

Parking Characteristics And Needs Study At Marga Traditional Market

Ni Ketut Sri Astatu Sukawati¹, Cokorda Putra Wirasutama², I Gede Putu Dhika Utama³

¹Civil Engineering Study Program, Universitas Mahasaraswati Denpasar, Bali, Indonesia

²Civil Engineering Study Program, Universitas Mahasaraswati Denpasar, Bali, Indonesia

³Civil Engineering Study Program, Universitas Mahasaraswati Denpasar, Bali, Indonesia

ABSTRACT

Marga Traditional Market is one of the markets in Tabanan Regency which is located in the Marga District. , is an activity of people engaged in the economy, especially traders. Marga Traditional Market is a place where the buying and selling process occurs, where most traders and buyers or people who come to Marga Traditional Market use transportation (vehicles) to get to the market, with these activities resulting in an increase in the volume of vehicles entering the Marga Traditional Market area due to the activities that occur, to anticipate this, adequate and neatly arranged parking facilities need to be provided so that they can provide the parking services desired by all parties. The purpose of this study was to determine the characteristics of parking at Marga Traditional Market and to determine whether the provision of parking space at Marga Traditional Market has met parking needs. The method used in data collection in this study is direct observation in the field by conducting a survey. The survey was conducted for 2 (two) days, namely on market days, namely Thursday, June 27, 2019, and Sunday, June 30, 2019. The study began from the start of routine market activities at 03.00 to 12.00 WITA. After conducting the research, the survey results then analyzed the parking volume, parking accumulation, average parking duration, parking turnover rate, parking capacity (parking supply), and parking index, then from the analysis the characteristics and parking needs at Marga Traditional Market can be known, the results of the data analysis obtained are that the volume of motorcycles is 768 vehicles, while for cars it is 325 vehicles. The highest parking accumulation for motorcycles occurred at 06.00-07.00 WITA, which was 153 vehicles, while for cars it occurred at 08.00-09.00 WITA, which was 47 vehicles. The average parking duration for motorcycles is 4.36 hours/vehicle, while for cars it is 4.22 hours/vehicle. The parking turnover rate for motorcycles is 0.74 vehicles/plot/hour, while for cars it is 0.89 vehicles/plot/hour. And the parking index for motorbikes is 6.32 while for cars it is 15.34, from the results of the research at the Marga Traditional Market, the parking needs for motorbikes and cars can no longer accommodate vehicles during market hours.

Keywords: Marga Traditional Market, Parking Characteristics, Parking Capacity.

INTRODUCTION

Parking facilities are an inseparable part of the transportation system, especially land transportation. Basically, parking is a place to stop and store vehicles temporarily in a certain space. Where the space can be in the form of a parking roadside, shop yard and other places provided to accommodate the vehicle. Thus, parking is defined as a special place for vehicles to stop for safety. Therefore, parking facilities are very necessary, both on the roadside (on street parking) and parking outside the road or a special place (off street parking)

One of the places that is a location for observation that is closely related to the problem of providing parking spaces is the market. It is a place where the buying and selling process takes place, where most of the traders and buyers or people who come to the market use transportation services (vehicles) to get to the market, so the market plays a very important role in driving the economic activities of the community. Marga Traditional Market and other markets in Tabanan Regency really need to handle the number of vehicles carrying out market activities and parking can meet adequate needs so as to create a sense of security and comfort.

Therefore, in order to anticipate and provide excellent service to parking users and to smooth traffic flow, improvements are needed in every aspect that supports the progress of Margadi Traditional Market in the future. Aspects that deserve attention in the Margadi Traditional Market environment besides human resources in this case the market employees and parking attendants who work in it to support orderly

vehicle parking. The parking area is a very important thing in every location that is often visited by many people such as Marga Traditional Market.

For example, the number of traders using four-wheeled or two-wheeled vehicles has reduced the parking area available for visitors and buyers in the Marga Traditional Market parking area. With this, the Marga Traditional Market needs a larger parking area. For this reason, a study of the characteristics of the parking area is needed and improving the quality of service so that motorized vehicle users can park their vehicles properly.

LITERATURE REVIEW

Transportation System

Marlok, 1991 defines transportation as "an action, process or thing that is being moved from one place to another," in transportation there is an element of movement, and physically there is a movement of people or goods with or without a means of transport to another place, pedestrians are the movement of people without means.

Transportation System is useful for travel, traveling and traffic purposes. Travel is the process of moving from one place to another (using routes and means of transportation). Traveling is reaching a place and not aiming to enjoy what happens along the track. (Abyansyah, 2010)

Sukawati, 2013 describes transportation technology has touched briefly on several basic elements in the transportation system. The first is directly related to the movement of an object from one place to another, there are two things that must always be available, namely the object and the path, where the object moves. The object is something that must be moved by passengers or goods and the path of movement is the location in space where the movement occurs. In general, the object or object moves in a type of vehicle that causes the object to move on a certain path. In addition, the vehicle can also protect the object from damage.

A transportation system is a form of connection and interconnection between passengers, goods, infrastructure and facilities that interact in the context of moving people or goods, which are included in a system, either naturally or artificially/engineered.

Parking facilities are an inseparable part of the transportation system, especially land transportation. The Transportation System consists of 2 (two) syllables, namely: System which means a form of relationship between 1 (one) variable with another variable in a structured order, and transportation which means the activity of moving passengers and goods from one place to another, So the Transportation System is a form of relationship between passengers or goods, infrastructure and facilities that interact in a series of movements of people or goods included in an order in traffic.

Concept About Parking

In general, vehicles that are not being used on the highway will stop somewhere temporarily. One part of the traffic system is to provide special facilities where vehicles stop when not in use, so that the stopped vehicles are safe enough in terms of security against criminal acts and do not interfere with the comfort of other road users, and facilitate access for users of the vehicle when needed. Adequate and well-regulated parking facilities are very necessary, especially in areas or places/highways where the volume of vehicles is very large, because even if only a few vehicles are parked along the road, these vehicles effectively reduce the width of the road and that means reducing the capacity to accommodate traffic flow. (Suwardjoko, 1985).

Parking Characteristics

Parking characteristics are a basic parking study/calculation and will later be able to provide an assessment of the parking problems that occur. Based on parking characteristics, parking conditions that occur in the study area can be known, including parking demand and utilization, including parking volume, parking accumulation, parking duration, parking turnover rate, and parking index.

A. Parking Volume

VolumeParking is the number of vehicles included in the parking load (i.e. the number of vehicles per certain period of time, usually per day). The time used for parking is calculated in minutes or hours which indicates the duration of parking. Parking volume calculations can be used as an indication of whether the available parking space can meet the parking needs of vehicles or not. So by knowing the level of parking volume, in planning the construction of new parking spaces, the amount of parking space needed can be planned. The formula that can be used is:

$$\text{Volume} = N_{in} + x - y$$

Information :

N_{in} = Number of vehicles entering (assuming every vehicle entering is parked).

x = Vehicles that existed before the survey was conducted

y = Vehicle that exits

B. Parking Accumulation

AccumulationParking is the total number of vehicles parked in a certain period(Hobbs, 1975). This accumulation can be used as a measure of parking space needs at the research location.

C. Parking Time

Longparking is the length of time a vehicle is in a particular parking lot. A parking lot will be able to serve more vehicles if it is used to park vehicles for a short time. According to the time used for parking, parking can be classified as follows:

a. Parkingshort time

Namely, parkers who use the parking space for less than 1 hour.

b. Parkingmedium time

Namely, parkers who use the parking space between 1-4 hours.

c. Parkinglong time

Namely, parkers who use the parking space for more than 4 hours.

From the parking duration, it will be known the time used for each parker to park their vehicle in each parking space. To find out the average parking duration of each vehicle can be found from the following formula.

$$D = \frac{\sum(Nx).(X).(I)}{Nt}$$

Information :

D =Average parking time (hours/vehicle)

Nx = Number of vehicles parked during the survey time interval

X =Sum of intervals (time spans)

I =Length of time for each interval (hours)

Nt =Total number of vehicles at the time of observation/survey

AverageThe length of parking will affect the number of vehicles that can be parked in a parking area (Parking Supply) during a certain period of time.

$$Ps = \frac{(St)}{D} \times 0,9$$

Information :

Ps =Number of vehicles that can be parked (Vehicles)

S =Total number of official stalls/plots

t =Survey duration (hours)

D =Average parking time (hours/vehicle)

0.9 = *Insufficiency factor*(due to turn over)

D. Parking Turn Over Rate

Parking turnover rate will show the level of parking space usage obtained by dividing the parking volume by the number of parking spaces available during the observation period. The formula used is:

$$TR = \frac{NT}{S \times Ts}$$

Information :

TR = Parking turnover rate (Vehicle/space/hour)

S = Total number of official stalls/plots

Ts = Length of survey period (hours)

Nt = Total number of vehicles during the survey period

E. Parking Index

Parking index is the amount of parking space usage calculated from the number of parked vehicles divided by the total number of parking spaces. The formula that can be used to calculate the index is:

$$IP = \frac{VolumeParkir}{Ps}$$

IP value > 1 meaning that parking requirements exceed capacity / abnormal capacity.

IP value = 1 This means that parking needs are balanced with normal capacity.

IP value < 1 meaning that parking requirements do not exceed normal capacity.

The parking index value is obtained from the comparison between the total number of vehicles and the total number of parking spaces / parking capacity.(Abubakar, 1998).

RESEARCH METHODS

Research methods

The stages in this research begin with a literature review that will be used as a guide and reference in conducting the research. Then continued with the selection of a location to obtain data from a field survey with the preparation of a report as the final data. The method that will be used in this research is by survey. The things that will be surveyed are the area of the parking area, the number of parking lots available, parking patterns that include the size of the parking lot and parking angle, parking accumulation, parking volume and parking duration.

RESULTS AND DISCUSSION

Parking Facilities Inventory

Systematically, parking facilities for vehicles in the study location can be seen in Table 4.1 below. Because there are no official parking lots in the research location, the author conducted measurements and obtained the number of official parking lots for motorbikes as many as 210 lots, and for cars as many as 23 lots.

Table 4.1 Inventory of Motorcycle and Car Parking Facilities

Vehicle Type	Number of Plots	Parking Angle	Plot Size
Motorcycle	210	900	0.70 x 2.00 m
Car	23	900	2.50 x 5.00 m

Source: Survey Results

Parking Volume

VolumeParking is the number of vehicles parked at the study location during a certain period of time, in this case the calculation is every 1 (one) hour, so that later the fluctuation of vehicles parked every hour at the research location can be seen, the formula used is:

$$\text{Volume} = N_{in} + x - y$$

Information :

N in = Number of vehicles entering (assuming every vehicle entering is parked).

X = Vehicles that existed before the survey was conducted

y = Vehicles that come out

- Data can be seen in Appendix A, Table A.2 and Table A.3.

FromThe results of the survey conducted can then be used to determine the number of vehicles entering or leaving the research location. Furthermore, an analysis of the survey data was carried out to obtain the volume of vehicles parked at the study location during 9 (nine) hours of observation. From the results of the data analysis, the parking volume of vehicles parked at the study location is known as shown below:

Table 4.2 Motorcycle Parking Volume
On June 27, 2019
Source: Survey Data Analysis

No	Time	Motorcycle Volume
		67
1	03.00 – 04.00	68
2	04.00 – 05.00	97
3	05.00 – 06.00	108
4	06.00 – 07.00	153
5	07.00 – 08.00	59
6	08.00 – 09.00	85
7	09.00 – 10.00	48
8	10.00 – 11.00	34
9	11.00 – 12.00	49
	Total = 9 hours	768
	Average / Hour	83.33

From Table 4.2 above, it can be seen that the highest motorcycle parking volume occurred at 06.00 – 07.00 WITA, which was 153 vehicles. It can also be seen that the total motorcycle parking volume during market days was 768 vehicles.

From Table 4.2, a graph of motorbike parking volume can be made as shown in Graph 4.1 below:

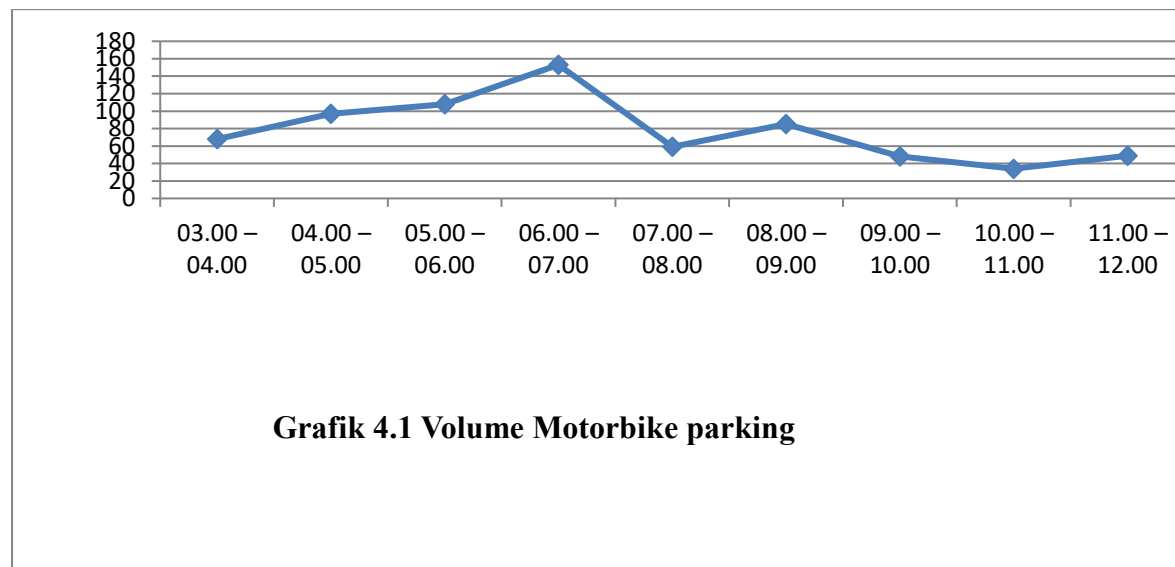


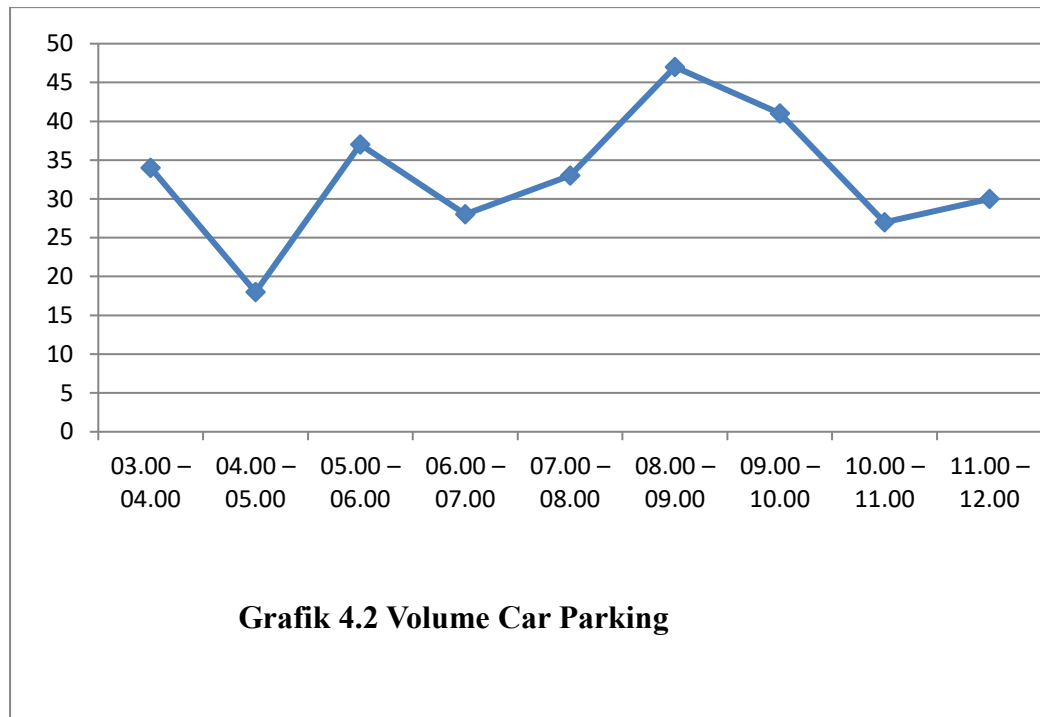
Table 4.3 Car Parking Volume
On June 27, 2019

No	Time	Car Volume
		30
1	03.00 – 04.00	34
2	04.00 – 05.00	18
3	05.00 – 06.00	37
4	06.00 – 07.00	28
5	07.00 – 08.00	33
6	08.00 – 09.00	47
7	09.00 – 10.00	41
8	10.00 – 11.00	27
9	11.00 – 12.00	30
	Total = 9 hours	325
	Average / Hour	36.11

Source: Survey Data Analysis

From table 4.3 above, it can be seen that the highest car parking volume occurs at 08.00 – 09.00 WITA, which is 47 cars. It can also be seen that the total parking volume for cars on market days is 325 cars.

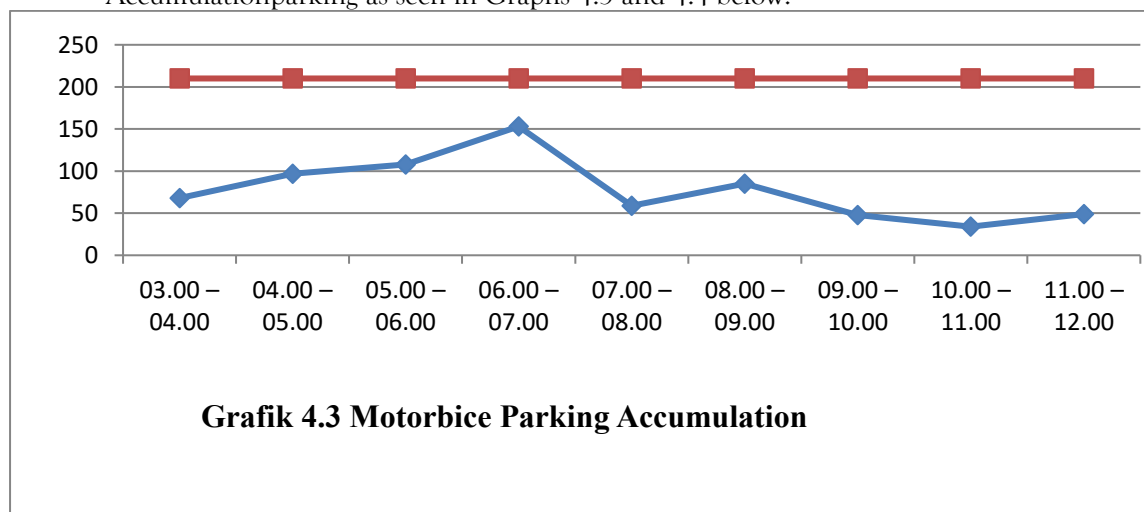
From Table 4.3 above can be used to create a car parking volume graph as shown in Graph 4.2 below:



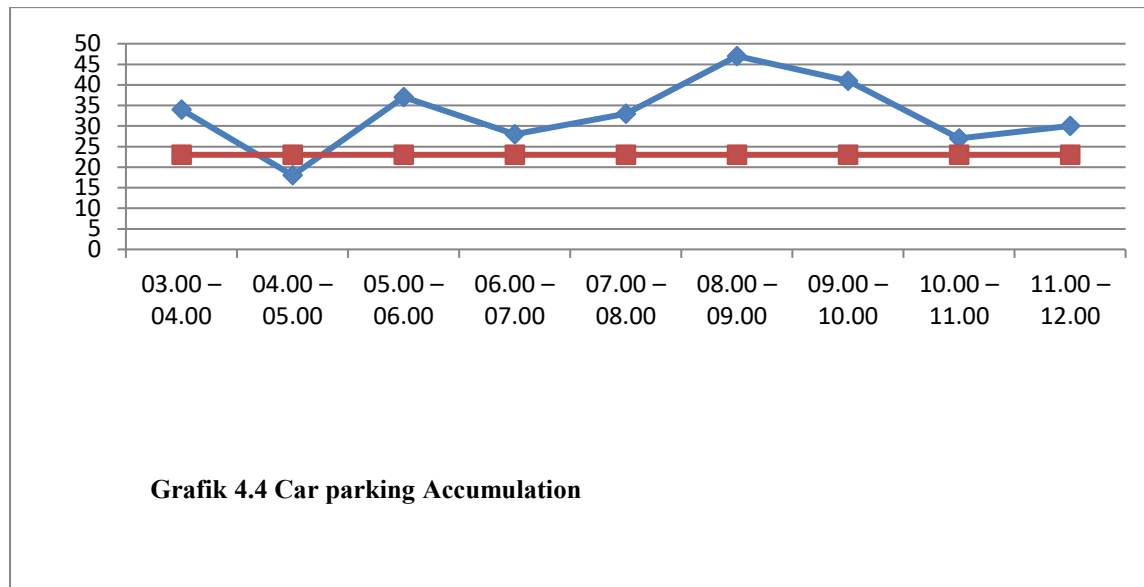
Parking Accumulation

Accumulation parking is the total number of vehicles parked in a certain period of time. In this case, a time interval of 1 (one) hour is taken. Parking accumulation can be seen in table 4.2 and table 4.3 throughout a certain time, from the survey results it can be seen the fluctuation of vehicles parked every 1 (one) hour and based on the results of the survey data analysis it can be seen that the highest accumulation for motorbikes occurred at 06.00 - 07.00 WITA, which was 153 vehicles, while for cars it occurred at 08.00 - 09.00 WITA, which was 47 vehicles.

Accumulation parking as seen in Graphs 4.3 and 4.4 below:



From Graph 4.3 above, it can be seen that the highest parking accumulation for motorbikes occurred at 06.00 – 07.00 WITA, which was 153 vehicles.



From Graph 4.4 above, it can be seen that the highest parking accumulation for cars occurred at 08.00 – 09.00 WITA, which was 47 vehicles, and it can also be seen that the accumulation of car parking exceeded the capacity or number of existing parking spaces, which was 23 spaces.

Average Parking Length

What is meant by the average parking duration is the average length of time a vehicle is in a particular parking lot. A parking lot will be able to serve more vehicles if it is used to park vehicles for a short time. According to the time used for parking, parking can be classified as follows:

a. Parkingshort time

Namely, parkers who use the parking space for less than 1 hour.

b. Parkingmedium time

Namely, parkers who use the parking space between 1-4 hours.

c. Parkinglong time

Namely, parkers who use the parking space for more than 4 hours.

To find out the average parking time for each vehicle, the following equation can be used:

$$D = \frac{\sum(Nx).(X).(I)}{Nt}$$

Information :

D =Average parking time (hours/vehicle)

Nx = Number of vehicles parked during the survey time interval

X =Sum of intervals (time spans)

I =Length of time for each interval (hours)

Nt =Total number of vehicles at the time of observation/survey

1. Average length of motorcycle parking.

$$D = \frac{6093}{1399}$$

$$D = 4.36 \text{ hours/vehicle}$$

So you can get itnamely the average parking duration for motorbikes is 4.36 hours/vehicle which can be classified as long-time parking, namely parking duration of more than 1 hour.

2. Average length of car parking.

$$D = \frac{780}{185}$$

$$D = 4.22 \text{ hours/vehicle.}$$

So, it can be concluded that the average parking duration for cars is 4.22 hours/vehicle, which can be classified as long-term parking, namely parking duration of more than 1 hour.

Parking Turn Over Rate

Parking turnover rate will show the level of parking space usage obtained by dividing the parking volume by the number of parking lots available during the observation period. The formula used is as follows:

$$TR = \frac{NT}{S \times Ts}$$

Information :

TR = Parking turnover rate (Vehicle/space/hour)

S = Total number of official stalls/plots

Ts =Length of survey period (hours)

Nt = Total number of vehicles during the survey period

From the survey data, the parking turnover rate can be determined as follows:

1. Parking Turnover Rate For Motorcycles.

It is known:

Nt =1399 vehicles

Ts = 9 hours

S = 210 plots

$$\begin{aligned} \text{So : } TR &= \frac{1399}{210 \times 9} \\ &= \frac{1399}{1890} \\ &= 0.74 \end{aligned}$$

2. Parking Turnover Rate For Cars.

It is known:

Nt = 185vehicle

Ts = 9 hours

S = 23 squares

$$\begin{aligned} \text{So : } TR &= \frac{185}{23 \times 9} \\ &= \frac{185}{207} \\ &= 0.89 \end{aligned}$$

Parking Supply

Parking Supply is the limit of the number of vehicles that can be accommodated during a certain period of time (during the survey period). Parking Supply calculations can use the following formula:

$$Ps = \frac{S \cdot t}{D} \times 0,9$$

Information :

- Ps = Number of vehicles that can be parked (Vehicles)
- S = Total number of official stalls/plots
- t = Durationsurvey (hour)
- D = Average parking time (hours/vehicle)
- 0.9 = Insufficiency factor (due to turnover)

From the assumption of the parking lot that the compiler measured using a 900 angle, then from the survey data and data analysis, the size of the Parking Supply at the study location can be determined as follows:

1. The size of the parking supply for motorbikes.

It is known :

- S = 210plot
- t = 9 hours
- D = 4.36 hours/vehicle

So :

$$\begin{aligned} Ps &= \frac{(210 \times 9)}{4,36} \times 0.9 \\ &= \frac{1890}{4,36} \times 0.9 \\ &= 390.13 \text{ capacity} \end{aligned}$$

From the results of the analysis above, it can be seen that the number of motorbikes that can park during the 9-hour survey period at the Marga Traditional Market is 481.65 vehicles.

2. The Size of Parking Supply for Cars

It is known :

- S = 23plot
- t = 9 hours
- D = 4.22hours/vehicle

So :

$$\begin{aligned} Ps &= \frac{(23 \times 9)}{4,22} \times 0.9 \\ &= \frac{207}{4,22} \times 0.9 \\ &= 44.15 \text{ capacity} \end{aligned}$$

From the results of the analysis above, it can be seen that the number of cars that can park during the 9-hour survey period at the Marga Traditional Market is 44.15 vehicles.

Parking Index

As explained in Chapter II, the Parking Index can be used as a measure of assessing parking space needs. Whether the existing parking space capacity can still accommodate parking.

Parking Index calculation uses the formula:

$$IP = \frac{VolumeParkir}{Ps}$$

IP value > 1 meaning that parking requirements exceed capacity / abnormal capacity.

IP value = 1 This means that parking needs are balanced with normal capacity.

IP value < 1 meaning that parking requirements do not exceed normal capacity.

From the results of the survey and data analysis, the Parking Index can be determined as follows:

1. Motorcycle Parking Index

It is known :

Parking Volume = 768 vehicles

Ps = 390.13 capacity

So : $IP = \frac{768}{390,13}$
IP = 1.96

So IP > 1 or 768 > 390.13 IP obtained 1.96 is greater than one, meaning the parking capacity is not sufficient to accommodate the volume of vehicles/motorcycles that will be parked there.

2. Car Parking Index

It is known :

Parking Volume = 325 vehicles

Ps = 44.15 capacity

So : $IP = \frac{325}{44,15}$
IP = 7.36

So IP > 1 or 325 > 44.15 IP obtained 7.36 is greater than one, meaning the parking capacity is not sufficient to accommodate the volume of vehicles / cars that will be parked there.

CONCLUSION AND SUGGESTIONS

Conclusion

Based on the research process which includes data collection and data analysis as well as from the data analysis and discussion described in the previous chapters, the following conclusions can be drawn:

1. Parking characteristics include parking volume, parking accumulation, average parking, parking duration, parking turnover rate, and parking index.

a) Characteristics of motorcycle parking.

- The volume of motorbikes parked at Marga Traditional Market is 768 on market days.
- The highest parking accumulation occurred at 06.00-07.00 WITA, which was 153 vehicles.
- The average parking duration is 4.36 hours/vehicle, which can be classified as long-term parking because parking is more than 1 hour.
- The parking turnover rate is 0.74 vehicles/space/hour
- The size of the parking supply for motorbikes is 390.13 vehicles.
- Parking Index is 1.96

b) Car parking characteristics.

- The volume of cars parked at Marga Traditional Market is 325 on market days.
- The highest parking accumulation occurred at 08.00-09.00 WITA, which was 47 vehicles.
- The average parking duration is 4.22 hours/vehicle, which can be classified as long-term parking because parking is more than 1 hour.

- The parking turnover rate is 0.89 vehicles/space/hour
- The size of the parking supply for cars is 44.15 vehicles.
- Parking Index is 7.36

2. Parking Requirements

a. Motorcycle parking needs can be seen from the parking index, so $IP > 1$ or $768 > 390.13$ IP obtained 1.96 greater than one means that the parking capacity is not sufficient to accommodate the volume of vehicles / motorcycles that will be parked there. And the factor causing the parking index higher than 1 for motorcycles is that during peak market hours the number of cars that will park cannot park their vehicles in the places that have been provided, because the car parking space can no longer accommodate in its proper place, because along with the increasing level of parking turnover, car drivers then park their vehicles in the motorcycle parking lot which results in a reduction in motorcycle parking space, where this motorcycle parking space is not enough to accommodate the volume of vehicles / motorcycles that will be parked.

b. Parking requirements for cars also exceed 1 So $IP > 1$ or $325 > 44.15$ IP obtained 7.36 is greater than one, meaning the parking capacity is not sufficient to accommodate the volume of vehicles / cars that will be parked there.

Suggestion

Based on the conclusion above, the author tries to provide some suggestions related to parking at Marga Traditional Market. The suggestions are as follows:

1. For the management of the Marga Traditional Market, they should prohibit traders from using the parking area as a place to sell.
2. For traders who sell from their cars and use the parking area as a parking space as well as a place to sell, a special place should be provided.

BIBLIOGRAPHY

1. Abubakar, I., 1996. Towards Orderly Traffic and Road Transportation. Jakarta: Directorate General of Land Transportation.
2. Abubakar, I., 1998. Guidelines for Planning and Operation of Parking Facilities. Jakarta: Directorate General of Land Transportation.
3. Abyansyah, M., 2010. Transportation system. [Online] Available at: <http://www.scribd.com/doc> [Accessed 1 May 2019].
4. Directorate of Urban Transportation Traffic System Development and Directorate General of Land Transportation, Jakarta March 1998
5. Hobbs, F.D., 1975. Tactical and Traffic Planning. [Online] Available at: <http://library.um.ac.id> [Accessed 1 May 2019].
6. Kadir, Y., 2008. Analysis of Characteristics in Macro Department Store Gorontalo. [Online] Available at: <http://ejurnal.ung.ac.id> [Accessed 1 May 2019].
7. Ministerial Decree Number 66 of 1993 Concerning Public Parking Facilities.
8. Minister of Transportation Decree Number 4 of 1994 Concerning Parking Procedures
9. Decree of the Director General of Land Transportation Number 272 of 1996 Concerning Technical Provision of Parking Facilities
10. Marlok, E., 1991. Introduction to Transportation Engineering and Planning. Jakarta: Erlangga.
11. Government Regulation of the Republic of Indonesia Number 44 of 1993 Concerning Vehicles and Drivers
12. Government Regulation Number 43 of 1993 concerning Traffic and Roads.
13. Sukawati, SA, 2013. Urban Transportation, Planning, Management and Policy. Denpasar: Udayana University Press.