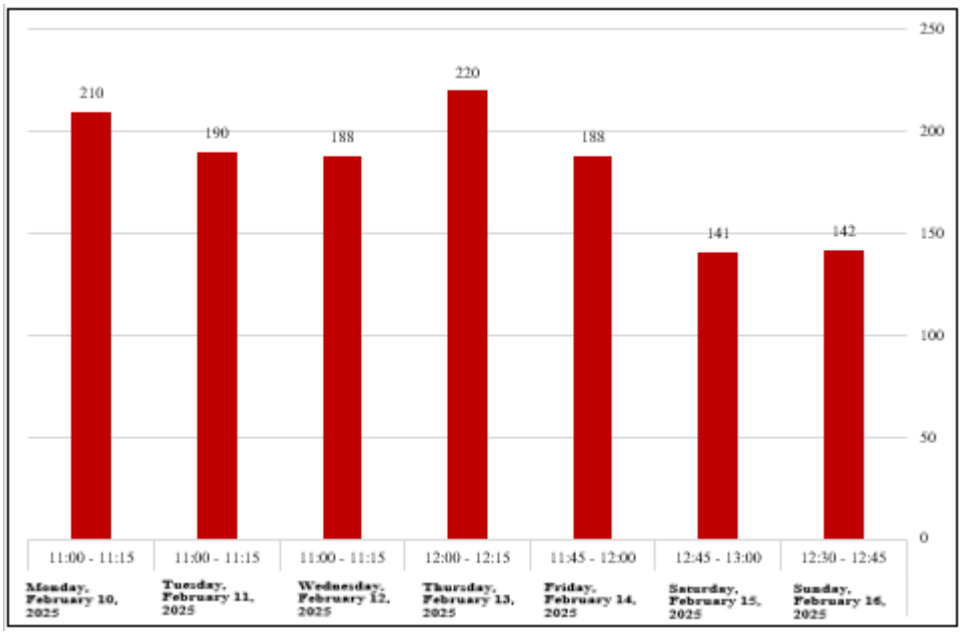

Figure 6. Maximum parking accumulation

2. 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 10, 2025	07:00 - 17:00	09:47	01:04	05:14
2	Tuesday, February 11, 2025	07:00 - 17:00	09:48	00:28	05:12
3	Wednesday, February 12 2025	07:00 - 17:00	09:38	00:24	05:15
4	Thursday, February 13, 2025	07:00 - 17:00	09:32	00:15	05:21
5	Friday, February 14, 2025	07:00 - 17:00	09:39	00:56	05:01
6	Saturday, February 15, 2025	07:00 - 17:00	09:26	00:27	04:25
7	Sunday, February 16 2025	07:00 - 17:00	09:34	00:30	04:15
	Max			09:48	
	Average			05:01	
	Min			00:15	

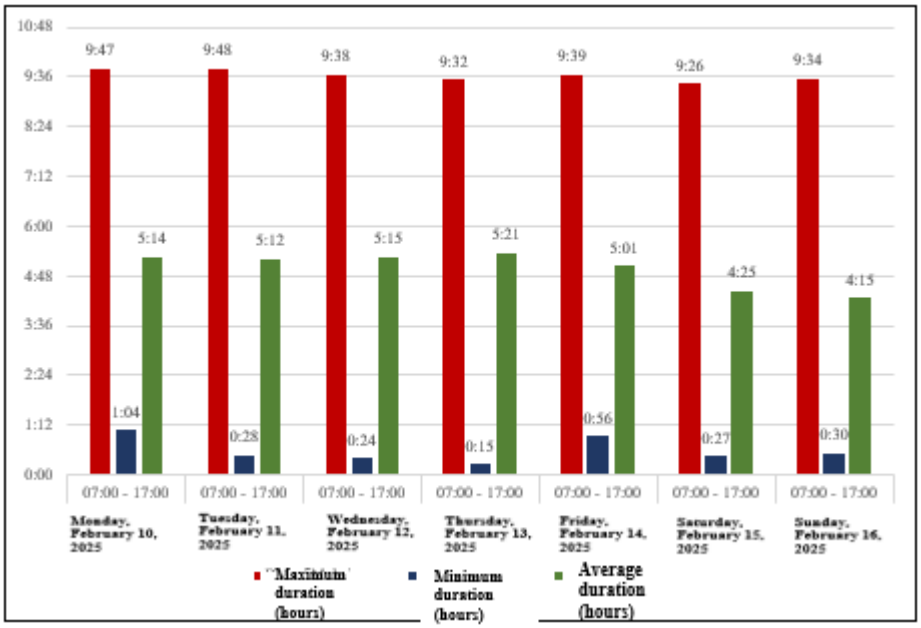

Figure 7. Parking duration

Based on Table 5 and Figure 7 above, the maximum duration occurred on Tuesday, February 11, 2025, at 9:48 hours. The average maximum duration occurred on Friday, February 14, 2025, at 05:01 hours, and the minimum duration occurred on Thursday, February 13, 2025, at 0:15 hours.

3. 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 10, 2025	124	263	212.10
2	Tuesday, February 11, 2025	124	255	205.65
3	Wednesday, February 12 2025	124	253	204.03
4	Thursday, February 13, 2025	124	274	220.97
5	Friday, February 14, 2025	124	252	203.23
6	Saturday, February 15, 2025	124	237	191.13
7	Sunday, February 16 2025	124	228	183.87
		Max		220.97
		Average		203.00
		Min		183.87

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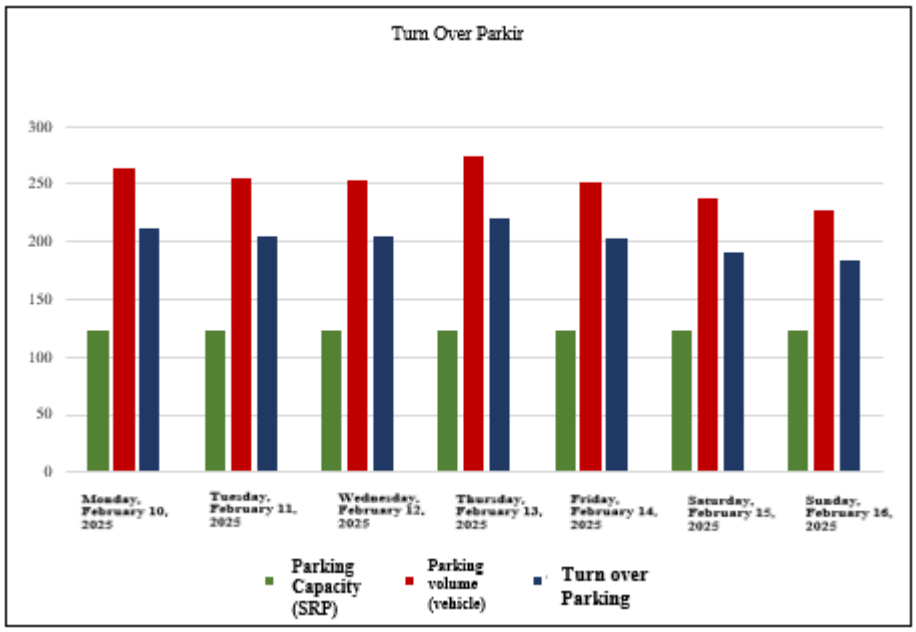

Figure 8. Parking turnover

Based on Table 6 and Figure 8 above, it can be seen that the highest motorcycle parking turnover rate is 220.97%, the average value is 203.00%, and the minimum value is 183.87%. This shows that motorcycle parking performance is quite high, exceeding 100%.

4. Parking index

Parking performance can also be seen based on the parking index figure. The motorcycle parking index value at Karya Bhakti Pratiwi 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 10, 2025	124	210	169.35
2	Tuesday, February 11, 2025	124	190	153.23
3	Wednesday, February 12 2025	124	188	151.61
4	Thursday, February 13, 2025	124	220	177.42
5	Friday, February 14, 2025	124	188	151.61
6	Saturday, February 15, 2025	124	141	113.71
7	Sunday, February 16 2025	124	142	114.52
		Max		177.42
		Average		147.35
		Min		113.71

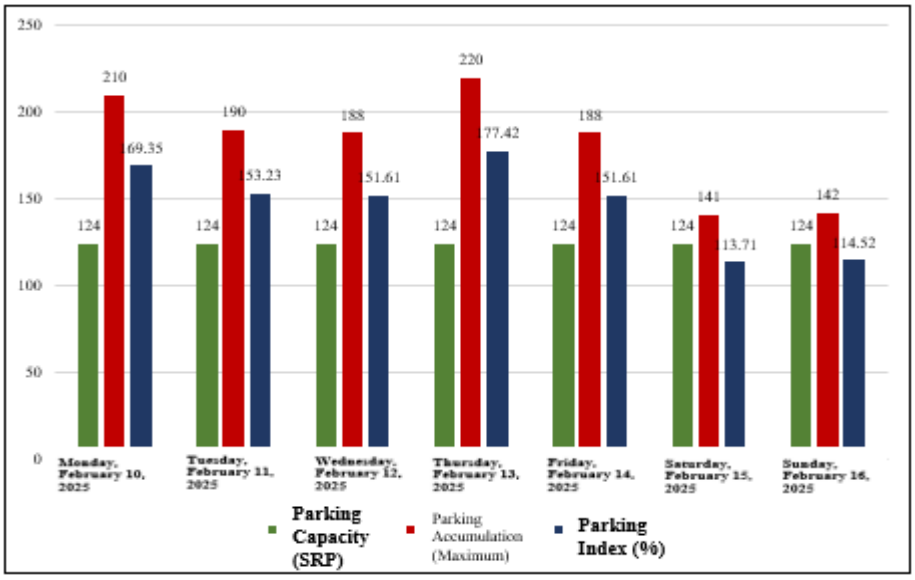

Figure 9. Parking Index

Based on Table 7 and Figure 9 above, the motorcycle parking index that occurs at the maximum value is 177.42%, 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

1. Parking space needs

From the calculation results, 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 needs

No	Day/Date	Survey Duration (Hours)	Parking Volume (Vehicles)	Average Duration (Hours)	Parking Space Needs
1	Monday, February 10, 2025	10	263	05:14	138
2	Tuesday, February 11, 2025	10	255	05:12	132
3	Wednesday, February 12 2025	10	253	05:15	133
4	Thursday, February 13, 2025	10	274	05:21	147
5	Friday, February 14, 2025	10	252	05:01	126
6	Saturday, February 15, 2025	10	237	04:25	105
7	Sunday, February 16 2025	10	228	04:15	97
		Max			147
		Average			125
		Min			97

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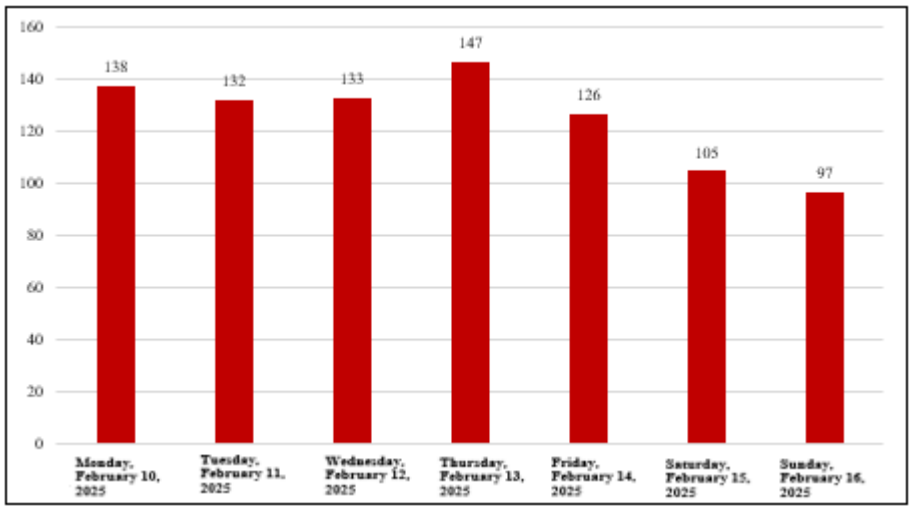

Figure 10. Parking space requirements

Based on Table 8 and Figure 10 above, it shows that the largest parking space requirement for motorbikes at Karya Bhakti Pratiwi Hospital occurred on Thursday, February 13, 2025, amounting to 147 SRP.

2. 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 Karya Bhakti Pratiwi 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 [17, 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 10, 2025	138	124	-14
2	Tuesday, February 11, 2025	132	124	-8
3	Wednesday, February 12 2025	133	124	-9
4	Thursday, February 13, 2025	147	124	-23
5	Friday, February 14, 2025	126	124	-2
6	Saturday, February 15, 2025	105	124	19
7	Sunday, February 16 2025	97	124	27
		Max		27
		Average		-1
		Min		-23

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

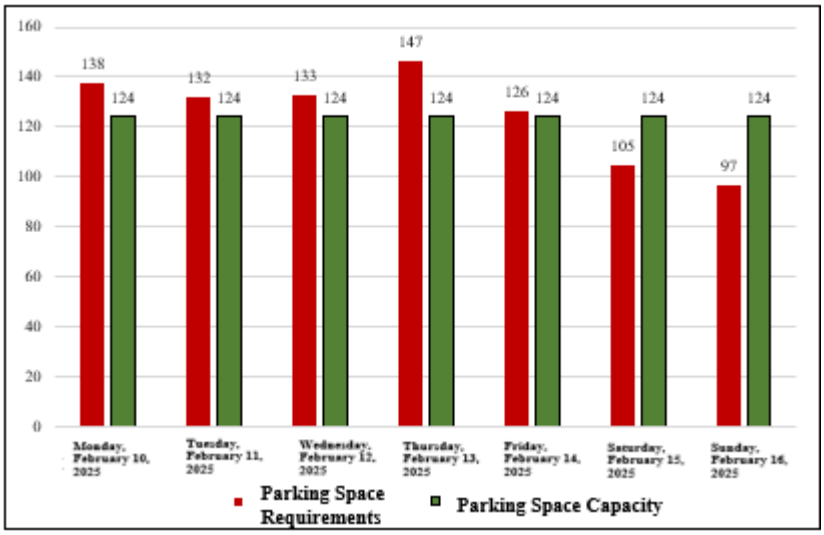

Figure 11. Parking space capacity requirements

Based on Table 9 and Figure 11 above, it shows that the parking space requirement value 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 310m2 of motorcycle parking area with a capacity of 124 SRP (Parking Space Units) with a slope angle of 90° at the Karya Bhakti Pratiwi Hospital. In this analysis study, the results of the largest accumulated stasis 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 274 vehicles with a maximum vehicle parking accumulation of 220 vehicles which occurred on Thursday, February 13, 2025. The highest motorcycle parking turnover at Karya Bhakti Pratiwi Hospital reached 220.97%, 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 100%.

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