Feasibility Study of Park and Ride City of Depok

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ABSTRACT

Depok City is a city in West Java Province, Indonesia. The city is located just south of Jakarta, which is between Jakarta and Bogor. The total population of Tangerang Regency in 2020 is ± 2,457,745 people according to the Central Statistics Agency (BPS) of Depok City. Depok City which has an area of 200.29 km. This research was conducted to determine the feasibility level of the Park and Ride development plan in Depok City. Traffic counting surveys and interviews were carried out on the main road sections which were then processed using Microsoft Excel to determine the parking accumulation until the fluctuation of motorbikes and cars was known. Furthermore, the interview data is processed to determine the amount of public interest in the development of Park and Ride which is reviewed based on gender, age, trip duration, trip intent, parking duration, monthly fuel expenditures, desired parking rates and those who agree to use Park and Ride when the survey was conducted at 06.00-21.00 WIB on Jalan Jatijajar Terminal area. From the results of processing this data using Microsoft Excel, the characteristics of Park and Ride facilities users and also the number of users of Park and Ride facilities for motorbikes were found to be 421, while for cars of 116 with a plan age until 2021, this proves that there is a need to increase interest in motorbikes Park and Ride development at Jatijajar Depok Terminal.

Keywords: park and ride; Jatijajar terminal; transportation; motorcycles; terminal.

INTRODUCTION

Depok City is one of the city partners for DKI Jakarta after Tangerang, Bogor and Bekasi which are currently developing quite rapidly as regions with respect to the City, relying on the service and trade sectors. With an area of ± 200.29 km2 and a population of 1,809,120 people. With the provision of Park and Ride facilities at Jatijajar Terminal, Depok City is expected to be able to encourage private vehicle users, especially road users who travel commuting and their activity areas are in line with transportation. mass so that they want to park their private vehicles in park and ride facilities and continue the journey to the destination city using mass transportation, and be able to encourage the economy of the Depok City Government. Transportation is one aspect that plays a direct role in the development of an urban area. City development causes a person's mobility to increase, so it is necessary to have transportation infrastructure that can support his movement needs. Transportation has two main roles, namely as a tool for directing development in urban areas and as a means for the movement of people and goods arising from activities in that area.

Travel is carried out in every activity. Activities that support travel are very important to learn. Travel facilities carried out in the study area, allow vehicles and people to always move. The movement of people and goods along with the consequences of the pattern of travel of people and goods as well. Someone will move according to the planning that is done so that the planning will be successful according to the context that is carried out. To determine activities that require travel time. Travel time depends on how fast it is (Syaiful S, Pratama Y, 2019; Syaiful S, Hariyadi D, 2019; Syaiful S et.al, 2020).

Understanding people in making a move will have a big influence on a person's behavior. This behavior depends on the form adapted to the current situation. People will travel with a clear purpose. The purpose of the trip must be carried out as planned. The destination area must also have been determined in advance, so that the trip takes place without significant obstacles. This condition is always a concern for every good activity (Syaiful S, Fadly A, 2020; Syaiful S et.al, 2021; Syaiful S, Rusfana H, 2022; Syaiful S et.al, 2022).
All movement of people is a journey in the future. This condition demands a clear and directed path. This path affects the surface hardness and clear shape in terms of the surface traversed. The journey of people and goods is determined by how much influence is significant. According to this effect, it is related to the road conditions above. So that the better the path traversed, the faster people will reach their destination. Remembering people's journey is very important. The importance of travel is measured by activities that are always well planned (Syaiful S et.al, 2022; Syaiful S, Lasmana L, 2020).

Parking

According to the Directorate General of Land Transportation No.8 of 2009, the meaning of parking is the activity of not moving a vehicle temporarily with the driver not leaving the vehicle. Parking is one element of the means that cannot be separated from the road transportation system as a whole. Parking facilities must be available at the destination (offices, shopping, entertainment or recreation places, etc.) and at home (in the form of a garage or parking setting). If not available, the road space will become a parking space, which means reducing the effective width of the road and thereby reducing the effective width of the road and the capacity of the space concerned. The next consequence is traffic jams (Tamin, 2008). The role of parking facilities in the transportation system can be seen from its function in providing travel destinations from traffic movements. Problems that arise in parking facilities if the parking requirements do not match or exceed the available parking requirements is that vehicles cannot be accommodated so that it will interfere with the smooth flow of traffic on the surrounding roads. The parking pattern on the road is parallel and angular parking patterns. However, on-street parking is not always permitted due to traffic conditions. We can only recommend which one is best applied to road bodies (Warpani, 2002).

RESEARCH METHODS

The research was carried out in July to August 2020. And the location of this research was carried out in the area around Jatijajar Terminal. With an area of land to be built a park and ride 1,786 m².

![Figure 1. Location planning](image)

The stages of this research are shown in the form of a flow chart as follows:
RESULTS AND DISCUSSION
Parking Characteristics

The parking survey at Jatijajar Terminal was conducted for 12 hours (06:00 - 21:00) for four-wheeled and 2-wheeled vehicles. The following are the results of the parking survey at the Jatijajar Terminal parking lot:

Table 1. Accumulated parking at Jatijajar Terminal

| Execution time | Vehicle amount | Car | Motorcycle |
|----------------|----------------|-----|------------|
|                | Accumulated in | Accumulated out | Accumulated in | Accumulated out | Car total | Motorcycle total |
| 06.00-07.00    | 12             | 3    | 26         | 21             | 5         | 12               | 26             |
| 07.00-08.00    | 15             | 4    | 41         | 20             | 5         | 15               | 41             |
| 08.00-09.00    | 23             | 5    | 57         | 25             | 9         | 23               | 57             |
Table 2. Parking survey at Jatijajar terminal

| Execution time   | Car | Motorcycle |
|------------------|-----|------------|
|                  | accumulated  | in |  out | accumulated  | in |  out |
| 06.00-07.00      | 12  | 5 | 3 | 12 | 15 | 13 |
| 07.00-08.00      | 20  | 10 | 2 | 31 | 28 | 9 |
| 08.00-09.00      | 23  | 5 | 2 | 34 | 10 | 7 |
| 09.00-10.00      | 33  | 15 | 5 | 42 | 13 | 5 |
| 10.00-11.00      | 34  | 3 | 2 | 57 | 25 | 10 |
| 11.00-12.00      | 37  | 6 | 3 | 81 | 32 | 8 |
| 12.00-13.00      | 39  | 4 | 2 | 82 | 12 | 11 |
| 13.00-14.00      | 42  | 7 | 4 | 91 | 23 | 14 |
| 14.00-15.00      | 50  | 13 | 5 | 95 | 14 | 10 |
| 15.00-16.00      | 54  | 11 | 7 | 104 | 27 | 18 |
| 16.00-17.00      | 56  | 5 | 3 | 111 | 20 | 13 |
| 17.00-18.00      | 59  | 10 | 7 | 113 | 11 | 9 |
| 18.00-19.00      | 51  | 2 | 10 | 108 | 10 | 15 |
| 19.00-20.00      | 42  | 3 | 12 | 100 | 12 | 20 |
| 20.00-21.00      | 33  | 1 | 10 | 90 | 7 | 17 |
| amount           | 100 | 77 | 259 | 179 |

Figure 3. Graph of Accumulated Car Parking at Jatijajar Terminal
Figure 3. Graph of Accumulated Car Parking at Jatijajar Terminal

Parking Capacity

Table 3. The results of the parking capacity calculation

| Allocation               | Unit (SRP for passenger cars) | Need for Parking Space |
|--------------------------|-------------------------------|------------------------|
| Trading center           |                               |                        |
| Shops                    | SRP/100 m² efektive floor area| 3.5 – 7.5              |
| Supermarkets             | SRP/100 m² efektive floor area| 3.5 – 7.5              |
| Public service           |                               |                        |
| Non public service       | SRP/100 m² efektive floor area| 1.5 – 3.5              |
| Public service           | SRP/100 m² efektive floor area| 1.5 – 3.5              |
| School                   | SRP/student                    | 0.7 – 1.0              |
| Apartemen /lodging       | SRP/room                       | 0.2 – 1.0              |
| Hospital                 | SRP/beds                       | 0.2 – 1.3              |
| Cinema                   | SRP/seats                      | 0.1 - 0.4              |
| No                       | Type of building               | Total                  |
| Terminal parking         |                               | 935                    |

Apartment Parking Space Needs

| No  | SRP       | Number of parking spaces (SRP) |
|-----|-----------|---------------------------------|
| 1   | Public facilities | 14,025                          |
|     | Station coefficient 1,5 |

Motorcycle parking capacity

Car parking capacity

The highest parking accumulation is at 17: 00-18: 00 as many as 59 vehicles parked at Jatijajar Terminal. That way the parking index or parking turnover rate can be calculated.

Level of Use of Parking Areas

Parking index

The highest parking accumulation is at 17: 00-18: 00 as many as 59 vehicles parked at Jatijajar Terminal, Depok City. Thus the parking index or parking turnover rate can be calculated as follows:

\[
\text{Car Parking Index} = \frac{\text{Number of Vehicles}}{\text{Highest accumulation}} = \frac{59}{100} = 1.694
\]
Motorcycle Parking Index = Number of Vehicles
Highest accumulation

\[
\frac{259}{113} = 2.292
\]

**Turn over**

Turn Over or the level of parking land use is obtained by comparing the number of parking vehicles with the parking capacity provided. The following is the Turn Over of four-wheeled vehicles and motorbikes:

\[
\text{(Turn OverMobil} = \frac{\text{Number of Parking Vehicles}}{\text{Parking Capacity}}) = \frac{100}{4.9} = 20,408
\]

\[
\text{(Turn OverMotor} = \frac{\text{Number of Parking Vehicles}}{\text{Parking Capacity}}) = \frac{259}{32,164} = 8,052
\]

**Table 4. Parking and turnover index**

|          | Parking index | Turn over |
|----------|---------------|-----------|
| Motorcycle | 2.292         | 8,052     |
| Car       | 1.694         | 20,408    |

**Interview**

An interview survey was conducted to determine the number of demands and also to determine the characteristics of park and ride users at Jatijajar Terminal. The survey was carried out by conducting direct interviews with parking users who were carrying out activities in the terminal environment located in the parking lot. Interviews were conducted between 6:00 am and 8:00 am within a few working days.

Survey results on the number of potential park and ride users

Based on the desired parking rates
Based on the number of Park and Ride users using motorbikes

Figure 4. Diagram of motorbike users based on desired parking rates

Figure 5. Diagram of car users based on desired parking rates

Figure 6. Diagram of motorcycle users based on the desire to use park and ride services
Figure 7. Diagram of car users based on their desire to use park and ride services

Demand Park and Ride

In the interview results for motorbikes, it was found that the number of people who wanted to use the park and ride facilities was 56%. Meanwhile, for cars, people who want to use park and ride facilities are 51%.

Demand park and ride for motorbikes

The data obtained for motorbikes are:

- Total Vehicle Volume = 431 vehicles
- Error Percentage = 44%
- Percentage of desire = 56%

\[
\text{Demand Park and Ride} = 0.56 \times 431 = 241
\]

\[
\text{Demand maximum} = 241 + (241 \times 0.44) = 347 \text{ vehicles}
\]

\[
\text{Demand minimum} = 241 - (241 \times 0.44) = 134 \text{ vehicles}
\]

From the calculation above, the maximum demand is selected. Therefore, it can be concluded that the number of park and ride demand for motorbike users in 2021 is 347 vehicles.

Demand park and ride for cars

The data obtained for the car are:

- Total Vehicle Volume = 127 vehicles
- Error Percentage = 49%
- Percentage of desire = 51%

\[
\text{Demand Park and Ride} = 0.51 \times 127 = 64
\]

\[
\text{Demand maximum} = 64 + (64 \times 0.49) = 95 \text{ vehicles}
\]
Demand minimum  

\[= 64 - (64 \times 49\%)\]

\[= 32 \text{ vehicles}\]

From the calculation above, the maximum demand is selected. Therefore, it can be concluded that the number of park and ride demand for car users in 2021 is 95 vehicles.

Estimated Income Scenarios.

### Table 5. Estimated annual revenue for scenario 1

| No | Type                   | Volume | Unit price (Rp) | Time | Unit | Income   |
|----|------------------------|--------|----------------|------|------|----------|
| 1  | Motorcycle parking     | 347    | Rp 5.000       | 360  | day  | Rp 624,600,000 |
| 2  | Car parking            | 95     | Rp 15.000      | 360  | day  | Rp 513,000,000  |
| 3  | Retail land lease      | 1      | Rp 50,000,000  | 1    | year | Rp 50,000,000   |
| 4  | Rental food court area | 3      | Rp 50,000,000  | 1    | year | Rp 150,000,000  |

Total  Rp 1,337,600,000

### Table 6. Estimated annual revenue for scenario 2

| No | Type                   | Volume | Unit price (Rp) | Time | Unit | Income   |
|----|------------------------|--------|----------------|------|------|----------|
| 1  | Motorcycle parking     | 347    | Rp 3.000       | 360  | day  | Rp 374,760,000 |
| 2  | Car parking            | 59     | Rp 10.000      | 360  | day  | Rp 342,000,000  |
| 3  | Retail land lease      | 1      | Rp 50,000,000  | 1    | year | Rp 50,000,000   |
| 4  | Rental food court area | 3      | Rp 50,000,000  | 1    | year | Rp 150,000,000  |

Total  Rp 916,760,000

Estimated Operating Costs

### Table 7. Estimated annual expenditure

| No | Operational Costs | Volume | Unit price (Rp) | Time | Unit   | Expenses/year |
|----|-------------------|--------|----------------|------|--------|---------------|
| 1  | Officer Salary    | 8      | Rp 4,200,000   | 12   | month  | Rp 403,200,000 |
| 2  | Electricity Usage | 132    | Rp 1,645       | 4320 | hours  | Rp 937,771,085 |
| 3  | Allocation of Care| 1320   | Rp 60,000      | 1    | year   | Rp 79,200,000  |

Total  Rp 1,420,171,085

### Table 8. Estimated expenditures for park and ride development

| No | Type                  | Volume  | Unit   |
|----|-----------------------|---------|--------|
| 1  | Land area             | 1786    | m²     |
|    | Building coverage area| 0.80    |        |
| Building area | 1428 | m² |
|---------------|------|----|
| Motorcycle parking | 378.00 | m² |
| Car park | 1.050.00 | m² |
| Number of towers | 1.00 | towers |
| Number of towers/units | 1.00 | unit |
| Number of units/floors | 1.00 | floors |
| Total GFA | 1.428.00 | m² |
| Number of units | 1.00 | unit |
| Unit size Avr | 2.560.00 | m² |
| Motorcycle/floors | 347.00 | Unit |
| Car/floors | 95.00 | Unit |
| Total number of vehicles | 442.00 | pax |
| Land value | 12.000.00 | per m² |
| Project development stage | 2.00 | year |
| Project age | 25.00 | year |
| Building costs | 4.000.000 | Rp |
| Total development costs | 5.715.200.000 | Rp |

### Figure 7. Economic Feasibility Analysis Table Scenario 1

| Parameter | Scenario 1 | Scenario 2 |
|-----------|-----------|-----------|
| Building area | 1428 | m² |
| Motorcycle parking | 378.00 | m² |
| Car park | 1.050.00 | m² |
| Number of towers | 1.00 | towers |
| Number of towers/units | 1.00 | unit |
| Number of units/floors | 1.00 | floors |
| Total GFA | 1.428.00 | m² |
| Number of units | 1.00 | unit |
| Unit size Avr | 2.560.00 | m² |
| Motorcycle/floors | 347.00 | Unit |
| Car/floors | 95.00 | Unit |
| Total number of vehicles | 442.00 | pax |
| Land value | 12.000.00 | per m² |
| Project development stage | 2.00 | year |
| Project age | 25.00 | year |
| Building costs | 4.000.000 | Rp |
| Total development costs | 5.715.200.000 | Rp |

### Figure 8. Economic Feasibility Analysis Table Scenario 2
In accordance with the investment criteria, namely:

NPV ≥ 1
IRR ≥ Loan interest rate at the bank
BCR ≥ 1

So from the results of the economic analysis for the first scenario meet the above criteria with an IRR of 2.9%, NPV more than 1 and a BCR of 1.13

**CONCLUSION**

Based on the results and discussion that have been described, the following conclusions can be drawn. From the results of the analysis using stated preference, it is found that the probability percentage of people who will use Park and Ride in Jatijajar Terminal, Depok City is as follows, percentage of motorcyclists: 56%, percentage of motorists: 51%. From the results of the projected increase in vehicles in Depok City, namely motorbikes by 5% and cars by 3% as well as data on potential Park and Ride users obtained from the interview survey, the maximum demand for Park and Ride is 347 motorbikes and as many as cars. 95 units. Payback analysis exists in the 19th year after development. For motorbike parking rates, IDR 5,000 and IDR 15,000 for car parking

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