

THE CONCEPT OF AN INTEGRATED PARKING TOWER FACILITY FOR PARK AND RIDE AT BEKASI KOTA STATION

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Abstract

The high number of commuters from Bekasi who use KRL to get to their places of activities, especially to Jakarta, makes Bekasi Kota Station requires parking facilities with a large and integrated capacity. The research used a qualitative approach and approach based on empirical facts and was supported by a theoretical basis as well as primary and secondary surveys for data collection. The results of the research indicate that to optimize the integration aspect of public transportation, it is necessary to have parking facilities that are physically integrated, integrated with service/operational, and integrated on a rate/payment supported by other supporting facilities with attention to the aspects of safety and comfort in it. The application of a parking tower for park and ride as an integrated parking facility in Bekasi Kota Station is considered capable to comply the preferences criteria of commuters who move through the station and attract the public's interest to switch to using public transportation modes to reduce the rate utilization of private vehicles heading to Jakarta.

Keywords: Parking, Park and Ride, Parking Tower, Station, KRL, Public Transport Integration, Smart Parking System

1. Introduction

Bekasi has several numbers of commuters aged over 5 years as many as 373,125 people, whom 277,234 people mobilize to Jakarta and only 36,583 people who use KRL Commuter Line as a mode of transportation to head to Jakarta (Badan Pusat Statistik, 2019). The problem of parking facilities at Bekasi Kota Station is one of the factors why only a few commuters use KRL Commuter Line as an option. The regional and central governments continue to strive to organize integrated transportation in the greater Jabodetabek area. The integration of public transportation modes has 3 (three) aspects of integration, that is, physical integration, service/operational integration, and rate/payment integration.

The utilization of limited parking space can be optimized with the concept of a parking tower, where the private vehicles of KRL Commuter Line users at Bekasi Kota Station are placed in a parking building that is integrated with the station and equipped with other supporting facilities at the parking tower to attract interest and make it easier for users so that in the end the volume of private vehicles entering Jakarta from neighboring cities such as Bekasi can be reduced and the level of congestion in the city can be reduced.

The application of the concept of a parking tower for Bekasi Kota Station refers to parking technology that has been applied to public facilities in the world and Jabodetabek, so there are opportunities and potentials to be able to apply it in Bekasi Kota Station.

Based on the problems above, the research was conducted on the application of The Concept of An Integrated Parking Tower Facility for Park and Ride at Bekasi Kota Station.

2. Literature Study

2.1 Parking

According to The Technical Guidelines for The Implementation of Parking Facilities (Direktorat Jenderal Perhubungan Darat, 1996), parking is a moveless state of a vehicle that is not temporary.

2.2 Park and Ride

Park and ride is a transportation system that uses parking space facilities by storing private vehicles, then switching to public transportation mode (Spillar, 1997). Park and ride policy is one of the policies that has not received special attention from the public regarding the implementation of park and ride.

Park and ride facilities are highly dependent on the public transportation system. It means that park and ride is one of the supporting facilities for stopping/transiting places such as bus station or KRL station which serve as an attraction for private vehicle users to use public transportation that has a

larger carrying capacity (South Yorkshire Passenger Transport Authority, 2012).

2.3 Parking Space Unit (PSU)

According to the Guidelines for Planning and Operation of Parking Facilities (Direktorat Jenderal Perhubungan Darat, 1998), PSU is a measure of the effective area for placing vehicles (car, bus/truck, or motorcycle), including free space and width of door openings. Determination of PSU in this study research refers to:

2.3.1 Determination of parking space unit (PSU)

Based on the table of PSU, it is divided into three types of vehicles and based on the determination of PSU for car passengers, it is classified into three groups, as in Table 1.

Table 1. Determination of Parking Space Unit (PSU)

No.	Vehicles Type	PSU in m ²
1.	a. Car passengers class I	2,30 x 5.00
	b. Car passengers class II	2,50 x 5.00
	c. Car passengers class III	3,00 x 5,00
2.	Buses/Trucks	3,40 x 12,50
3.	Motorcycles	0,75 x 2,00

Source: *Guidelines for Planning and Operation of Parking Facilities (Direktorat Jenderal Perhubungan Darat, 1998)*

2.3.2 Parking space unit for car passengers

PSU for car passengers is shown in Figure 1.

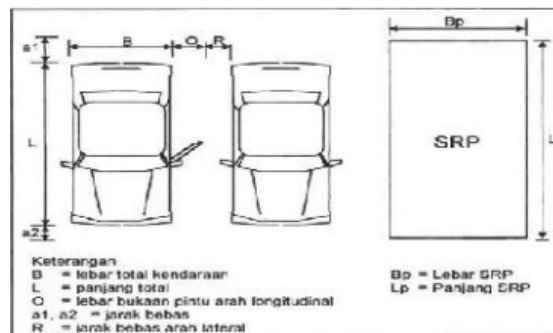


Figure 1. PSU for car passengers (in cm)

Source: *Guidelines for Planning and Operation of Parking Facilities (Direktorat Jenderal Perhubungan Darat, 1998)*

2.3.3 Parking space unit for motorcycles

PSU for motorcycles is shown in Figure 2.

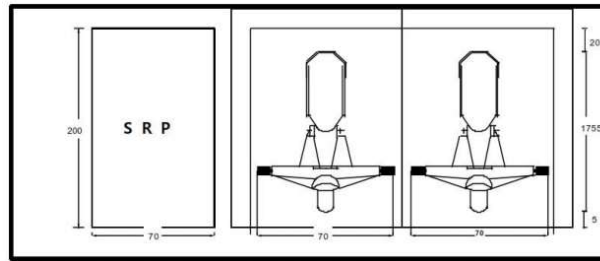


Figure 2. PSU for motorcycles (in cm)

Source: Guidelines for Planning and Operation of Parking Facilities (Direktorat Jenderal Perhubungan Darat, 1998)

The size of the parking space unit for motorcycles is determined from the size of the motorcycle with dimensions of 200 cm for length and 75 cm for the width.

2.4 Parking Space Capacity (PSC)

Parking Space Capacity is the capacity of vehicles parked in the available parking area. Parking space capacity can be calculated using the formula:

$$PSC = \frac{\text{Parking Space}}{\text{Parking Space Unit}}$$

3. Research Methodology

The research used a qualitative method by taking an approach based on empirical facts supported by the theoretical basis. Focus of the research is limited to the problem of capacity and facilities in parking lots at Bekasi Station based on the preferences of commuters. Data collection was conducted with a survey method both primary and secondary.

Research Variable

Table 2. Research Variable at Bekasi Kota Station

Indicators	Variables
Parking Characteristics	• Parking capacity • Parking rate • The convenience of existing parking facilities • Parking duration
Socioeconomic Characteristics	• Occupation • Residences status • Monthly salary income • Number of vehicles owned • Respondent age • Sex
Travel Characteristics	• Mode of transportation used to get to the station • Distance of residence to the station • Travel time to station • The intensity of using a private vehicle to the station

Source: (Authors Documentation, 2021)

The primary data (Parking Characteristics and Travel Characteristic Indicator) was obtained from an online questionnaire distributed to 68 respondents using KRL Commuter Line at Bekasi station and analyzed using descriptive statistical analysis methods. Meanwhile, the secondary data (Socioeconomic Characteristic Indicator) was from BPTJ (Jabodetabek Transportation Management Agency) data.

4. Result and Discussion

4.1 The Application of Parking Tower Technology in The World

The Parking Tower concept has been widely applied in developed countries, in particular. The type of Parking Tower facility is used to optimize parking space by utilizing vertical space. Car ramps or car lifts take up a lot of space, so mechanical car parking systems have proven viable. Multi-Level Car Parking System (MLCPS) has several advantages over conventional parking systems. Some of the advantages of MLCPS are, (1) Best use of space; (2) Low construction costs; (3) Low labor and maintenance costs; (4) Vehicle safety; (5) Environmentally friendly; (6) Driver-friendly; (7) Architects-friendly; (8) Advantages for builders/contractors.

4.2 The Application of Parking Tower Technology for Park and Ride in Jabodetabek

The initial foundation for Transit Oriented Development (TOD) and the provision of park and ride parking facilities in Jabodetabek are listed in the Regional Regulation of the Jakarta Capital Region Province concerning Detailed Spatial Planning and Zoning Regulation Number 1 of 2014 (Gubernur Provinsi Daerah Khusus Ibukota Jakarta, 2014). The basis of spatial utilization is (1) Road infrastructure development through the development of new roads, roads and parallel roads, construction of non-level crossings and the development of inspection roads; (2) Development of road-based and rail-based mass public transportation; (3) Implementation of Transit Oriented Development (TOD); (4) Provision of the park and ride parking facilities.

Until now, in Indonesia, especially Jabodetabek, there is no special regulation that regulates the standard of park and ride in public facilities such as railway stations. However, these standards are only limited to suggestions from previous research published in several national journals. In overseas, the

standards regarding park and ride are more in the form of transportation modeling or familiarly known as a push and pull strategy.

The application of parking towers for park and ride in public facilities such as electric railway (KRL Commuter Line) station is still not available in the Jabodetabek area. Quoting from Lee (2019), the Provincial Government of Special Capital Region of Jakarta through the Transportation Service has first implemented park and ride for Mass Rapid Transit (MRT) public transportation facilities, precisely around the Lebak Bulus Grab MRT station area in cooperation with Indonesian MRT Ltd. The park and ride is located 200 m from Lebak Bulus Grab MRT station with a capacity of 150 cars and 500 motorcycles. However, the park and ride available in the area is only limited to park and ride with the usual type of horizontal parking on flat land.

4.3 The Potential Implementation of Parking Tower for Park and Ride in Bekasi Kota Station

Based on the survey results, commuters at Bekasi Kota Station are dominated by students (41%) and private employees (39.3%) who have high mobility. 55.7% of respondents used private vehicles to get to the station from their residence. 63.9% of respondents agreed and 33.3% of respondents have the possibility to park their vehicles in the parking tower if the facility has been realized.

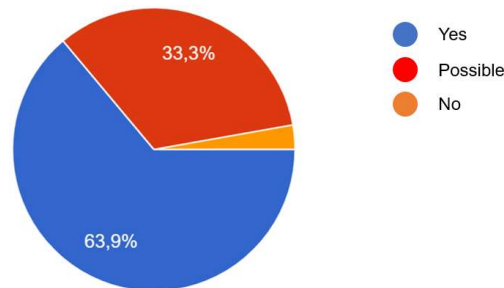


Figure 3. The Possibility of The Respondents Parking Their Vehicles at Parking Tower Facility If There is An Integrated Parking Tower with The Station

Source: (Author Documentation, 2021)

This is an indication that the parking facility at Bekasi Kota Station has great potential as a place to switch private transportation modes to public transportation modes. In order to maximize the potential, a parking facility is required that can accommodate the needs of commuters who use private vehicles to get to the station.

The development of Bekasi Kota Station parking area in the south side area is 2,800 m² and in the north side area is 4,400 m² (Humas Direktorat Jenderal Perkeretaapian, 2019). Those areas are still unable to accommodate the commuter's private vehicle as a whole, this fact is obtained from the survey results of 63.9% commuters who still park their private vehicles outside the station as well as field observations shown in Figure 3.



Figure 4. Parking Facilities Outside Bekasi Kota Station

Source: (Author Documentation, 2021)

4.3.1 Parking Space Capacity (PSC) at Bekasi Kota Station

Based on the survey, 66.7% of respondents rated the existing parking facilities at Bekasi Kota Station currently is quite good. However, from the survey, 47.2% of respondents rated that parking capacity at Bekasi Kota Station needs to be increased.

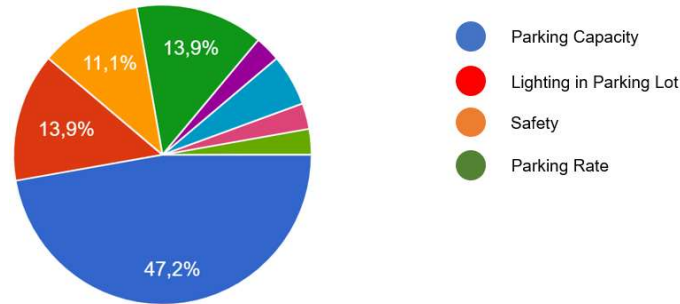


Figure 5. What Should be Improved from The Existing Parking Facilities
Source: (Author Documentation, 2021)

Location : Bekasi Kota Station
North side area (development) : 2.800 m²
South side area (development) : 4.400 m²

The mock-up floor plan of Bekasi Kota Station can be seen in Figure 6.



Figure 6. Bekasi Kota Station Floor Plan
Source: (Authors Documentation, 2021)

Based on the observation, the parking pattern applied at Bekasi Kota Station is using a two-sided vehicle parking pattern by forming an angle of 90° as shown in Figure 4. This pattern was chosen because it has more vehicle capacity, but the driver's maneuverability becomes limited if it is compared to the smaller angle parking pattern of 90°. Later, the area of north side is divided into two parts, one to accommodate car vehicles and the other for motorcycles.

The authors use PSU of Passenger Cars Class I and Motorcycles as shown in Table 2. in this research, PSC in north side of Bekasi Kota Station is 121 cars and 933 motorcycles. Meanwhile, in south side of the station, PSC obtained as many as 191 cars and 1466 motorcycles.

4.3.2 Parking Tower for Park and Ride at Bekasi Kota Station

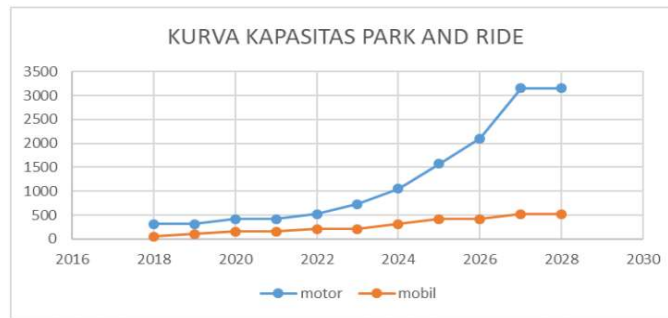


Figure 7. Park and Ride Projection in 2018 to 10 Years
Source: (Hakim, Andhika Zulfikri., Dilya, Sherly Putri., 2018)

The projection of park and ride capacity increases every year, this indicates that the increase will also occur in the park and ride of Bekasi City Station. Therefore, the management, in this case KAI Ltd, should focus more on dividing the parking area for motorcycles compared with cars.

This parking tower concept can be made in the form of a parking building consisting of several floors within the station area and also equipped with supporting facilities such as the Sky Bridge which is connected to the station platform and other supporting facilities such as service stations, helmet washing service, vehicle wash, helmet storage, and street vendors. This can be done to provide comfort for parking tower users.

4.3.3 Smart Parking System for Parking Tower at Bekasi Kota Station

The implementation of a parking tower in Bekasi Kota Station will be equipped with a smart parking system.

In terms of rate/payment aspect, for the current payment system, Bekasi Kota Station has used 2 (two) types of methods such as:

(1) Contact Method. This method is a payment system using e-money from banks or minimarkets that have cooperated with the station;

(2) Mobile Devices. This method uses a cashless payment system of an e-money balance that is connected to a smartphone application for parking tower users. Users will be directed to the parking menu and download the 3rd application in the form of *Parkee* or *Sky Parking* application to be able to scan the barcode at the auto gate in the station.

The current payment system still uses hourly rates, both cars and motorcycles.

In terms of service/operational aspect, the development of smart parking system innovation that can be applied to the Parking Tower Concept at Bekasi Kota Station are:

(1) Cashless Integrated Payment. 80% of survey respondents agreed that parking tower payment uses a cashless payment system. Then the development of the current payment system can be integrated with round-trip KRL Commuter Line fares to the destination through a cashless application that can be downloaded on users' smartphone. It is reinforced by the survey results of 72.2% of respondents agreed to the integration of parking tower rates so that seamless transportation can be realized at Bekasi Kota Station. With the integration of the payment system, users can choose the type of subscription and non-subscription payment packages provided by Bekasi Kota Station manager to be more efficient, considering that there are still many commuters who have many activities so they often park their vehicles for hours;

(2) Online Vehicle Parking Reservation System (OVPRS). Online Parking Reservation System is a system that allows parking tower users to reserve their parking slots in advance online which is connected to the users' smartphone. Bekasi Kota Station Manager should provide a particular slot with a certain capacity both car and motorcycle for users who have reserved with OVPRS;

(3) Online CCTV Monitoring. With the development of Online CCTV Monitoring, parking tower users can monitor their vehicles in real-time through their smartphone;

(4) Parking Sensor Availability. Parking Sensor Availability is a system that detects the availability of parking location slots. This system can be a signal light placed on the parking lot ground of each PSU or integrated with the application on the user's smartphone;

(5) Ladies and Disability Friendly Parking. Until now, Ladies and Disability Friendly Parking system is still rarely applied in public facilities, especially at stations. This special area will be provided at the parking point closest to the station's main entrance. The survey showed that 61.7% of respondents are dominated by women. Therefore, the purpose of Ladies and Disability Friendly Parking is to provide convenience for ladies and disabilities so they have no difficulty parking their vehicles without worrying and having to go around to find a parking slot.

5. Conclusion

Increasing parking capacity at Bekasi Kota Station is now needed, considering the current condition of Bekasi Kota Station in the process of developing train lanes so that it will cause an increase of station visitors and the increasing of park and ride facility for commuters who use KRL from Bekasi Kota Station to their place of activities.

In order to implement the 3 (three) aspects of good public transport integration, it is necessary to optimize the three aspects:

(1) Physical Integration, which is the development of park and ride facilities in the form of parking tower;

(2) Service/Operational Integration, which is the application of a smart parking system at parking tower;

(3) Rate/Payment Integration, which is integrating parking tower payment with round-trip KRL Commuter Line fares to the destination.

The parking tower concept for park and ride at Bekasi Kota Station is expected to attract public interest to switch using public transportation

(especially KRL) to their place of activities, to reduce the rate utilization of private vehicles heading of Jakarta.

Thus, Bekasi Kota Station as one of the urban transportation nodes will successfully implement the 3 (three) aspects of public transport integration namely physical integration, service/operational integration, and rate/payment integration.

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