ANALYSIS OF PARKING SPACE NEEDS IN RATU JEPARA MARKET

Bagas Prayoga[1*], Putri Anggi Permata S.[2], Farida Yudaningrum[3]

[1,2,3] Faculty of Engineering and Informatics, Universitas PGRI Semarang, Jl. Sidodadi-Timur No.24 Semarang, Central Java 50232, Indonesia

*bagaaprayoga@gmail.com

Abstract. Jepara Satu Market is a traditional market built by the Jepara Regency government. With the large number of sellers in the market, indirectly the number of visitors also increases every day. This is what causes Ratu Jepara Market to have the necessary facilities, namely the need for parking space. This research aims to analyze the capacity and need for parking space in the Ratu Jepara Market area and plan optimal parking patterns for motorbike and car parking. From the results of the analysis, the need for motorbike and car parking space in the Ratu Jepara Market parking area still meets existing capacity, namely of 390 SRP. The motorbike parking pattern used for on street motorbike parking in the Ratu Jepara market area uses a one-sided parking pattern, namely a 90° angle. Meanwhile, the on-street car parking pattern at Ratu Jepara market parking uses a 45° angle pattern, while the off-street car parking pattern uses a 90° angle parking pattern.

Keywords: Need for parking space, Ratu Jepara Market, Parking area

1. Introduction

Jepara Satu Market (Ratu Market) is a traditional market built by the Jepara Regency government. The building at the Jepara market has a land area of ±12,500.00 m2 with 2 floors, on the 1st floor for kiosk traders and the 2nd floor for stall or stall traders. The total number of traders at the Ratu Jepara market reaches 1500 traders with a total of 2,315 units accommodated in stalls/stalls/lots. The average number of market visitors every day is ± 2500 visitors. With the large number of sellers in the market, indirectly the number of visitors also increases every day. This is what causes Ratu Jepara Market to have the necessary facilities, one of which is the need for parking space [1]. You can see many two-wheeled vehicles (motorbikes) and four-wheeled vehicles (cars) parked on the side of the road. The increase in the number of vehicles will affect the need for parking space [2]. Initial observations show that parking in the Ratu Jepara Market area is off street and on street. However, many visitors park on the side of the road or on the street because there is a lack of adequate parking areas [3]. Currently there is a lack of arrangement on street parking in the Ratu Jepara Market area, whereas along the roads in Ratu Jepara Market there are office, school and business areas so that at certain times there is a buildup of vehicles which affects traffic performance.

In this case, it can be seen that the need for parking space is very necessary in areas that are centers of community activities, such as the Ratu Jepara market.

Based on the background that has been described, the objectives to be achieved in this research are analyzing the capacity and need for parking spaces in the Ratu Jepara Market area and planning the most optimal parking pattern for cars and motorbikes. By considering the studies that can be taken in this study and due to limitations in implementation, this study uses the following limitations:

a. The research location surveyed was Ratu Jepara Market.
b. The vehicles surveyed were cars and motorbikes.
c. Research data from field surveys.
d. Data collection was carried out 3 times on Monday, Thursday and Saturday (06.00-13.00 WIB).

2. Methods

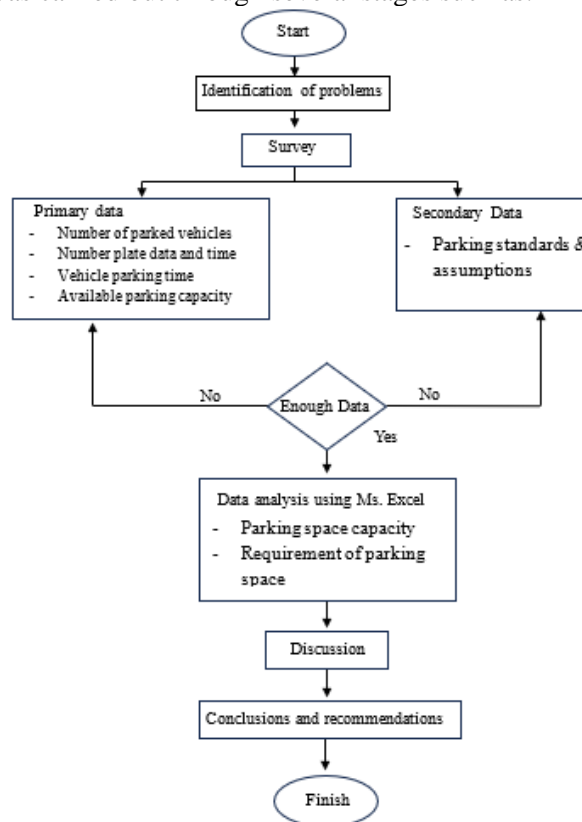In general, this research was carried out through several stages such as:

Figure 1. Flowchart Study
Source: Researcher, 2023

This research was conducted at Ratu Jepara Market located on Jalan Pelabuhan, Jobokuto, Jepara Regency. The type of data that will be used in this research consists of primary data and secondary data

a. Primary data in the form of vehicle plate number data and time is matched between those entering and leaving after matching, calculating the parking time based on entry and exit times using an equation formula approach to obtain parking characteristic results and produce parking space requirements.

b. Secondary data is supporting data that has been processed first. Secondary data sources are journals, articles, government publications, and other supporting sources. Secondary data in this research was obtained from the Department of Land Transportation's Technical Guidelines regarding parking standards and assumptions.

3. Results and Discussion

3.1 Dynamic Capacity

The dynamic capacity of this parking space depends on the average duration or length of time vehicles are parked. The shorter the duration, the greater the dynamic capacity of the parking space or conversely, the longer the duration, the less the dynamic capacity of the parking space. This dynamic capacity value is obtained using formula from Pignatoro (1973) [4] . The following is a dynamic capacity calculation:

a) Thursday, 7 September 2023

$$KD = \frac{Space\ capacity\ available\ x\ Survey\ duration\ (hour)}{Average\ duration\ (hour)}$$

$$KD = \frac{200\ x\ 7}{0,49}$$

KD = 2857 vehicle.

b) Friday, 8 September 2023

$$KD = \frac{Space\ capacity\ available\ x\ Survey\ duration\ (hour)}{Average\ duration\ (hour)}$$

$$KD = \frac{200\ x\ 7}{0,57}$$

KD = 2456 vehicle.

c) Saturday, 9 September 2023

$$KD = \frac{Space\ capacity\ available\ x\ Survey\ duration\ (hour)}{Average\ duration\ (hour)}$$

$$KD = \frac{200\ x\ 7}{0,53}$$

KD = 2641 vehicle.

Table 1. Dynamic Capacity of On Street Motorbikes

No	Date and Time	Space Capacity	Survey Length (hour)	Average Duration (hour)	Dynamic Capacity
1	Thursday, 7 September 2023	200	7	0,49	2857
2	Friday, 8 September 2023	200	7	0,57	2456
3	Saturday, 9 September 2023	200	7	0,53	2641

(Sumber : Analysis results, 2023)

It can be seen in table 1. that the largest dynamic capacity based on average duration for on street motorbikes at the Ratu Jepara market was on Thursday, September 7 2023, amounting to 2857 motorbikes.

Table 2. Dynamic Capacity of Off Street Motorcycles

No	Date and Time	Space Capacity	Survey Length (hour)	Average Duration (hour)	Dynamic Capacity
1	Thursday, 7 September 2023	250	7	0,83	2108
2	Friday, 8 September 2023	250	7	0,75	2333
3	Saturday, 9 September 2023	250	7	0,71	2464

(Sumber : Analysis results, 2023)

It can be seen in table 2. that the largest dynamic capacity based on average duration for off street motorbikes at the Ratu Jepara market is on Saturday, September 9 2023, amounting to 2464 motorbikes.

Table 3. Dynamic Capacity of On Street Cars

No	Date and Time	Space Capacity	Survey Length (hour)	Average Duration (hour)	Dynamic Capacity
1	Thursday, 7 September 2023	70	7	0,67	731
2	Friday, 8 September 2023	70	7	0,76	644
3	Saturday, 9 September 2023	70	7	0,92	532

(Sumber : Analysis results, 2023)

It can be seen in table 3. that the largest dynamic capacity based on average duration for on street cars at the Ratu Jepara market was on Thursday, September 7 2023, amounting to 731 cars.

Table 4. Dynamic Capacity of Off Street Cars

No	Date and Time	Space Capacity	Survey Length (hour)	Average Duration (hour)	Dynamic Capacity
1	Thursday, 7 September 2023	25	7	0,86	203
2	Friday, 8 September 2023	25	7	0,75	233
3	Saturday, 9 September 2023	25	7	0,92	190

(Sumber : Analysis results, 2023)

It can be seen in table 4. that the largest dynamic capacity based on average duration for off street cars at the Ratu Jepara market is on Friday, September 8 2023, amounting to 233 cars.

3.2 Analysis of Parking Space Needs

The number of dynamic parking spaces currently needed can be calculated in several ways, including:

Calculation Example Formula Approach:

Parking space requirements(Z)

$$Z = \frac{Parking\ Volume\ (motorcycle)\ x\ Average\ duration\ (hours)}{Survey\ Length}$$

$$Z = \frac{212\ x\ 0{,}49}{7}$$

$$Z = 14{,}8$$

From the results of calculations using this formula, a recapitulation of parking space requirements (z) at the Ratu Jepara market is obtained as shown in table 3.5.

Table 5. Need for On Street Motorcycle Parking Space

No	Date and Time	Parking Volume	Survey Length (hour)	Average Duration (hour)	Parking space requirements (z)
1	Thursday, 7 September 2023	212	7	0,49	15
2	Friday, 8 September 2023	183	7	0,57	15
3	Saturday, 9 September 2023	225	7	0,53	17

(Sumber : Analysis results, 2023)

From table 5. above, it shows that the greatest need for parking space for on-street motorbikes at the Ratu Jepara market occurs on Friday, September 8 2023, amounting to 15 SRP.

Table 6. Off Street Motorbike Parking Space Requirements

No	Date and Time	Parking Volume	Survey Length (hour)	Average Duration (hour)	Parking space requirements (z)
1	Thursday, 7 September 2023	153	7	0,83	18
2	Friday, 8 September 2023	104	7	0,75	11
3	Saturday, 9 September 2023	143	7	0,71	14

(Sumber : Analysis results, 2023)

From table 6. above, it shows that the greatest need for parking space for off street motorbikes at the Ratu Jepara market occurs on Thursday, September 7 2023, amounting to 18 SRP.

Table 7. On Street Car Parking Space Requirements

No	Date and Time	Parking Volume	Survey Length (hour)	Average Duration (hour)	Parking space requirements (z)
1	Thursday, 7 September 2023	31	7	0,67	3
2	Friday, 8 September 2023	46	7	0,76	5
3	Saturday, 9 September 2023	46	7	0,92	6

(Sumber : Analysis results, 2023)

From table 7. above, it shows that the greatest need for parking space for on-street cars at the Ratu Jepara market occurs on Saturday, September 9 2023, amounting to 6 SRP.

Table 8. Need for Off Street Car Parking Space

No	Date and Time	Parking Volume	Survey Length (hour)	Average Duration (hour)	Parking space requirements (z)
1	Thursday, 7 September 2023	20	7	0,86	2
2	Friday, 8 September 2023	27	7	0,75	2
3	Saturday, 9 September 2023	22	7	0,92	3

(Sumber : Analysis results, 2023)

From table 8. above, it shows that the greatest need for parking space for off street cars at the Ratu Jepara market occurs on Saturday, September 9 2023, amounting to 3 SRP.

3.3 Methods of the Directorate General of Land Transportation 1996

According to the Directorate General of Land Transportation 1996 [5], for the market center the SRP requirement for the number of visitors to the Ratu Jepara market with a total of 2800 has a minimum total unit parking space of:

$$\text{Total KRP} = 350 + \frac{2800 - 1500}{3000 - 1500} \times (400 - 350) = 390 \text{ SRP}$$

Based on the minimum requirements for the size of parking space needed at the market center from the Directorate General of Land Transportation 1996 [5], the car parking space available at Ratu Jepara market meets the minimum requirement for motorbike and car parking space at the market, namely 390 SRP due to the number of traders and visitors ranging between 1500 – 3000 people, the KRP needed is between 350 – 400 SRP.

3.4 Parking Space Requirement Standards

The largest parking space requirement based on the (z) formula approach is determined as the value of the parking space requirement that must be met by the parking management. If parking space requirements are determined based on the results of research in the field, then the value of parking space requirements taken is at the time of maximum accumulation. In this research, the parking space capacity or capacity is ± 25 cars and ± 250 motorbikes.

The following is a comparison of parking space requirements to the existing parking space capacity (based on calculations by the Director General of Land Transportation 1996) [5]:

Table 9. Parking Space Requirements on Car Parking Space Capacity

Date and Time	Parking Space Requirements		Parking Space Capacity	Parking space requirements – Parking space capacity			
				Z		KRP	
	Z	KRP		Difference	(+/-)	Difference	(+/-)
Thursday, 7 September 2023	2	390	25	23	+	365	+

Date and Time	Parking Space Requirements		Parking Space Capacity	Parking space requirements – Parking space capacity			
				Z		KRP	
	Z	KRP		Difference	(+/-)	Difference	(+/-)
Friday, 8 September 2023	2	390	25	23	+	365	+
Saturday, 9 September 2023	3	390	25	22	+	365	+

(Sumber : Analysis results, 2023)

The table above shows the value of parking space requirements based on the formula approach (Z) which is smaller than the capacity. If the value of the parking space requirement is determined based on the maximum accumulation that occurs (field survey results), then the parking space requirement relative to capacity does not need to be increased, or in other words, the parking space currently available is sufficient.

Table 10. Parking Space Requirements on Motorcycle Parking Space Capacity

Date and Time	Parking Space Requirements		Parking Space Capacity	Parking space requirements – Parking space capacity			
				Z		KRP	
	Z	KRP		Difference	(+/-)	Difference	(+/-)
Thursday, 7 September 2023	18	390	250	232	+	140	+
Friday, 8 September 2023	11	390	250	239	+	140	+
Saturday, 9 September 2023	14	390	250	236	+	140	+

(Sumber : Analysis results, 2023)

The table above shows the value of parking space requirements based on the formula approach (Z) which is smaller than the capacity. If the value of the parking space requirement is determined based on the maximum accumulation that occurs (field survey results), then the parking space requirement relative to capacity does not need to be increased, or in other words, the parking space currently available is sufficient.

3.5 Parking Space Capacity
a. 4 wheeled vehicle Corner 0°

$$N = \frac{L}{5}$$

$$N = \frac{180}{5}$$

N = 36 Plot
Where :
N : Number of vehicles that can be parked
L : Length of parking area (meters)

b. 4 wheeled vehicle Corner 90°

$$N = \frac{L}{2,3}$$

$$N = \frac{180}{2,3}$$

N = 78 Plot

c. 4 wheeled vehicle Corner 45°

$$N = \frac{L}{2,3}$$

$$N = \frac{180}{2,5}$$

N = 72 Plot

d. 4 wheeled vehicle Corner 90°

$$N = \frac{L}{0,75}$$

$$N = \frac{70}{0,75}$$

N = 90 Plot

Based on research and analysis, according to the researchers, an alternative parking angle pattern for 4-wheelers was used using a 45° angle because this parking pattern has more capacity compared to the parallel parking pattern (0°) and reduces the length of the parking area used. And the reason why choosing a 45° angle rather than a 90° angle which is almost the same has more capacity because it makes it easier for the driver to maneuver in and out of the parking space. Meanwhile, the parking pattern used for 2-wheeled vehicles (motorbikes) uses a 90° angle because it is considered more efficient for arranging the parking position. And from the initial width of the road which was originally 11 meters due to a 5 meter cut for shoulder parking, the remaining width of the road that can be passed by passing vehicles is 6 meters
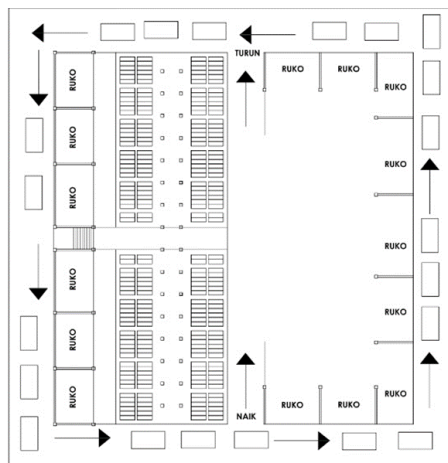

Figure 2. Real Parking Plans
Source: Researcher, 2023

In the floor plan image of the existing pattern, you can see that there are no parking markings for cars in the 2nd floor parking area, only motorbike markings. Meanwhile, in the on-street parking area, there are only car markings for motorbikes, and the parking area is still not arranged. So planning is needed to regulate parking in this market parking area.
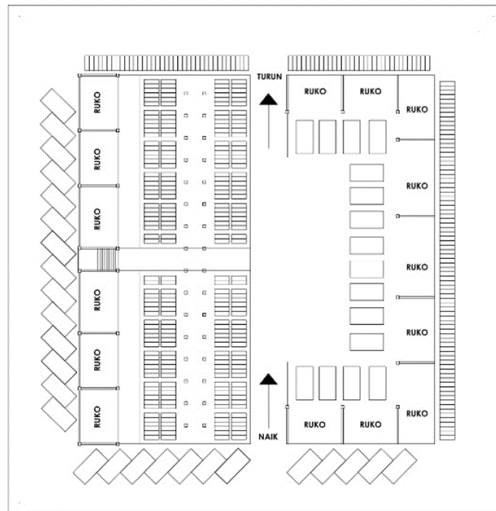

Figure 3. Parking Floor Plan
Source: Researcher, 2023

Planning for parking patterns in the parking area of the Ratu Jepara market area is applied according to the parking requirements for the parking space units. For the parking pattern in the off street car parking area, use a 90° angle parking pattern so that the parking position is more organized and it is easier for the driver to park the vehicle so that it is not difficult to get in and out of the parking area. Meanwhile, the on street car parking area uses a 45° angle parking pattern because it provides more parking capacity and also makes it easier for drivers to maneuver when entering or leaving the parking area. And for on-street motorbike parking patterns, use a 90° angle parking pattern because it is considered more efficient.

4. Conclusion
4.1 Conclusion
Based on the results of the survey and data analysis carried out, several conclusions were obtained relating to the capacity of car parking spaces at the Ratu Jepara market, as follows:
1. From the results of observations and analysis, the need for motorbike and car parking spaces in the Ratu Jepara market parking area still meets existing capacity.
2. For the motorbike parking pattern used for on street motorbike parking in the Ratu Jepara market area, use a one-sided parking pattern, namely a 90° angle, because in terms of effectiveness, a parking pattern with a 90° angle is the most profitable. Meanwhile, the on street car parking pattern at Ratu Jepara market parking uses a one-sided pattern, namely a 45° angle, because it is considered more effective for entering the parking space, and for off street car parking patterns, the 90° angle parking pattern is used. So from planning this parking pattern you can increase the SRP and organize existing parking

4.2 Suggestion
1. Parking managers are expected to use this research as recommendations. Additional parking attendants need to be carried out during peak conditions in order to provide better service for parking

users. For parking, discipline is required in occupying the designated parking area. Next, the parking attendant will direct you to the parking lot.

2. So that parking users want to use existing parking spaces and not use the road shoulder by installing signs prohibiting parking. If there are still people parking haphazardly or on the side of the road, the parking management can give a warning or strict sanctions so that this doesn't happen again.

References

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