

Planning of Sukabumi – Padalarang Toll Road in View of Economic and Financial Feasibility

Muhammad Arya Indrayana, and Hera Widyastuti

Department of Civil Engineering, Institut Teknologi Sepuluh Nopember (ITS)

Corresponding Author: hera@ce.its.ac.id

ARTICLE INFO

Article Information

Article Received: 03-02-20

Article Revised: 14-09-22

Article Accepted: 14-09-22

Keywords

Planning of Sukabumi - Padalarang Toll Road in View of Economic and Financial Feasibility.

ABSTRACT

Construction planning of the Sukabumi - Padalarang toll road requires economic and financial considerations. Economic consideration is required to find out the advantage of the existence of the Sukabumi-Padalarang toll road towards the local communities. On the other hand, financial consideration is required as a reference in investment to know that the toll road is an efficient plan. Therefore, it is necessary to conduct the Planning of the Sukabumi - Padalarang Toll Road in View of Economic and Financial Feasibility in order to determine whether the toll road is feasible to be built. The method used to analyze the Vehicle Operating Cost (VOC) and time value was Jasa Marga Method. BCR and NPV parameters were used to analyze the economic feasibility aspect as the feasibility reference. In addition, the financial feasibility of profits analyzing was obtained from toll road revenue using the planned rates and BCR, NPV, and IRR parameters as feasibility references. The analysis obtained the economic feasibility of $2,51 > 1$, and the NPV value of IDR 11.582.529.466.479,80 > 0 . Financial feasibility obtained that the BCR value of $2,47 > 1$, NPV value of IDR 11.250.417.138.120,8 > 0 , and IRR value of $10,11 \% > 5,63 \%$ (MARR) as well as payback period for 2 years, 10 months, and 3 days. According to the results, it can be concluded that the construction of the Sukabumi - Padalarang toll road was feasible from economic and financial aspects.

INTRODUCTION

The rapid development of the economy causes the mobility of people and goods in West Java will be increasing. Due to the increasing of these motilities, transportation problem will become the main problem. This problem will continue to overshadow the provinces and/or big cities. Transportation plays a significant role in accommodating the smooth running of the economy. In other words, the economic growth in a region must be in line with the development of the region, especially in terms of transportation infrastructure development. The traffic jam that occurs in an area, especially from Sukabumi to Padalarang city will disrupt the road users' mobility and will hamper the economy in the region.

It is necessary to build an adequate facility in economic locations in West Java to overcome these problems. Thus, the government will build a Sukabumi – Padalarang Toll Road. In the future, it is expected that the road access from Sukabumi to Padalarang will not experience traffic congestion problems, and the region's economic growth can run smoothly. There are two sections on this toll road. Section 1 (Sukabumi-Ciranjang) is 30 km long, and Section 2 (Ciranjang – Padalarang) is 27 km long, and the total of this toll road is 57 km.

This toll road is intended to increase accessibility and reduce the traffic congestion level at this time. In addition,

it aims to increase productivity by reducing distribution costs in economic activity through saving Vehicle Operating Costs (VOC) and saving travel time.

In planning the Sukabumi – Padalarang Toll Road, it is necessary to review the economic and financial feasibility. Economic feasibility is required to determine the usefulness of the Sukabumi – Padalarang Toll Road. Besides, financial feasibility is required to avoid conflict in investment by investors. This study was conducted to determine the existing traffic condition and estimate the transfer number of the vehicle from the existing lane to the toll road. Further, it will get the amount of savings on Vehicle Operating Costs (VOC) and Time Value by the existing Sukabumi – Padalarang Toll Road.

METHODOLOGY

The following are the steps that must be carried out in conducting this study:

A. Identification Problem Step

In this step, the author observed the field conditions and problems that occurred until the author raised the topic of financial feasibility analysis in this study. Several things need to be identified, including toll road location; the area that will be passed by the road users, and what factors can affect the feasibility from the economic and financial

Table 1. DS Traffic Analysis

Year	Q(scr/hour)	C(scr/hour)	DS
2019	3533	2945	1.2
2024	4591	2945	1.559
2029	5966	2945	2.026
2034	7753	2945	2.633
2039	10075	2945	3.421
2044	13093	2945	4.446
2049	17016	2945	5.778
2054	22112	2945	7.508
2059	28736	2945	9.754

aspects.

B. Literature Study Step

In this step, the author looked for references that could support the implementation of the research preparation on the Financial and Economic Feasibility Study of the Sukabumi – Padalarang Toll Road in the form of journals, information from the internet, and books.

C. Collecting Data Step

Data collected in writing this study consisted of 2 types of data: primary and secondary. The following is an explanation of the data that would be collected:

1) Primary Data

Primary data was collected by collecting the data directly in the field. It used the observation method, namely direct observation and recording in the field, which was the VOC component survey prices, where the survey aimed to determine the prices of each VOC component for each class.

2) Secondary Data

Secondary data was data obtained from the results of studies that have been carried out previously. It included geometry data, existing road traffic volume, PDRB, toll road investment value, and construction drawings.

D. Data Analysis Step

In this step, the collected data was processed to analyze the road to be reviewed. Here are the steps:

1. Forecasting
2. Trip Assignment [1]
3. Road conditions *without project* analysis
4. Road conditions *with project* analysis
5. Investment cost calculation
6. Economic feasibility analysis
7. Financial feasibility analysis

E. Conclusion

After processing the existing data, thus it obtained the results as follows:

- a. The volume of vehicle passing through the route.
- b. The feasibility of Sukabumi – Padalarang toll road from economic and financial aspects.

RESULTS AND DISCUSSIONS

A. Data Analysis

Data collection and analysis aimed to collect data and then analyzed it according to the next calculation stage.

The research location in this study included the national roads section in the study area covering West Java Province.

1) Traffic Volumes

The traffic volume data used in this study was obtained from the project owner of PT. Bina Marga with the results of the daily traffic recapitulation on each road section.

2) Degree of Saturation (DS)

Degree saturation value showed the density or traffic rate of a road. This degree of saturation will be used as a basis for determining the traffic correction factor in calculating VOC from the economic perspective.

3) Free Flow Velocity Analysis

The free flow speed is defined as the speed when the flow level is zero. In other words, it is a situation where there is no obstacle for other motorized vehicles on the road. The analysis of the free flow speed was based on the geometric condition of each road section, and it used the formula of PKJI Outer City Road, Urban Roads, and Toll Roads.

The general form of the equation for determining free-flow speed for out-of-town roads is:

$$F_v = (FV_0 + FV_w) \times FFV_{SF} \times FFV_{CS}$$

- a. The Calculation of Existing Free Flow Velocity on Sukabumi – Grekbong Section.

One of the examples is:

Light Vehicle (LV)

Base Free Flow Speed LV (FV_0) = 65 km/jam

Road Width Factor (FV_w) = 0

Side Friction Factor (FF_{SF}) = 0,95

Road Function Class Factor (FFV_{CS}) = 1

$$F_{v, LV} = 61,75 \text{ km/jam}$$

- b. The Calculation of Free Flow Speed of the Toll Road Light Vehicle (LV)

Base Free Flow Speed LV ($FV_{0, LV}$) = 88 km/hour

Lane width factor (FC_w) = 0 km/hour

$$F_{v, LV} = 88 \text{ km/hour}$$

4) Trip Assignment Analysis

The trip assignment is one of the methods used to predict the percentage of vehicle movement from the existing road to the Sukabumi – Padalarang toll road when the toll road was operated. JICA Model 1 method was used to carry out trip assignment analysis calculation with the parameters analyzed by the comparison of travel time on toll roads with the existing road. On the other hand, the toll road will be affected by the time value and cost of the toll road.

B. Feasibility Analysis

The feasibility assessment of developing a project can be reviewed from several aspects, but this study only reviewed the economic and financial aspects. The

Table 2. Trip Assignment Results with the JICA Model 1 for the Sukabumi – Grekbong Section.

Class I	Percentage			smp/day		
	KR	KBM	BB	KR	KBM	BB
Existing Road	47,07	52,42	66,23	6302	1420	3143
Toll Road	52,93	47,58	33,77	7086	1289	1603
Class II	KBM			KBM		
Existing Road	66,51			251		
Toll Road	33,49			126		
Class III	TB			TB		
Existing Road	67,52			1079		
Toll Road	32,48			519		
Class IV	TB			TB		
Existing Road	67,61			10		
Toll Road	32,39			5		
Class V	TB			TB		
Existing Road	68,53			130		
Toll Road	31,47			60		

Table 3. Total Saving VOC.

Tahun	VOC Without Project	VOC Without Project	Saving VOC
2019	IDR 1.701.019.385.330	IDR 1.551.726.162.889	IDR. 149.293.222.431
2024	IDR 2.181.145.000.581	IDR 1.994.439.265.426	IDR 186.705.735.154
2029	IDR 2.799.447.320.507	IDR 2.549.929.734.146	IDR 249.517.586.360
2034	IDR 3.593.020.378.288	IDR 3.261.772.562.982	IDR 331.247.815.306
2039	IDR 4.611.551.240.694	IDR 4.171.450.478.178	IDR 440.100.762.515
2044	IDR 5.918.806.584.518	IDR 5.323.993.778.383	IDR 594.812.806.135
2049	IDR 7.596.634.139.645	IDR 6.800.458.090.690	IDR 796.176.048.954
2054	IDR 9.750.078.273.161	IDR 8.766.183.204.280	IDR 3.143.621.226.848
2059	IDR 12.513.965.113.712	IDR 11.319.807.230.773	IDR 4.042.860.408.144

economic and financial analysis is basically almost the same, which compares the benefit obtained to the development value of a project (cost). The difference was the economic analysis of profit was reviewed from the communities perspective as the user road (user cost), and the financial analysis of profit was reviewed from the investor perspective as the parties who invested the costs of the construction of the Sukabumi –Padalarang toll road.

1) *Vehicle Operating Costs Analysis (VOC)*

Vehicle Operating Cost (VOC) is the cost spent for the vehicle to travel. The value of the benefit from the VOC was obtained from the calculation of the VOC savings value.

Comparing the VOC value before the toll road was built (without the project) with the VOC value after the toll road was built (with project) was carried out to obtain the VOC saving value.

The VOC calculation in this study used Jasa Marga Method. VOC consists of variable cost: fuel consumption costs, lubricant costs, tire costs, maintenance costs (spare parts), maintenance costs (mechanical wages), and fixed costs: vehicle depreciation costs, capital interest costs, and overhead costs. The parameters used to calculate vehicle operating costs were the prices of each component for various types of vehicles and speeds.

The parameters used to calculate vehicle operating costs were the price of each component for various types of vehicles and speeds. The following are the assumptions used for each type of vehicle class and its unit prices used to calculate the VOC.

a. Fuel Consumption

Fuel consumption = Basic fuel consumption

$$[1 + (kk + kl + kr)]$$

Basic fuel consumption in liters/1000km, according to class:

$$\begin{aligned} \text{Group I} &= 0,0284V^2 - 3,0644V + 141,68 \\ &= 0,0284(35)^2 - 3,0644(35) + 141,68 \\ &= 65,364 \text{ liter/1000km} \end{aligned}$$

$$\begin{aligned} \text{a) Class IIa} &= 2.26533 * \text{Basic Fuel Consumption Class I} \\ &= 148,07 \text{ liter/1000km} \\ \text{b) Class IIb} &= 2.90805 * \text{Basic Fuel Consumption Class I} \\ &= 190,07 \text{ liter/1000km} \end{aligned}$$

Fuel Consumption (IDR/1000 km):

$$\text{Fuel Consumption (IDR/1000 km)} = \text{Basic Fuel Consumption} * [1 + (kk + kl + kr)] * \text{Fuel Price}$$

$$\begin{aligned} \text{c) Class I} &= 65,364[1 + (0,4 + 0,185 + 0,035)] * 7400 \\ &= \text{IDR } 783.583,844 /1000\text{km} \\ \text{d) Class II} &= 148,07[1 + (0,4 + 0,185 + 0,035)] * 5150 \\ &= \text{IDR } 1.235.348,01 /1000\text{km} \\ \text{e) Class III} &= 190,07 [1 + (0,4 + 0,185 + 0,035)] * 5150 \\ &= \text{IDR } 1.585.754,01 /1000\text{km} \\ \text{f) Class IV} &= 190,07 [1 + (0,4 + 0,185 + 0,035)] * 5150 \\ &= \text{IDR } 1.585.754,01/1000\text{km} \\ \text{g) Class V} &= 190,07 [1 + (0,4 + 0,185 + 0,035)] * 5150 \\ &= \text{IDR } 1.585.754,01/1000\text{km} \end{aligned}$$

b. VOC Saving Calculation

Vehicle operating cost saving is a comparison of the amount of the VOC value in conditions without-project and condition with-project. Condition with-project is a condition before the Sukabumi - Padalarang toll road was built whereas condition with-project is a condition after the Sukabumi - Padalarang toll road was built. The VOC Saving Calculation was obtained from:

$$\text{a) Total of VOC}_{\text{without project}} = \text{VOC}_{\text{all existing road section without-project}}$$

- b) Total of $VOC_{with\ project} = VOC_{all\ existing\ road\ section\ with-project} + VOC_{toll\ road}$
- c) Saving $VOC = VOC_{without-project} - VOC_{with-project}$

2) *Time Value Analysis*

Time value is the amount of money the road user spends to do one unit of travel time. The amount of benefit from the time value was obtained from the calculation of the saving value of time value. The value of saving time value was obtained by comparing the time value before the toll road was built (without project) with the time value after the toll road was built (with project).

a. *Vehicle Travel Time Analysis*

This analysis was used as road segment performance and an important input to road user costs in economic analysis. The average travel time (TT) was obtained by comparing the road segment long (L) and the average speed of space (V) in all study locations, both the existing road before (without project) and after the project (with project) and the Sukabumi – Padalarang toll road plan. The following is an example of calculating travel time on the existing Sukabumi – Grekbong section of the first year with a road segment long of 10.88 km.

- a) Class. I = $L / V = 10,88 / 40 = 0.31$ hour
- b) Class. II = $L / V = 10,88 / 37 = 0.34$ hour
- c) Class. III = $L / V = 10,88 / 36.13 = 0.35$ hour
- d) Class. IV = $L / V = 10,88 / 36.13 = 0.35$ hour
- e) Class. V = $L / V = 10,88 / 36.13 = 0.35$ hour

b. *Time Value Savings Analysis*

The method for calculating class time values is as follows:

$$\text{Time Value} = \text{Max} \{ (k * \text{Base Time Value} * \text{calibration factor}); \text{Minimum Time Value} * \text{calibration factor} \}$$

Thus, it produced the time value of each class as follows:

- a) Class I = IDR 69.091,82
- b) Class II A = IDR 104.219,72
- c) Class II B = IDR 77.419,72

The lifetime value of the plan will experience a price increase every year. Thus, the time value calculation in the following years will be affected by an increase in inflation every year based on Bank Indonesia inflation rate data.

From the inflation data for the 2 years from 2018 to 2019 above, it can be determined an increase in the inflation rate of 3.13%. It was obtained from the average Bank Indonesia inflation.

From all the results of the calculations and analysis above, it can be calculated the total cost of the time value for a year by:

$$\text{LHRT Flow (QLHRT)} * \text{Travel Time} * \text{Time value inflation}$$

And it will result in cost-saving Time value as follows:

$$\text{Saving Time Value} = \text{Time Value}_{without\ project} - \text{Time Value}_{with\ project}$$

3) *Project Investment Cost*

- a. *Investment Costs for the Sukabumi – Padalarang Toll Road Construction*

The investment cost was obtained by calculating the Budget Plan for the project by calculating the road volume multiplied by the Activity’s Main Unit Price. The following are the recapitulation results of the calculation of construction cost and investment value from the Sukabumi – Padalarang Toll Road project.

Based on the Project Budget Plan, it got Investment Cost that must be incurred when carrying out the Sukabumi – Padalarang Toll Road project was IDR.5.781.828.980.487.

- b. *Maintenance and Operational Costs of the Sukabumi – Padalarang Toll Road.*

Maintenance and Operational Costs (M/O) covered costs for maintaining the Sukabumi – Padalarang Toll Road facilities and operational costs for employees for 40 years according to the length of the concession for the construction of this toll road. The total fee is IDR 115,636,579,609. This data was obtained from 2% assumption of the construction cost of the Sukabumi – Padalarang toll road. This fee will increase according to inflation by 3.13% per year.

4) *Economic Feasibility*

In this analysis, the feasibility was assessed from the parameter of NPV (*Net Present Value*) and BCR (*Benefit Cost Ratio*) over the lifetime plan. Both parameters were obtained by comparing the benefit value and the construction costs of the Sukabumi – Padalarang toll road.

- a. *Benefit Cost Ratio Analysis*

This analysis aimed to determine the feasibility of the Sukabumi – Padalarang toll road construction project from the economic aspect. The analysis calculation was carried out by comparing the amount of investment cost (Cost) and the amount of saving cost (*Benefit*). The following is the amount of investment cost and toll road maintenance costs:

- a) Investment costs: IDR.IDR.5.781.828.980.487
- b) Maintenance costs: IDR. 115.636.579.609
- c) Interest rate: 5,63% (*BI Rate*)

The interest rate used was the loan interest rate. It used BI rate as a reference because it can adjust to the economic conditions in Indonesia. The BI Rate percentage is from January 2-19 to December 2019.

- b. *Nett Present Value (NPV) Analysis*

$$\begin{aligned} NPV &= \text{Benefit} - \text{Cost} \\ &= \text{IDR } 56.438.346.484.377 - \text{IDR } 7.664.394.545.180 \\ &= \text{IDR } 48.773.951.939.197,00 > 0 \end{aligned}$$

Thus, it can be concluded that the Sukabumi – Padalarang toll road construction is considered “FEASIBLE” economically.

5) *Rates Plan for the Sukabumi – Padalarang Toll Road*

According to Law No. 38 of 2004 concerning the Road and PP No. 15 of 2005 the determination of toll rates was based on the Number of Profits for Vehicle Operating Costs (BKVOC). The profit was obtained from the difference in vehicle operating cost during the existing condition with the toll road, and the maximum value used was 70% of BKVOC.

6) *Financial Feasibility*

The analysis of financial feasibility was determined by several indicators, including *Benefit Cost Ratio* (BCR),

Net Present Value (NPV), and *Internal Rate of Return (IRR)*.

a. Revenue from Toll Rates

The annual toll price was multiplied by the volume of vehicles passing the toll road based on the trip assignment calculation results of the JICA Model 1 method.

b. The Analysis of Benefit Cost Ratio (BCR) and Net Present Value (NPV)

The value of the present worth Benefit was obtained from the toll fee revenue for vehicles that pass through the toll road. On the other hand, the present worth Cost was obtained from the investment costs of toll road construction and annual maintenance costs.

c. Internal Rate of Return Financial Analysis

Internal Rate of Return analysis is the return rate that produced the NPV of cash inflow equal to the NPV of cash outflow. The analysis was carried out by comparing interest rate that cause NPV value = 0 and the lowest interest rate of return MARR (*minimum attractive rate of return*).

The calculation obtained the interest rate of return (IRR) = 10,11 %

$$IRR > Discount Rate = 5,63\%$$

Thus, the Sukabumi – Padalarang Toll Road construction Project is considered “FEASIBLE” Financially.

d. Payback Period Analysis

In the feasibility analysis of the financial aspect, it is necessary to know how long the return period for investment costs.

According to the calculation, it obtained the investment payback time.

(*Payback Period*) for 20 Years 10 Months 30 Days

Payback Period < Concession period = 40 years

Therefore, the Sukabumi – Padalarang Toll Road construction project is considered “FEASIBLE” Financially.

CONCLUSIONS AND SUGGESTIONS

A. Conclusion

The result obtained from the analysis of economic feasibility aspect is as follow:

a) *Benefit* = IDR 19.246.924.011.659

b) *Cost* = IDR 7.664.394.545.180

So, it obtained the value of *Benefit Cost Ratio (BCR)*:
2,51 > 1

And *Net Present Value (NPV)*:

$$IDR 11.582.529.466.479 > 0$$

Thus, it can be concluded that the Sukabumi – Padalarang Toll Road construction is considered “FEASIBLE” economically.

The result obtained from the analysis of financial feasibility aspect is as follow:

a) *Benefit* = IDR 18.914.839.065.143

b) *Cost* = IDR 7.664.394.545.180

So, it obtained the value of *Benefit Cost Ratio (BCR)*:
2,47 > 1

Net Present Value (NPV): =

$$IDR 11.250.417.138.120 > 0$$

And the value of *Internal Rate of Return (IRR)*: 10,11 % > 5,63 % *Payback Period*: 10 Years 3 Months 1 Week < 40 Years.

Therefore, it can be concluded that the Sukabumi – Padalarang Toll Road construction is considered “FEASIBLE” financially.

B. Suggestions

This study's analysis and calculation results demonstrated that the Sukabumi – Padalarang toll road construction is considered feasible from the economic and financial aspects. Therefore, the project is expected to be built as soon as possible to overcome traffic congestion problems.

REFERENCES

- [1] Daftar and Dirjen Bina Marga, “Pedoman Kapasitas Jalan Indonesia (PKJI),” 2014.