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Financial and Economic Feasibility Study for the Development of West Java International Airport Road Access

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Abstract
West Java International Airport is an airport that has the status of an important transportation hub for the local community and the development of the Rebana Area. The development of access to West Java International Airport is a step that must be taken to serve the demand or demand for air movement, with the development of this access it is hoped that it can increase the demand of Airport passengers. This research is in the form of a study on the financial and economic feasibility of the development of road access at West Java International Airport. The research methodology uses modeling to determine the rise and pull, then to get the comparison value between the rise and pull using the gravity method calculation and modeling is carried out using the PTV assistance program. VISUM. Based on the results of the analysis that has been carried out, it is indicated that the development of access to West Java International Airport can be declared financially unfeasible because of the BCR value of 0.56 <1 and NPV of IDR. 3,023,624,980 >1 and the calculation time of the payback period value cannot be returned for 20 years of the planned time. Meanwhile, the economic analysis for the development of access to West Java international Airport can be declared feasible because of the BCR value of 1.70 >1 and NPV IDR. 4,758,339,992,555 >0.

Keywords: BIJB, Financial and Economic Feasibility, Modeling, BCR, NPV

1. Introduction

The construction of an access toll road to BIJB Kertajati which is connected to the Cikopo – Palimanan Toll Road along with the construction of the Cisumdawu Toll Road will support connectivity to the Airport by reducing travel time from the government center and activities of Indamayu Regency located in Jatibarang District. The distance between the activity center of Indramayu Regency and BIJB Kertajati is 57-kilometers with a travel time of 1 hour and 45 minutes via national road. to 45 minutes. This toll road connects the city of Bandung through the Cipularang – Cipali Toll Road with many problems related to land acquisition located on the *Twin Tunnel* section with a length of 472 meters. Therefore, to facilitate access for people in Indramayu Regency to use BIJB Kertajati, it is necessary to develop road access by

building access to the Jatibarang Toll Road which is connected to the Cikopo – Palimanan Toll Road. Since the Airport began operating on May 24, 2018, the utility of this Airport is quite low and was closed during the pandemic, from these problems, the development of road access to the Airport is one of the efforts to increase the demand of Airport passengers by making accessibility to the Airport easier. In this study, a case study of accessibility from the activity center of Indramayu district to Kertajati Airport was taken due to the absence of a freeway at the center of the district activity.

2. Literature Review

2.1 Highway

Based on Government Regulation No. 15 of 2005 concerning toll roads which are defined as part of the road network system and as a national road whose users are required to pay tolls. In addition, it was also explained in MKJI 1997 regarding toll roads as roads for continuous traffic with full control of the entrance road, both divided and undivided roads,

2.2 Traffic Flow

According to Jyoti and Anak Agung (2021), in this case, there are several stages in analyzing a road condition by taking into account the maximum traffic flow to the capacity of the road section per unit hour. So that from this comparison, a value is obtained as a factor in determining traffic performance at an intersection and road segment.

2.3 Vehicle Operating Costs

According to the PUPR Construction and Building Guidelines related to Vehicle Operating Costs are the total costs needed to operate vehicles in traffic and road conditions for a type of vehicle per kilometer of mileage. VOC consists of several components, including:

1. Running Cost
2. Fixed Cost

The cost incurred by a vehicle in traveling. The amount of benefit from VOC is obtained from the calculation of the saving value.

2.4 Time Value

According to Hanser (1989), time value is the amount of money available by a person to save travel time or a certain amount of money prepared to spend one unit of travel time value (Rogers, 1975). The calculation of the time value uses the following formula.

$$Time\ Savings = Time\ Value \times (Travel\ Time\ Eksisting - Travel\ Time\ with\ Project) \times V \quad (1)$$

2.5 Economic Feasibility Analysis

According to Ardina, et al. (2016) the economic feasibility of the development of a road network must be able to provide benefits to the community if viewed from the Government's perspective. Aspects that affect the analysis of economic feasibility are the benefits of the project, such as: VOC Savings, Time Value Savings and Accident Cost Savings. In addition, according to Jyoti and Anak Agung (2021), the puIDRose of the economic aspect analysis is the occurrence of economic efficiency of projects that will be built by the government can provide maximum benefits to the community. The parameters/criteria used include: NPV, BCR and EIRR.

2.6 Toll Tariff Analysis and Advertising

The toll tariff provisions for new toll roads in 2023 are 500/Km/Vehicle for passenger cars and 3500/Km/Vehicle. The increase in toll rates every year is based on an inflation rate of 4.71%. The calculation of toll tariff revenue is calculated by the following formula.

Toll tariff revenue = toll tariff x toll road length x Toll volume (2)

2.7 Financial Feasibility Analysis

According to Jyoto and Anak Agung (2021), the financial feasibility analysis is the basis for determining the financial resources needed for a certain level of activity and the profits that can be expected. So it aims to find out whether the planning is feasible or not. According to Ardina, et al. (2016), the aspects that affect the analysis of financial feasibility include:

1. Cost-investment
2. Toll rates
3. Operational-Maintenance Costs

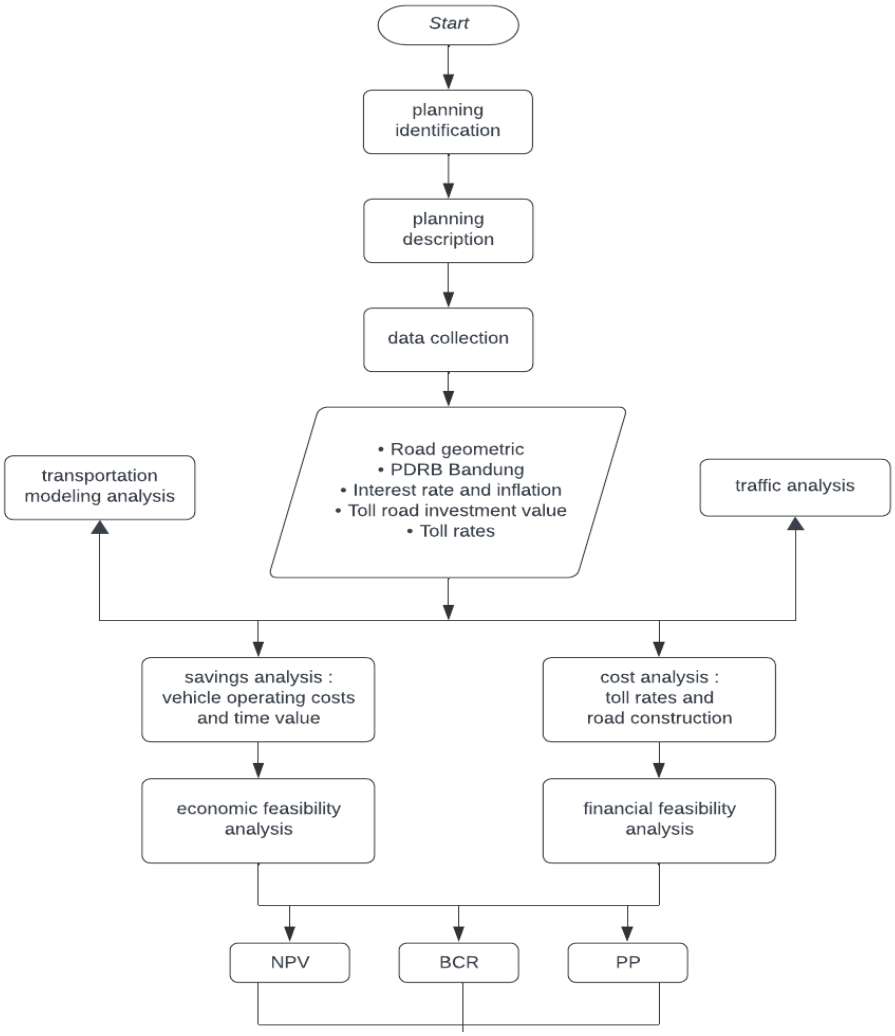
The calculation methods used to determine the financial feasibility of the project include:

1. Benefit Cost Ratio (BCR)
2. Net Present Value (NPV)
3. Payback Period (PP)

3. Methodology

3.1 Flow Chart

This flowchart is the stages/steps used in this research.



3.2 Data Needed

In the feasibility study of the development of West Java toll road access, the data needed includes:

1. Road geometry data
2. West Java GDP Data
3. Interest Rate and Inflation Data
4. Investment value of toll and non-toll roads
5. Toll rates
6. Vehicle Operating Cost Data

3.3 Data Analysis

In this analysis, there are several stages of analysis, including traffic analysis to find out traffic flow data on each road condition, including the calculation of the degree of saturation (DS). Furthermore, a modeling analysis was carried out to find out the results of Rise and Pull on each motor vehicle, so that a percentage value was obtained for the comparison between Rise and Pull using the Gravity Method.

3.4 Eligibility Analysis

The several stages of analysis in analyzing the feasibility of this research include:

1. Vehicle Operating Cost Analysis (VOC)
2. Time-Saving Analysis
3. Cost Analysis (Toll Rates and Road Construction)
4. Financial & Economic Feasibility Analysis

3.5 Output

So that from the feasibility analysis, the results are expected to meet the eligibility criteria for economic aspects (BCR >1, NPV >0) and financial aspects (BCR>1, NPV>0). So that the development of access to toll roads and non-toll roads is declared feasible from an economic and financial perspective.

4. Data Analysis and Discussion

4.1 Traffic Data Analysis

From the traffic volume data obtained through direct observation in the field, it is then used to analyze the capacity of the road section and the degree of saturation. The calculation of road capacity uses the following formula.

$$C = CO \times FC_W \times FCSP \times FCSF \quad (3)$$

So that the road capacity of national roads and existing toll roads is obtained as listed in Table 1 below.

Table 1. Existing Condition Road Capacity

Road	Co.	FCw	FCsp	FCsf	C
Lohbener Highway	2900	1,25	0.94	0.89	3300
Lohbener Highway	2900	1,25	0.94	0.89	3300
Kertajati-Sumberjaya Toll Road	2300	1.04	0.91	-	2177
Sumberjaya - Kertajati Toll Road	2300	1.04	0.88	-	2105

From the calculation of the road capacity above, the degree of saturation is calculated using the following formula.

$$Ds = Q/C \quad (4)$$

So that the value of the degree of saturation in 2023 from each road is obtained as follows in Table 2 below.

Table 2. Degree of Saturation

Road	Q	C	Ds
Lohbener Highway	1987	3300	0.655
Lohbener Highway	2177	3300	0.718
Kertajati-Sumberjaya Toll Road	1554	2177	0.714
Sumberjaya - Kertajati Toll Road	1659	2105	0.788

From the results of table 2, it can be seen that several road sections, both national roads and toll roads, are in a saturated condition (Ds > 0.75), then the calculation of traffic flow growth is carried out using population data, GDP per capita data and GDP data on constant prices. These data are then used as a reference for vehicle growth up to the plan year, which is 5 years.

The free-flow speed for freeways is calculated according to the type of vehicle. The calculation of the free current velocity can be seen in Table 3 below.

Table 3. Freeway Flow Speed

Road	FVo				FVw	FV			
	LV	MHV	LB	LT		LV	MHV	LB	LT
Kertajati-Sumberjaya Toll Road	78	63	81	60	1	79	64	82	61
Sumberjaya - Kertajati Toll Road	78	63	81	60	1	79	64	82	61

After calculating the capacity, degree of saturation and free flow velocity on the existing road section, modeling was carried out using Vissum software rocks.

4.2 Modeling Analysis

In the analysis of toll road construction, a modeling analysis stage was carried out on the calculation of the rise and pull of motor vehicles which aimed to find out the number of road users compared due to the construction of new roads. In the calculation of the following rise and pull using the Gravity method and model initiation by providing a load on the ODM that has been modeled using PTV Vissum software.

Table 4. Vehicle Attraction Awakening

Regency	Resurrection				Pull			
	Motor		Car		Motor		Car	
	2023	2028	2023	2028	2023	2028	2023	2028
Indramayu Regency	16.289.624	19.967.425	16.289.642	19.967.425	16.291.458	19.971.687	16.291.458	19.971.687
Majalengka Regency	9.742.338	12.700.587	9.742.338	12.700.587	9.739.798	12.700.015	9.739.798	12.700.015

To form the Origin Destination Matrix (ODM) using the UCGR (Unconstrained gravity) gravity calculation (without Constraints) with the input of the ODM result *f (Cid)* and the calculation of *β*. ODM modeling by determining *Ti*d with the following formula.

$Tid = Oi \times Dd \times Ai \times Bd \times f\ (Cid)$, with a value $Bd = 1$ and $Ai = 1$ (5)

Where for the calculation of the resistance matrix and the calculation of the cost matrix use the following formula.

$f(Cid) = exp(-\beta Cid)$ (6)

$\beta = 2.5\ avg\ (Cid)$ (7)

Based on the road network and the ODM charged, Private Transport Assignment is used with the equilibrium method. The results of the loading of traffic volume and the results of the volume capacity ratio of each road section based on the ODM that has been formed can be seen in the following figure based on the results of the model initiation and after the model calibration on the construction of the Indramayu-Kertajatu toll road towards the 2028 plan year with the addition of Airport demand.

4.3 Traffic Analysis with Project

The traffic flow for the Indramayu – Kertajati toll road using the unit of junior high school/hour is determined by the LHRTD value multiplied by the k factor. The determination of the type of queue, the number of lanes, and the equivalent value of passenger cars refers to the Manual of the Directorate General of Highways No. 007/TBM/2009 concerning the procedures for geometric planning of toll roads. The following parameters are used in the construction of the Indramyu – Kertajati toll road.

	Q
LHRT	1500
k	0.11
Number of columns	4/2 D
C	2320
V/C Ratio	0,85

The following is the traffic performance after traffic capitalization using Vissum software.

Table 2. Degree of saturation with project

Road	Q	C	Ds
Lohbener Highway	1130	3300	0.373
Lohbener Highway	1134	3300	0.374
Kertajati-Sumberjaya Toll Road	1667	2177	0.765
Sumberjaya - Kertajati Toll Road	892	2105	0.424
Indramyu - Kertajati Toll Road	1500	2320	0.646

From traffic modeling using Vissum software, it can produce vehicle volume values that occur after the Indramayu – Kertajati toll road. After obtaining the traffic volume, it is then divided by the road capacity that has been calculated in existing conditions. From the results of the degree of saturation that has been calculated after the construction of the Indramayu – Kertajati toll road, vehicles that move using the toll road cause the road load to decrease.

4.4 Vehicle Operational Cost Savings

The operational costs of the vehicles in this study use the Jasa Marga method. The components of VOC in this method consist of fuel consumption costs, lubricating oil, tire usage costs, maintenance costs, depreciation costs, capital interest and insurance costs. The parameter used in the VOC calculation is the price of components in each type of vehicle based on different classes. To get the VOC savings value by comparing the VOC without project value with the VOC with project value as follows.

Total VOC without Project = VOC all existing roads without project
= IDR 10,464,399,867,164

Total VOC with project = VOC of all existing roads with project + VOC of Indramayu – Kertajati toll road
= IDR 10,074,284,928,908

So that the VOC savings value for the Indramayu-Kertajati toll road construction in 2028 is IDR. 390,114,938,256.

4.5 Time Value Savings

The calculation of the time value in this study uses sources from LAPI ITB 1997, so that the time value for 2023 is obtained as follows:

- Goal 1 = IDR 38,871
- Goal IIa = IDR 56,637

For the next time value, the inflation rate factor is 4.71%. With the calculation of the time value as follows.

Time Savings = Time Value × (Travel Time Eksisting – Travel Time with Project) × V (8)

In 2028, the construction of the Indramayu – Kertajati toll road will have an existing time value of IDR. 4,388,359,407,866 and with project of IDR. 4,003,167,050,981. So that a time saving value of IDR. 385,197,356,884 099 was obtained.

4.6 Economic Feasibility Analysis

On the economic feasibility of toll road construction, it is assumed that it will be in 2023 – 2027 and is planned to operate in 2028 – 2048 with an inflation rate of 4.71% and an interest rate of 5.48%. Economic feasibility is assessed from 2 parameters, namely NPV (Net Present Value) and BCR (Benefit Cost Ratio) by comparing the length of the road due to time savings with the inflation rate factor, the calculation of investment and maintenance value is obtained as follows.

- Investment Value = IDR 5,541,000,000,000
- Maintenance Costs = IDR 98,100,000,000

So that the parameter values for economic feasibility are obtained as follows.

- EBCR = 1.70
- ENPV = IDR 4,758,339,992,555

Therefore, it can be concluded that the construction of the Indramayu – Kertajati toll road with BCR>1 and NPV>0 values is said to be "Feasible" economically.

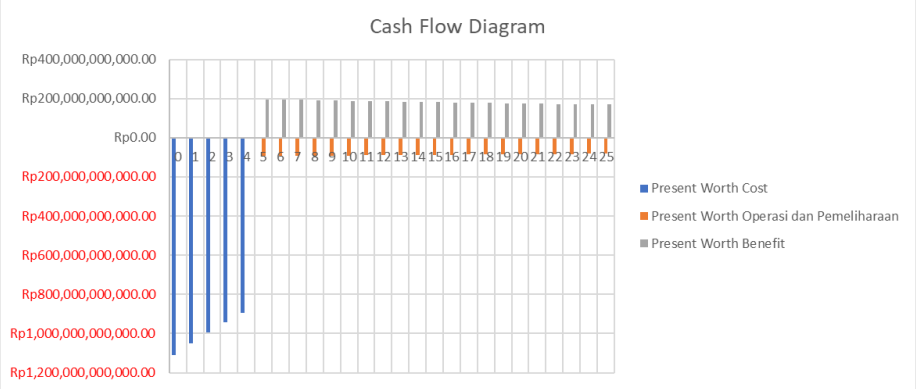
4.7 Financial Feasibility Analysis

In this analysis, expenditure is seen from the cost of investment in toll roads and O&M. While the income itself can be seen from the calculation of toll rates and toll advertisements as follows. The toll tariff used for the Indramayu-Kertajati line with a toll length of 36.9 km is as follows.

- Goal 1 = IDR. 1,044/Km/Vehicle
- Goal II = IDR. 3,375Km/Vehicle

The tariff increase for each year is based on an inflation rate of 4.71% from 2028 which is assumed to operate for the first time until 2048 based on the calculation of toll tariff revenue of IDR. 631,118,713,159. Revenue for toll advertising is assumed to be 1.5% of toll tariff revenue, so that advertising revenue in 2028 will be IDR. 3,771,449,106.94 and advertising revenue in 2048 will be IDR. 9,466,780,697.39. So that the total revenue from toll and advertising tariff revenues in 2028 will be IDR 255,201,389,569.56 and in 2048 will be IDR 640,585,493,856.86. To determine the financial feasibility analysis, it can be seen from the following indicators, including, BCR, NPV and Payback period. Therefore, cash flow is obtained for the Indramayu – Kertajati toll road in the following figure.

Figure 1. Diagram Cash Flow



So from the cash flow chart above, the results of the financial feasibility indicator value are obtained as follows.

- FBCR = 0.56
- FNPV = IDR 3,023,624,980
- FPP = No return in 20 years plan

So, it can be concluded from the construction of the Indramayu – Kertajati toll road with BCR<1 and NPV>1 values that can be said to be "Not Feasible" financially.

4. Conclusion

Based on the results of the analysis that has been carried out, it is indicated that the development of access to West Java international airport in terms of financial feasibility is obtained with a BCR calculation of 0.56 <1 and NPV of IDR.3,023,624,980 >1 with the calculation of the value of the Payback Period (PP) which cannot be returned within 20 years of the plan. Meanwhile, in terms of economic feasibility, a BCR value of 1.70 >1 and an NPV of IDR. 4,758,339,992,555 >0 were obtained. Based on these results, it can be concluded that the development of West Java International Airport toll road access is declared feasible from an economic point of view but not feasible from a financial point of view.

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