

Analysis of Parking Space Requirements in Grand Galaxy Park Mall and Performance of Boulevard Raya Roads Jakasetia, Bekasi City

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Abstract

Bekasi City is a large city with a population of 2,803,283 people (BPS, 2016). The area of Bekasi City is 210.49 km². Grand Galaxy Park Mall is one of the malls located in the city of Bekasi precisely on Boulevard Raya Roads Grand Galaxy City Jakasetia. The area is of land approximately 19.000 meters² with a floor area of 17.000 meters² which consists of 5 floors. Grand Galaxy Park Mall became one of the popular shopping centers because this mall is known as a modern mall and was built with an environmentally friendly concept and the location of this mall is also very strategic and integrated with the residential area of Grand Galaxy City, Schools, Shops and Offices. The method used in this research is the observation method. The Observation Method is a method by conducting direct survey of spaciousness. This is absolutely necessary to determine the actual condition. The survey method used in this analysis is the method of recording the number of vehicles. The largest accumulation of parking for cars on Saturday as many as 132 vehicles occurred between 18.00-18.59 WIB, while for motorcycles on Saturday as many as 167 vehicles occurred between 19.00-19.59 WIB. The average duration of vehicle parking is 3 hours 42 minutes for cars and 3 hours 30 minutes for motorbikes. The largest parking index is 85.16% for cars occurred on Saturday at 18.00-18.59 WIB and 41.75 for motorcycles occurred on Saturday at 19.00-19.59 WIB. The biggest Parking Turn Over is 4 vehicles / SRP / observation time for cars and 3 vehicles / SRP / observation time for motorcycles and that happens on Saturdays. Judging from the analysis of the Jalan Raya Raya Boulevard Jalan Jakasetia for the survey speed at peak hours in the morning, afternoon and evening get the level of service or Level of Service (LOS), namely B and C.

Keywords: Parking Index, parking requirements, Level of Service, Grand Galaxy Park Mall.

1. Introduction

Bekasi City is a large city with a population of 2,803,283 people (BPS, 2016). The area of Bekasi City is 210.49 km². Bekasi is also a buffer city of the capital city of Jakarta, where it has to accommodate several public facilities, due to the dense city of Jakarta. So, it can't be denied that many developers are now making the city of Bekasi as a business destination, with its many apartment, housing and shopping centers. Increasing population and activities have increased the complexity of transportation problems. One of the problems is the need to provide parking spaces in shopping centers that continue to grow.

The same thing happened to the Grand Galaxy Park Mall on the Boulevard Raya Grand Galaxy City, Bekasi City. Grand Galaxy Park Mall became one of the popular shopping centers because this mall is known as a modern mall and was built with an environmentally friendly concept and the location of this mall is also very strategic and integrated with the housing area of Grand Galaxy City, Schools, Shops and Offices .

The formulation of the problems in this study include: 1). What is the existing parking space capacity and whether the need for parking spaces at Grand Galaxy Park Mall, is now sufficient to meet the vehicle? 2). What are the characteristics of parking in the form of parking volume, parking accumulation, parking index, parking duration and *turn-over* at Grand Galaxy Park Mall Jakasetia, Bekasi City? 3). What are the alternative solutions in overcoming the problem of parking at Grand Galaxy Park Mall Jakasetia, Bekasi City? 4). What is the performance of the road in front of Grand Galaxy Park Mall Jakasetia, Bekasi City?

2. Methodology

2.1 Data Collection Methods

- a) Observations or field observations include various matters relating to observations of physical conditions and activities at the study site.

- b) Documentation is the activity of collecting and reviewing some information from periodicals, books, document literature, photographs, newspapers, electronic media and statistical references.

2.2 Data Processing Methods and Data Analysis

Data processing and data analysis methods used in this study are qualitative descriptive analysis by taking into account the results of the field survey regarding the duration of parking, accumulation, parking volume, parking capacity, parking index, parking space usage and parking space requirements. In addition, standards and guidelines for planning and operating parking facilities are also used. As for the performance of road sections by taking into account the results of the field survey regarding traffic volume data, side barriers data, road capacity (C) and Q / C ratio, speed of traffic survey results, speed based on MKJI 1997, and *Level of Service (Level of Service)*.

3. Results and Analysis

3.1 Parking Characteristics

3.1.1 Parking Accumulation

Parking accumulation is the number of vehicles that are in a parking lot at a specified time interval and divided according to the type of purpose of travel, where the integration of the accumulated parking during a certain period shows the parking load (number of parking vehicles) in units of vehicle hours per specified time period.

Table 1. Car and Motorcycle Parking Accumulation
Friday December 6, 2019 and Saturday December 7, 2019

Class Time	Car Accumulation		Motorcycle Accumulation	
	Friday	Saturday	Friday	Saturday
	December 6, 2019	December 7, 2019	December 6, 2019	December 7, 2019
<10.00	4	5	12	20
10.00 – 10.59	6	6	20	30
11.00 – 11.59	22	15	53	54
12.00 – 12.59	18	19	55	46
13.00 – 13.59	37	16	64	65
14.00 – 14.59	28	26	74	77
15.00 – 15.59	23	62	51	66
16.00 – 16.59	30	87	70	61
17.00 – 17.59	44	103	74	121
18.00 – 18.59	51	132	87	158
19.00 – 19.59	31	91	81	167
20.00 – 20.59	9	46	56	87
21.00 – 21.59	0	0	0	0
> 22.00	0	0	0	0

Source: Author's Process, 2019

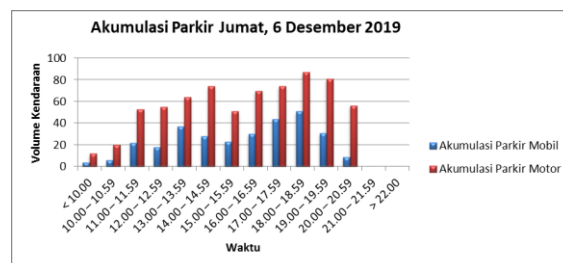


Figure 1. Graph Accumulated Parking Car and Motorcycle Friday December 6, 2019

Source: Author's Process, 2019



Figure 2. Graph Accumulated Parking Car and Motorcycle Saturday December 7, 2019
Source: Author's Process, 2019

3.1.2 Parking Index

The parking index is a comparison between the accumulation of vehicles parked with the available parking capacity. This parking index is used to determine whether or not the number of parking plots available at the study site is suitable for accommodating vehicles parked.

Table 2. Car and Motorcycle Parking Index
Friday December 6, 2019 and Saturday December 7, 2019

Class Time	Car Parking Index		Motorcycle Parking Index	
	Friday	Saturday	Friday	Saturday
	December 6, 2019	December 7, 2019	December 6, 2019	December 7, 2019
<10.00	2.58 %	3.23 %	3.00 %	5.00 %
10.00 – 10.59	3.87 %	3.87 %	5.00 %	7.50 %
11:00 – 11.59	14.19 %	9.68 %	13.25 %	13.50 %
12.00 – 12.59	11.61 %	12.26 %	13.75 %	11.50 %
13.00 – 13.59	23.87 %	10.32 %	16.00 %	16.25 %
14:00 – 14.59	18.06 %	16.77 %	18.50 %	19.25 %
15.00 – 15.59	14.84 %	40.00 %	12.75 %	16.50 %
16.00 – 16.59	19.35 %	56.13 %	17.50 %	15.25 %
17.00 – 17.59	28.39 %	66.45 %	18.50 %	30.25 %
18.00 – 18.59	32.90 %	85.16 %	21.75 %	39.50 %
19.00 – 19.59	20.00 %	58.71 %	20.25 %	41.75 %
20.00 – 20.59	5.81 %	29.68 %	14.00 %	21.75 %
21.00 – 21.59	0.00 %	0.00 %	0.00 %	0.00 %
> 22.00	0.00 %	0.00 %	0.00 %	0.00 %

Source: Author's Process, 2019

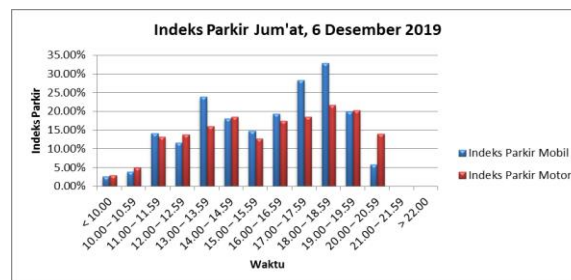


Figure 3. Graph Index Parking Car and Motorcycle Friday December 6, 2019
Source: Author's Process, 2019

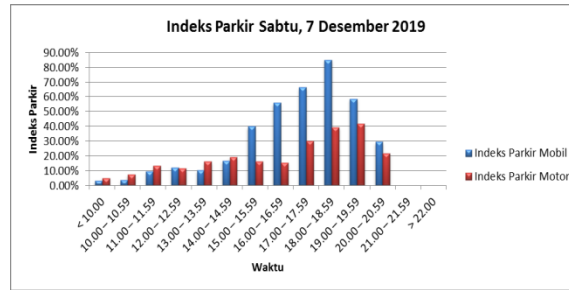


Figure 4. Graph Index Parking Car and Motorcycle Saturday December 7, 2019
Source: Author's Process, 2019

3.1.3 Analysis of Parking Space Needs for the Next 5 (Five) Years

To determine the need for parking spaces in the Grand Galaxy Park Mall in the next 5 years, the influential variable is economic growth in the city of Bekasi. Based on data from the Central Statistics Agency (BPS) of Bekasi City, the average economic growth rate of 5.8% per year, while the largest volume of cars and motor vehicles used by the volume in 2019. This figure can be used to estimate how long the parking space cars and motorbike parking spaces Grand Galaxy Park Mall can accommodate the number of vehicle volumes each year.

$$\text{Estimated Growth Center} = \text{Accumulated Vehicles} (1 + \text{Growth})^n$$

a) Car Vehicle

Highest vehicle accumulation in 2019 = 132 vehicles
Available car parking spaces = 155 SRP
Estimated parking growth = $132 \times (1 + 0.058)^5$
= 132×1.3
= 172

So, the accumulation of automobiles in 2024 is expected to increase to 172 vehicles.

b) Motorcycle Vehicles

The highest accumulation of motor vehicles in 2019 = 167 vehicles
Available motorcycle parking spaces = 400 SRP
Estimated parking growth = $167 \times (1 + 0.058)^5$
= 167×1.3
= 221

Thus, the accumulation of automobiles in 2024 is expected to increase to 218 vehicles.

Table 3. Estimated Car Parking Accumulation

Year of Prediction	Car		Motorcycle	
	Estimated Parking Index	Estimated Vehicle Parking Accumulation	Estimated Parking Index	Estimated Vehicle Parking Accumulation
2020	90.32%	140	44.25%	177
2021	95.48%	148	46.75%	187
2022	101.29%	157	49.50%	198
2023	107.11%	166	52.25%	209
2024	110.97%	172	55.25%	221

Source: Author's Process, 2019

3.2 Roads

3.2.1 Traffic Volume

Traffic data is obtained from field survey results during rush hour by counting the number of vehicles every 15 minutes for 2 hours in the morning, 15 minutes for 2 hours in the afternoon, and 15 minutes for 2 hours in the afternoon. The number of vehicles is converted into passenger car units (pcu) according to the type of vehicle that passes Jalan Boulevard Raya .

Table 4. Maximum Vehicle Traffic Volume

Period	Friday December 6, 2019		Saturday December 7, 2019	
	kend / hour	smp / hour	kend / hour	smp / hour
Morning (7.00 – 9.00)	2646	1612.1	1372	788.8
Afternoon (11.00 – 13.00)	2848	1847.6	2967	1676.0
Evening (16.00 – 18.00)	3650	2227.6	3643	2198.3

Source: Author's Process, 2019

3.2.2 Side Barriers

The side obstacle data is obtained from the results of the field survey during rush hour by counting the number of side barriers every 15 minutes for 2 hours in the morning, 15 minutes for 2 hours in the afternoon, and 15 minutes for 2 hours in the afternoon.

Table 5. Maximum Volume of Constraints

Period	Friday December 6, 2019		Saturday December 7, 2019	
	kend /hour	smp/hour	kend / hour	smp /hour
Morning (7.00 – 9.00)	138	101.0	289	206.6
Afternoon (11.00 – 13.00)	482	314.7	497	352.5
Evening (16.00 – 18.00)	464	316.9	621	428.9

Source: Author's Process, 2019

3.2.3 Road Capacity (C) & Q / C Ratio

The capacity of an urban road can be determined from the formula as follows:

$$C = Co \times FCw \times FCsp \times FCsf \times FCcs$$

Where :

C = Capacity (smp/hour)

Co = base capacity (smp/hour)

FCw = Lane width adjustment factor

FCsp = Directional separator adjustment factor

FCsf = Side drag adjustment factor

FCcs = City size adjustment factor

Then the value of C ratio can be known by calculation as follows:

$$C = Co \times FCw \times FCsp \times FCsf \times FCcs$$

$$C = 3300 \times 0.92 \times 1.00 \times 0.86 \times 1.00$$

$$C = 2610,9 \text{ smp / hour}$$

Table 6. Capacity of Jalan Boulevard Raya

Variable	Boulevard Raya Roads			
	Adjustment Factor	Morning	Noon	Afternoon
Co	Divided Road (2 lanes) / 1 direction	3300	3300	3300
FCw	The road is divided into 3 m width	0.92	0.92	0.92
FCsp	The road is divided in one direction	1	1	1
FCsf	Medium Side Barriers (M), Effective Width of Sidewalks 1 m, Road Divided 2/1	.86	.86	.86
FCcs	Total Population of Bekasi City is 2,803,283 Million	1	1	1
C		2610,9	2610,9	2610,9

Source: Author's Process, 2019

Table 7. Q / C Ratio of Jalan Boulevard Raya Section on Friday December 6, 2019

Period	Friday December 6, 2019			
	Q	C	Q / C	LOS
Morning (7.00 – 9.00)	1612.1	2610,9	0.62	B
Afternoon (11.00 – 13.00)	1847,6	2610,9	0.71	C
Evening (16.00 – 18.00)	2227,6	2610,9	0.85	D

Source: Author's Process, 2019

Table 8. Q / C Ratio of Jalan Boulevard Raya Section on Saturday December 7, 2019

Period	Saturday December 7, 2019			
	Q	C	Q / C	LOS
Morning (7.00 – 9.00)	788,8	2610,9	0.30	A
Afternoon (11.00 – 13.00)	1676.0	2610,9	0.64	B
Evening (16.00 – 18.00)	2198.3	2610,9	.84	D

Source: Author's Process, 2019

3.2.4 Speed of Traffic Survey Results

Following the complete traffic speed survey data at peak hours on each section, the results of primary data collection in the field can be seen in the calculation of the average speed based on a sample of 3 light vehicles / 15 minutes unless there is an error data (values that are too different).

Table 9. Speed Resume

TIME	Boulevard Raya Roads			
	Friday December 6, 2019		Saturday December 7, 2019	
	Speed	LOS	Speed	LOS
Morning (7.00 – 9.00)	41.58	B	45.16	B
Afternoon (11.00 – 13.00)	39.11	C	41.24	B
Evening (16.00 – 18.00)	35.08	C	34.64	C

Source: Author's Process, 2019

4. Conclusions

Based on the survey results and analysis of parking characteristics at the Grand Galaxy Park Mall in the previous discussion, the following results are obtained:

1. Available capacity and Parking Space Needs based on the Director General of Land Transportation at Grand Galaxy Park Mall.
 - a) Number of car parking entrances and exits, namely:
 - 1) 2 entrance car parking areas.
 - 2) 2 exit car parking areas.
 - b) Number of motorized parking entrances and exits, namely:
 - 1) 1 entrance to the motorcycle parking area.
 - 2) 1 exit for the motorcycle parking area.
 - c) The size of the Parking Space Unit (SRP) for cars in Grand Galaxy Park Mall has a dimension of 2.50 x 4.50 (90% of BSLLAK 1998) with a total capacity of 155 SRP.
 - d) The size of the Parking Space Unit (SRP) for motorcycles in the Grand Galaxy Park Mall has dimensions of 0.75 x 1.75 (87.5% of BSLLAK 1998) with a total capacity of 400 SRP
 - e) Minimum parking space requirements according to the Director General of Land Transportation are 184 SRP and a maximum of 394 SRP.
2. Characteristics of Parking at Grand Galaxy Park Mall.
 - a) Vehicle volume
 - 1) Friday, December 6, 2019

- Cars : 365 vehicles
 - Motorcycle : 518 vehicles
 - 2) Saturday, December 7, 2019
 - Cars : 547 vehicles
 - Motorcycle : 862 vehicles
 - b) Parking Accumulation
 - 1) Friday, December 6, 2019
 - Cars : 51 vehicles occurred between 18.00 - 18.59
 - Motorcycles: 87 vehicles occurred between 18.00 - 18.59
 - 2) Saturday December 7, 2019
 - Cars : 132 vehicles occur between 18.00 - 18.59
 - Motorcycles: 167 vehicles occurred between 19.00 - 19.59
 - c) Average Parking Duration
 - 1) Friday, December 6, 2019
 - Car : The average duration of a car park is 3 hours 36 minutes.
 - Motorcycle : The average duration of motorcycle parking is 3 hours 18 minutes.
 - 2) Saturday, December 7, 2019
 - Car : The average duration of a car park is 3 hours 42 minutes.
 - Motorcycle : The average duration of motorcycle parking is 3 hours 30 minutes.

So it is included in *middle parkers* .
 - d) Parking Index
 - 1) Friday, December 6, 2019
 - Car : Parking index of 32.90% occurs at 18.00 - 18.59
 - Motorcycles: The parking index of 21.75% occurs at 18.00 - 18.59
 - 2) Saturday, December 7, 2019
 - Car : The parking index of 85.16 occurs at 18.00 - 18.59
 - Motorcycles: The parking index of 41.75% occurs at 19:00 - 19.59
3. An alternative solution to improve parking services, especially during peak hours, is the need to increase the number of *parking officers* so that circulation and order of the parking area is maintained, especially in the afternoon at 17:00 - 19:00 and parallel parking provided with *traffic cones* is enforced with the help of officers parking. Another solution is the addition of a parking availability sensor installed at the top of the parking space with a red pointer to fill the vehicle and a green pointer for an empty parking space. In addition it needs to be circumvented by raising parking fees. At this time, the Grand Galaxy Park Mall implement car parking rates Rp 6,000 and Rp 4,000 next hour and for the motor tariff of Rp 3 .000 and the next hour Rp 2000. Planning car parking fees increase to Rp 8,000 and Rp 6,000 next hour while rates motorcycle parking for Rp. 5,000 and the next hour Rp. 3000 . The plan is expected to be able to limit visitors to the duration of parking considering the high cost of parking fees.
4. Performance of Jalan Boulevard Raya
- A. From the results of the analysis of Jalan Boulevard Raya Section that has been carried out:
 - 1) Friday, December 6, 2019
 - a) Morning average service level or *Level of Service* (LOS) is B at 07.00 - 09.00 with a Saturation Degree value of 0.62.
 - b) During the daytime the average level of service or *Level of Service* (LOS) is C at 11.00 – 13.00 hours with a degree of saturation that is 0.71.
 - c) In the afternoon the average level of service or *Level of Service* (LOS) is D at 16.00 - 18.00 with a value of degree of saturation that is 0.85.
 - 2) Saturday, December 7, 2019
 - a) In the morning the average level of service or *Level of Service* (LOS) is A at 07.00 - 09.00 with a Saturation Degree value of 0.30.
 - b) During the daytime the average level of service or *Level of Service* (LOS) is B at 11.00 - 13.00 with a saturation degree value of 0.64.
 - c) In the afternoon the average level of service or *Level of Service* (LOS) is D at 16.00 – 18.00 with a value of degree of saturation that is 0.84.
 - B. Judging from the speed of the service level survey or *Level of Service* (LOS) on Jalan Raya Boulevard Section that has been carried out on:

- 1) Friday, December 6, 2019
 - a) In the morning the level of service (LOS) is B.
 - b) Daytime service level or *Level of Service* (LOS) is C.
 - c) Evening service level or *Level of Service* (LOS) is C.
- 2) Saturday, December 7, 2019
 - a) In the morning the level of service (LOS) is B.
 - b) Daytime service level or *Level of Service* (LOS) is B.
 - c) In the afternoon service level or *Level of Service* (LOS) is C.

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Biography

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Alif Imamsyah is a student of the Faculty of Civil Engineering at Mercuru Buana University in 2015 and successfully completed his undergraduate education in February 2020. Mr. Alif Imamsyah was born in Bekasi August 31, 1994. He had worked in manufacturing companies namely PT Astra Honda Motor as an operator in the production division for 4 years, vocational education background with graduates Automotive Engineering in 2012.