

The Analysis of Parking Facility Characteristic Areas for Academic Activity at Universitas Internasional Batam

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ABSTRACT

Purpose: Parking is an essential need that the community has for a motorist. The density of parking lots is often a problem with parking needs in a place. Universitas Internasional Batam, one of the campuses in Batam City, has a relatively small parking area. Thus, this study aims to analyze the need for parking lots in the Universitas Internasional Batam environment.

Design/methodology/approach: The research method used is systematic observation guided by the Parking Space Unit (SRP) 1996. This research was carried out at night during the effective day of academic activity at Universitas Internasional Batam.

Findings: Based on the results of studies that have been carried out, it is concluded that the area of land to be carried out for car parking planning at Universitas Internasional Batam covers an area of 8,169.45 m² and has met the needs. In addition, the land to be planned for motorcycles parking covering an area of 1,574.69 m² has also met the needs.

Research limitations/implications: The planning and parking area at Universitas Internasional Batam have met vehicle parking needs.

Practical implications: Factors due to the density of parking lots at Universitas Internasional Batam cause many vehicles to park on the shoulder of the road (on-street).

Originality/value: This paper is an original work.

Paper type: Research papers.

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I. INTRODUCTION

The development of international parking is not just about the placement of temporary vehicles. At this time, vehicle parking lots are necessary for vehicle owners in big cities (Wang et al., 2017). In densely populated areas such as cities, problems regarding lack of space or parking lots often occur due to the limited availability of vehicle parking facilities (Paidi et al., 2018). When vehicle technology called self-driving (Badue et al., 2021) is not yet complete, opportunities open for cities to take the lead in forming vehicles to be used and structure provided to them (Winter et al., 2021). As time goes by, many new solutions have emerged to overcome these problems, one of which is Smart Building. Smart Building System is the use and application of information technology to control devices or vehicles in a building (Yu et al., 2021).

Vehicle parking in Indonesia has existed since the beginning of independence. At that time, vehicle parking activities grew spontaneously in the surrounding community and did not have a legal prohibition in the management of parking lots for vehicles. The term in this parking activity is also referred to as "Jaga Otto". Along with technological advances and economic developments in Indonesia, people's ability to buy private vehicles is also increasing (Münzel et al., 2019). In recent years, many authors or researchers have proposed a computer vision-based approach to solving problems related to vehicle parking management (Almeida et al., 2022) This parking problem arises due to several factors, including the lack of parking space (Mikusova et al., 2020)

Sometimes, the difficulty of finding a place to park the vehicle makes the layout of the vehicle irregular in a place. This is because motorists tend to take the opportunity to allow their vehicles to park even though it will be dangerous for their vehicles. In addition, this will undoubtedly interfere with road performance for other motorists because they must reduce the speed of their vehicles to be careful that there is a buildup of vehicles.

Batam City is one of the largest cities in the Riau Islands province. Batam Island has a very strategic geographical landscape. The city in the Riau Islands has a land area of about 715 km², and the overall area is estimated to reach 1,575 km² (Batam, 2022). Batam City has relatively large land and is not too dense because there are still natural areas containing trees. From the data from the Batam City Transportation Agency survey, there are 555 parking points in the Batam area. At first, this parking point only amounted to 202 points, and now there have been 353 vehicle parking points in Batam City (Dewi Haryati, 2017).

In recent years, parking studies have aimed to measure the relationship between parking costs (Zhuge et al., 2019) and or economic factors to organize more acceptable and balanced transportation policies in the community (Dowling et al., 2017) (Meng et al., 2018). One of the complex problems in finding parking locations is in educational environments such as universities which often cause many losses, disrupting road performance and other alternative policies (Gurbuz & Cheu, 2020). Based on the results of field observations on the campus of Universitas Internasional Batam, the lack of comfort for car and motorcycle users is caused by the dense parking space available. The lack of space for parking is caused by the imbalance in the number of parking lots with students carrying vehicles, which later will cause various kinds of problems. As a result, to be an alternative to this problem, many student vehicles are parked in places that should not be like the body of the road. This is a bit annoying for other motorists passing by because part of the road section has been used by motorists who park.

The density of vehicles parked in the campus environment of Universitas Internasional Batam causes a lack of parking space which is a problem for students who bring vehicles to campus because of difficulties and are pretty risky in their vehicles. Therefore, to review this problem, a study and evaluation are needed to determine the need for parking spaces that the Universitas Internasional Batam campus must provide. The evaluation in question aims to determine the density of motorists on the campus of Universitas Internasional Batam and determine the level of need for parking facilities on available land in the campus environment of Universitas Internasional Batam. This research is expected to help to review the problem of the availability of parking facilities in the campus area of Universitas Internasional Batam. Suppose the parking facilities are sufficient to accommodate existing vehicles. In that case, this will optimize the facilities needed for parking lots and provide a sense of comfort for students and visitors in the campus environment of Universitas Internasional Batam.

A. Literature Review

1. Parking

Parking space facilities are one of the needs that can affect the comfort and safety of vehicle users (Scheck et al., 2022). A driver tends to find a place to park his vehicle as close to his destination as possible (Rifai et al., 2021). This is a concern for the campus environment of Universitas Internasional Batam. The increasing volume of motorists carrying private vehicles will undoubtedly increase the need for parking spaces in a location (Levin et al., 2020). Based on the facilities, parking is divided into two: parking not on the road body (off-street) and parking on the street body (on-street). Off-street is a vehicle parking location not on the road, with parking available both in buildings and on open land. However, this type of parking requires a cost as measured by how long the vehicle is parked in the area (Biswas et al., 2017). At the same time, parking on the road body (on-street) is parking on the part of the road body whose position tends not to be organized but does not require a fee (Fokker et al., 2022). On-street parking (Rifai, 2021).

Two parking lots are located in the campus environment of Universitas Internasional Batam, namely on-street and off-street. Although only a few vehicles are parked on-street, this will reduce the effectiveness of the existing road. Therefore, the need for parking space on the campus of Universitas Internasional Batam is an absolute condition. This interest is expected to solve several problems, such as congestion, delays, and queues. The lack of parking space will cause vehicles to park on the shoulder of the nearby road, interfering with the smooth traffic flow of other motorists (Singh & Kumar, 2022). To accommodate the increase in the number of private vehicles, the need for parking is significant for every faculty. Not only motorcycles, but this campus also has many car users who carry out parking activities during the effective day of lectures, so qualified parking facilities are needed.

2. Parking Characteristics

Parking is necessary for every motorist because it requires a place to rest their vehicles. Various types of parking vary in each place because it adapts to the situation and conditions. Of course, the type of parking also differs in the type of vehicle that can park its vehicle. Different types of parking have different characteristics and have their characteristics (Brown et al., 2020). Parking characteristics are specifications owned by various types of parking. These characteristics can affect the type of situation, vehicle, and policy that applies to a parking

location. This can be seen in various situations that show significant differences in the type of vehicle. Parking characteristics have a variety of parameters, including parking accumulation, duration, turnover rate, usage rate, parking volume, parking capacity, and parking index (Rifai Andri Irfan & Hafis Khairul, 2021). These parameters can be viewed by modeling the type of parking in a specific location and paying attention to the type of vehicle.

Parameters that can be reviewed from the parking situation can determine the standard of parking needs in a location. One of the things that can be a difference in the standard of parking needs is the location of parking. The relationship between parking needs and the location is the basis for forming a parking space model according to the parking situation's characteristics (Kazazi Darani et al., 2018) The modeling of the parking space can also be determined from the characteristics of the location so that this can determine the final result. Good parking certainly has characteristics that are by international parking standards. In addition, parameters are also of particular concern in creating a systematic parking system. Thus, characteristics become the main determinants of parking in a location. A poor parking system infrequently occurs due to a lack of understanding of parking characteristics.

3. Parking Lot Analysis

The main index in the construction of a park system island. The land is a primary need for vehicle volume collectors, so that it can be a good location for parking. Parking lots can be decisive for a systematic parking system (Peng et al., 2017) Because this can create much space to rest the vehicle. The large parking spaces can also create comfort and safety for vehicles parking in a location. Narrow land is a very influential thing in the performance of parking spaces. So important is the land in the park is so important that it causes many parking problems in locations with narrow land. In addition to being challenging to accommodate the volume of vehicles, narrow land can undoubtedly hinder the flow of vehicle movement and cause road performance problems (De Ryck et al., 2020) If this is not addressed, the problem will undoubtedly continue to occur and can cause losses to many people, especially in their vehicles.

Nevertheless, a large parking lot may not necessarily create a reasonable parking system. This is because a sound parking system must, of course, have good flow management and management. In addition, parking management can certainly be an alternative thing to overcome land problems at parking locations (Bahrami et al., 2021) Given several cases in various locations, there are constraints on parking lots the only solution to this problem is the management of park management performance. The parking system can be a particular concern for parking locations with limitations in terms of parking spaces. Narrow land is not a problem for parking management, so parking performance can still run well as it should. Several things also need to be considered so parking performance on narrow land can run well. One of the things is to pay attention to the type and time of the vehicle within a certain period (Małeckki, 2018). Thus, cases like this can be solved despite inadequate land conditions.

II. METHODS

In this study, the method used was to use the SRP 1996. Data is one of the main strengths in compiling scientific research and modeling (Rifai et al., 2015) This guideline is a reference in carrying out field data collection and research on procuring problems the systematic process of scientific research must begin with correctly identifying the problem (Rifai et al., 2016). For data collection on parking at Universitas Internasional Batam, a systematic observation method reviews two-wheeled and four-wheeled vehicles that park on campus land.

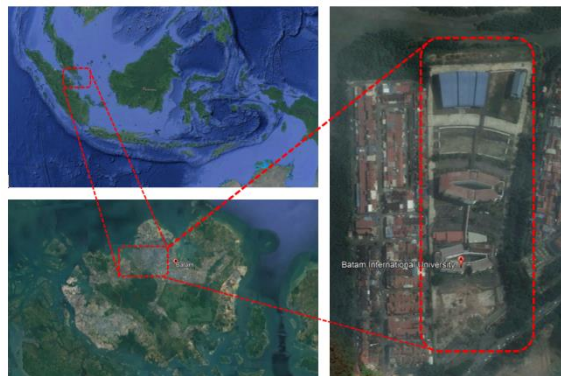


Figure 1 - Research Location at Universitas Internasional Batam

Observation of the use of parking facilities on campus is carried out on vehicles used by students, lecturers, and employees at Universitas Internasional Batam. The observation was carried out on Friday, starting from 17.00 WIB to 22.00 WIB. This is because the effective hours of lectures at Universitas Internasional Batam are curfews. The tendency and culture of students in Batam are to work while studying, so evening lecture hours, especially at Universitas Internasional Batam, are very crowded compared to morning and afternoon.



Figure 2 - Parking Lot at Universitas Internasional Batam

A. Parameters

According to the Directorate General of Land Transportation (1996), the characteristic parking parameters that need to be known are calculation, parking duration, and usage rate. In addition, the parameters used in the parking characteristics research are about the parking lot itself, namely volume, capacity, and parking index. Accumulation of parking is valuable information to find out the number of vehicles parked at a particular time in a parking building or yard. This accumulation is used to find out the design of the parking space needed. Durasi parking data is used to know how long it takes for a vehicle to be parked in a certaparticulare. The turnover and usage rates are the results of dividing the number of vehicles using the parking space at any given time by the number of available parking spaces.

Another parameter to assess parking characteristics is available land at a parking location. Parking volume is information about the number of vehicles using a particular parking space per unit of time. The capacity car is the maximum number of vehicles a parking lot can know during the service time. Meanwhile, parking is a measure that expresses the use of the length of the road and is expressed in the form of a per percentage of the space occupied by the vehicle.

B. SRP (Parking Space Unit) and Standard Parking Space Needs

According to the SRP 1996, a Parking Space Unit (SRP) is an effective placement measure for vehicles (cars, buses/trucks, and motorcycles), as well as a rider-free space to open vehicle doors as wide as possible. Based on figure II.2 about the parking space for passenger cars quoted from SRP 1996, has a description, namely the total width of the vehicle (B), the total length of the vehicle (L), the width of the door opening (O), the longitudinal directional clearance of -8-10 (a1, a2), and the lateral directional clearance (R). In addition, units of king spaces on motor vehicles, according to the SRP 1996, are attached.

Standard parking space requirements differ depending on several things, applicable services and rates. Based on research by the Directorate General of Land Transportation, activities and standards for parking needs for universities or schools are divided into two groups: lecturers or teachers and workers who work in the school or college and students or students. This parking need is reviewed from the number of students because most campus visitors who use parking facilities are students of Universitas Internasional Batam. As stated in the SRP 1996, from the results of a study by the Directorate General of Land Transportation table (e), Schools/Universities states that if the number of students (people) is 3000, the required SRP is 60, and for the number of students as many as 12000 then the required SRP is 240.

C. Parking Pattern

A parking pattern is a form or modeling of parking used at a location to accommodate vehicles that will park. Usually, the parking pattern will be determined according to the needs or problems contained in the location. The application of parking patterns should also not be determined without calculating the problems or consequences caused. Applying improper parking patterns will result in various things, such as hampering road performance, disturbing other motorists who pass by, and much more.

Parking patterns have variations that can be applied according to the needs of the field, one of which is double-sided parking. This parking pattern is a parking pattern that applies when sufficient space is available.

Two parking patterns have been specified in the SRP 1996, which form the 90° angle described in Figure II.12 of the SRP 1996. In addition, parking patterns form angles of 30°, 45°, and 60° as described in figure II.25 in the SRP 1996.

III. RESULTS AND DISCUSSION

This study aims to analyze the need for parking spaces for two-wheeled vehicles analyzes the need for parking spaces for two-wheeled parking characteristics and parking lots. This analysis was carried out to get the numbers of the parking index, parking duration, and parking space needs. This analysis uses data on the area available for car and motorcycles parking and the number of vehicles entering and leaving the parking lot, as well as parking lot units (SRP), used to calculate the needs of each type of parking space that parks vehicles in the campus environment of Universitas Internasional Batam.

Table 1 - Results of the UIB Campus Citizen Data Survey in 2022

<i>Description</i>	<i>Number of people</i>
<i>Lecturer</i>	<i>222</i>
<i>Employee</i>	<i>64</i>
<i>Mahasiswa</i>	<i>3895</i>
<i>Total</i>	<i>4181</i>

A. Results of Analysis of Car Parking Spaces

From the data obtained through observations in the parking lot of Universitas Internasional Batam, which was analyzed in November 2022, there are three parking spots for four-wheeled vehicles, and it is estimated that the total area of the parking space is 8,169.45 m² at Universitas Internasional Batam. From the data on the entry and exit of four-wheeled vehicles and after the analysis, several characteristics can be calculated, including the parking index, parking duration, and parking space needs. The parking duration obtained from the observation results can be calculated through data on four-wheeled vehicles entering and having been in the same direction as the exit time, data of $9824.4/90 = 109.16$ minutes as many as 90 vehicles and obtained an average duration of about 1.81 hours. Then the parking index from the data in table (2) is known as parking accumulation x 100% divided by available parking spaces, $90 \times 100 / 310 = 2.93$. Parking needs are equal to the number of vehicles, so the results obtained from the parking were multiplied by the average duration of parking/length of observation time of $90 \times 1.81 / 5 = 32.58$ vehicles.

Table 2 - Calculation Results of Characteristics of Four-Wheeled Vehicles

<i>Time</i>	<i>Enter</i>	<i>Out</i>	<i>Accumulated Parking</i>	<i>Volume</i>
<i>17.00 - 17.15</i>	<i>5</i>	<i>0</i>	<i>5</i>	<i>5</i>
<i>17.15 - 17.30</i>	<i>6</i>	<i>0</i>	<i>11</i>	<i>11</i>
<i>17.30 - 17.45</i>	<i>8</i>	<i>1</i>	<i>18</i>	<i>19</i>
<i>17.45 - 18.00</i>	<i>13</i>	<i>2</i>	<i>29</i>	<i>32</i>
<i>18.00 - 18.15</i>	<i>9</i>	<i>3</i>	<i>35</i>	<i>41</i>

18.15 - 18.30	9	6	38	50
18.30 - 18.45	5	0	43	55
18.45 - 19.00	5	2	46	60
19.00 - 19.15	3	2	47	63
19.15 - 19.30	4	7	44	67
19.30 - 19.45	5	4	45	72
19.45 - 20.00	3	3	45	75
20.00 - 20.15	5	2	48	80
20.15 - 20.30	4	3	49	84
20.30 - 20.45	0	5	44	84
20.45 - 21.00	0	8	36	84
21.00 - 21.15	3	5	34	87
21.15 - 21.30	2	7	29	89
21.30 - 21.45	1	13	17	90
21.45 - 22.00	0	17	0	90
<i>Total</i>	<i>90</i>	<i>90</i>		

Based on the Parking Space Unit (SRP) of four-wheeled vehicles of $2.30 \times 5.00 = 11.5$ m², with the number of vehicles based on the observation results is 90 vehicles, and the campus land availability area is 8,169.45 m², where the land area for car parking space is needed of $90 \times 11.5 = 1,035$ m² less than 8,169.45 m² (meet).

B. Results of Analysis Bicycle Parking Space Motor

The data obtained through observations in the parking lot of Universitas Internasional Batam, which was analyzed in November 2022 and carried out in a parking lot for two-wheeled vehicles, is estimated to be the total parking space area is 1,574.69 m² at Universitas Internasional Batam. The results obtained include the duration of parking with the calculation of the total time from the data of motorcycles entering and exiting the parking area and matched with the time, then obtained $8989.2 / 120 = 74.91$ minutes. The average parking duration of 120 vehicles entering the campus area is 1.24 hours. The parking index is obtained by calculating the accumulated parking $\times 100\%$ / available parking space with a value of $120 \times 100 / 906 = 13.24$. In addition, parking needs are obtained by calculating the number of vehicles that multiplied parking by the average duration of parking/observation time of $120 \times 1.24 / 5 = 29.76$ vehicles.

Table 3 - Data from the results of the Two-Wheeled Vehicle Survey (Observation Results, 2022)

<i>Time</i>	<i>Enter</i>	<i>Out</i>	<i>Accumulated Parking</i>	<i>Volume</i>
<i>17.00 - 17.15</i>	<i>7</i>	<i>3</i>	<i>4</i>	<i>7</i>
<i>17.15 - 17.30</i>	<i>3</i>	<i>0</i>	<i>7</i>	<i>10</i>
<i>17.30 - 17.45</i>	<i>9</i>	<i>5</i>	<i>11</i>	<i>19</i>
<i>17.45 - 18.00</i>	<i>10</i>	<i>4</i>	<i>17</i>	<i>29</i>
<i>18.00 - 18.15</i>	<i>11</i>	<i>7</i>	<i>21</i>	<i>40</i>
<i>18.15 - 18.30</i>	<i>20</i>	<i>10</i>	<i>31</i>	<i>60</i>
<i>18.30 - 18.45</i>	<i>8</i>	<i>4</i>	<i>35</i>	<i>68</i>
<i>18.45 - 19.00</i>	<i>5</i>	<i>0</i>	<i>40</i>	<i>73</i>
<i>19.00 - 19.15</i>	<i>5</i>	<i>2</i>	<i>43</i>	<i>78</i>
<i>19.15 - 19.30</i>	<i>9</i>	<i>9</i>	<i>43</i>	<i>87</i>
<i>19.30 - 19.45</i>	<i>7</i>	<i>3</i>	<i>47</i>	<i>94</i>
<i>19.45 - 20.00</i>	<i>8</i>	<i>4</i>	<i>51</i>	<i>102</i>
<i>20.00 - 20.15</i>	<i>5</i>	<i>5</i>	<i>51</i>	<i>107</i>
<i>20.15 - 20.30</i>	<i>3</i>	<i>3</i>	<i>51</i>	<i>110</i>
<i>20.30 - 20.45</i>	<i>0</i>	<i>7</i>	<i>44</i>	<i>110</i>
<i>20.45 - 21.00</i>	<i>0</i>	<i>6</i>	<i>38</i>	<i>110</i>
<i>21.00 - 21.15</i>	<i>2</i>	<i>9</i>	<i>31</i>	<i>112</i>
<i>21.15 - 21.30</i>	<i>1</i>	<i>8</i>	<i>24</i>	<i>113</i>
<i>21.30 - 21.45</i>	<i>4</i>	<i>14</i>	<i>14</i>	<i>117</i>
<i>21.45 - 22.00</i>	<i>3</i>	<i>17</i>	<i>0</i>	<i>120</i>
<i>Total</i>	<i>120</i>	<i>120</i>		

Based on the Parking Space Unit (SRP), two-wheeled vehicles are = $0.75 \times 2.00 = 1.5 \text{ m}^2$, with the number of vehicles based on the observation results, is 120 vehicles, and the campus land availability area is 1,574 m²,

where the land area for car parking space is $120 \times 1.5 = 180 \text{ m}^2$ less than $1,547 \text{ m}^2$ (meet). The results of a study conducted on Friday, November 25th, 2022, between 17.00 and 22.00 WIB showed that as many as 90 four-wheeled vehicles entered the parking area. Includes parking parameters, namely an average duration of 1.81 hours, a parking index of 20%, and the number of parking needs is 32.58 vehicles, so the area of parking area needed is calculated using the equation wide of parking area SRP x total of vehicles which is $2.30 \times 5.00 \times 90 = 1,035 \text{ m}^2$. With a total parking area of $8,169.45 \text{ m}^2$ which meets the needs. In addition, according to a survey regarding two-wheeled vehicles conducted on Friday, November 25, 2022, at 17 o'clock. 00 – 22. 00 WIB, as many as 120 motorcycles arrived at the motorcycle parking area with an average duration of 1.24 hours and 13% parking. Therefore, the equation calculates the required parking space, parking money with the SRP equation x number of vehicles = $0.75 \times 2.0 \times 120 = 180 \text{ m}^2$. The reusable parking fee is 50 m^2 to fit the required surface.

IV. CONCLUSION

Based on the results of studies that have been carried out, it is concluded that the area of land to be run for car parking planning at Universitas Internasional Batam, covering an area of $8,169.45 \text{ m}^2$ has met the needs. In addition, the land to be planned for motorbike parking covering an area of $1,574.69 \text{ m}^2$ has also met the needs. The highest accumulation was in area A (including the canteen building and building B), with 91 cars. The parking index was obtained from the total of all points at Universitas Internasional Batam, which includes three parking points, namely 20% for four-wheeled vehicles and 13% for two-wheeled vehicles. The peak parking time is obtained at 18.15-18.30 WIB with details of 20 motorcycles and 13 cars due to the tendency of students who will start their lectures.

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