Feasibility Study of Sigli - Banda Aceh Toll Road In Term of Financial And Economics

Muhammad Abiyyu Syauqi, and Hera Widyastuti

Department of Civil Engineering, Sepuluh Nopember Institute of Technology (ITS)
Corresponding Author: syauqy.abiyyu01@gmail.com

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ABSTRACT

The Province of Nanggroe Aceh Darussalam with its capital city, Banda Aceh, is one of the capital cities with areas that are still lacking in terms of infrastructure when compared to other capital cities in Java. Even though conditions the highways in the city of Banda Aceh itself quite good, but till this day the people of Aceh still need to spend a long time traveling out of town. Therefore, the government also built the Toll Road Sigli– Banda Aceh as one of the solutions in terms of travel time efficiency as well improve road network connectivity. Badan Pusat Statistik (BPS) noted that the Special Region of Aceh has become the poorest area compared to other regions in Sumatra since 2002. In 2002, the number of poor people in Aceh amounted to 1.19 million people or 29.83%. The feasibility and financial study conducted with calculating the savings value of Vehicle Operating Cost (VOC) of existing road and toll road, time value of existing road and toll road as the parameter to calculate the Benefit Cost Ratio (BCR), Net Present Value (NPV), toll rates, Economic Internal Rate of Return (EIRR), and Financial Internal Rate of Return (FIRR). Furthermore, we will know the feasibility of the toll road Sigli - Banda Aceh in terms of economic and financial analysis. The results of the Economics NPV is -Rp5,191,247,611,134 (NPV<0), it was concluded that the construction of the Sigli – Banda Aceh Toll Road is economically not feasible. The Financial NPV analysis, it was found that the NPV value was Rp2,307,253,704,888(NPV>0). Therefore, Sigli – Banda Aceh Toll Road is financially feasible with Viability Gap Funding value of 3.30%.

INTRODUCTION

Transportation development planning is a top priority in the context of Indonesia's overall development. Transportation planning to meet the ever-increasing transportation needs in line with demographic growth so that the level of mobility increasing. Therefore, to increase the rate of economic growth, it is necessary to develop roads, terminals, ports, and facilities to support an efficient, safe, and environmentally friendly transportation system. This efficient transportation system requires an economic review as a reference for investment in transportation facilities and infrastructure.

In an archipelagic country consisting of 17,508 islands [1], the road network system is a fundamental requirement for connecting people and commerce with jobs, services, markets, reducing logistics costs, and stimulating industrial growth in Indonesia. Responding to this need, the government places high connectivity as one of its top priori ties. Through PERPRES No. 100 of 2014 which was later amended by PERPRES no. 117 of 2015 [2], the Government gave a mandate to Hutama Karya to build and develop the Trans-Sumatera Toll Road.

The government has made infrastructure development a strategy in reviving the country's economy. The Government stated that underdeveloped and limited infrastructure has been an obstacle in increasing investment, high cost of logistics compared to other countries, to creating disparities between regions. Thus, Indonesia has an obligation to pursue an average standard of availability existing infrastructure in developed countries, so that efficiency and productivity can be increase, as well as support increased economic progress. Therefore, this is expected to increase the pillars of equitable development in Indonesia, so indirectly can improve the welfare of the people in the underdeveloped regions both in terms of economy, health, education, and tourism, accordingly with one of the values in Pancasila namely social justice for all Indonesian people. Road infrastructure is 1 of 10 mains sectors in the National Strategic Project can improve the economy in Indonesia. Road infrastructure itself is divided into several parts, both toll road projects and national roads/strategic roads. Toll road The Sigli – Banda Aceh section is one of the many road projects that are also taking place included in the list of Trans Sumatra Toll Roads. Trans Sumatra Toll Road itself is the longest toll, this toll road will connect

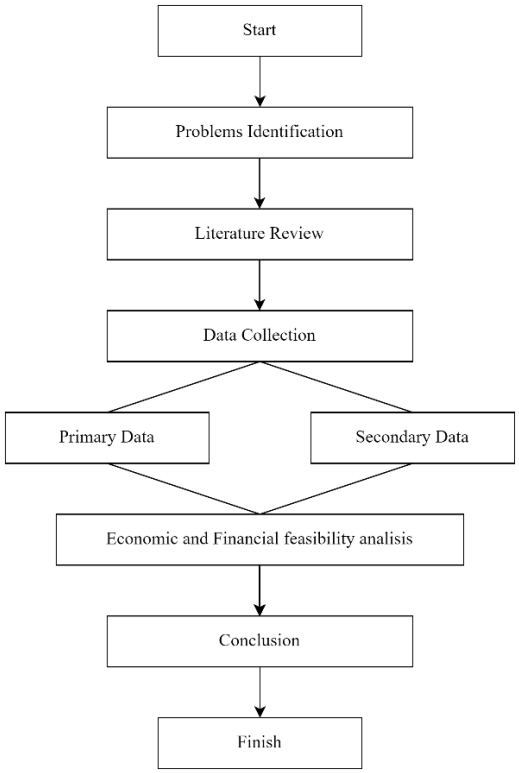

Figure 1. Research Flowchart

Lampung and Aceh through 24 different road sections with a total length of 2,704 km and cost 206.4 Trillion Rupiah [3].

The Province of Nanggroe Aceh Darussalam with its capital city, Banda Aceh, is one of the capital cities with areas that are still lacking in terms of infrastructure when compared to other capital cities in Java. Even though conditions the highways in the city of Banda Aceh itself can be said to be quite good, but till this day the people of Aceh still need to spend a long time traveling out of town. Therefore, the government also built the Toll Road Sigli– Banda Aceh as one of the solutions in terms of travel time efficiency as well improve road network connectivity [4].

Construction of the Sigli-Banda Aceh toll road requires an investment of 12.35 trillion rupiah. The Sigli-Banda Aceh Toll Road is part of the Trans Sumatra Toll Road and has a length of 74.21 kilometres which is divided into 6 sections, the Sigli - Banda Aceh Toll Road will be divided into six sections, namely Section 1 Padang Tiji-Seulimeum (24.67 Km), Section 2 Seulimeum-Jantho (6.26 Km), Section 3 Jantho-Indrapuri (16.37 km) K, Section 4 Indrapuri-Blang Bintang (14.6 Km), Section 5 Blang Bintang-Kuta Baro (7.3 Km), and Section 6 Kuto Baro-Simpang Baitussalam (5.01 Km). Finally, section 6 stretches for 5 kilometres from Kuta Baro to Baitussalam. With the construction of the Sigli-Banda Aceh toll road, it will reduce the distance and travel time from around 2 hours with winding road conditions through the hills to 1 hour drive [5].

The construction of this toll road, it is hoped that it will provide benefits for improving the economy of the Acehnese people to be specific.

The objective of carrying out this research is to figure out existing traffic conditions and estimate mobilization the number of vehicles from the existing lane to the toll road. after that we get how much is the Vehicle Operating Cost (VOC) savings and the time value with the Sigli-Banda Aceh toll road. In the end we will know the feasibility of the toll road Sigli - Banda Aceh in terms of economic and financial analysis.

METHODOLOGY

In the process of carrying out the final project, it is necessary to carry out precise and accurate analysis. The more complicated the problem at hand, the more complex the analysis that must be done. Therefore, the support of data, information, theory, or basic concepts and qualitatively adequate tools is very important to produce a good analysis. So that in the process of carrying out the final assignment, it is necessary to carry out the stages of work to produce research that is clearly organized and in accordance with the initial objectives of the research. The flow chart of this research is shown in Figure 1.

A. Problem Identification

Observing field conditions is the first step in working on this final project. The existing problems were raised to be the topic of the final project in order to find a solution. The problem in question is the congestion that occurs on the existing section of the National Road between Sigli - Banda Aceh. For the scope of this Final Project, it is certainly not complex, the author will provide a solution to the problem, this is because there are problems that must be met so that it can be completed within the specified time limit.

B. Literature Review

To complete this final project, various theories are needed as the basis for the work. Basic theory can refer to books, rules, and other sources. The theory used in this final project is also the basis for equalizing perceptions for writers and readers so that they can be accounted for in the future, so that the result of this final project is a scientific conclusion based on a technical approach. Broadly speaking, the theories studied are as follows:

1) Economic feasibility analysis
2) Financial feasibility analysis

C. Data Collection.

Data collection is done in two methods which are primary and secondary. The data that is used is traffic counting, GDP growth, population growth, and vehicle operational cost.

D. Results Analysis.

At this stage analysis that conducted is VOC savings and time values then continued analysis economic feasibility and financial.

1) Economic feasibility analysis is based on several parameters, there are:
   a. Calculation of BOK from the existing road with the planned toll road
   b. Cost savings (user cost) and time (time value)

Table 1. Vehicle Volume

Location	MC	Traffic Volume Type.2 LV	Type. 3 LV	Type.4 LV	Type. 5A MHV	Type. 5B LB	Type. 6A MHV	Type. 6B MHV	Type. 7A LT	Type. 7B LT	Type 7C LT
Sigli - Seulimum	1189230	1010816	487944	305629	18853	33269	135584	61578	30507	22033	50
Seulimum - Jantho	2490836	1507246	606603	376810	44914	31051	121461	77396	37286	22598	47
Jantho - Indrapuri	2197729	232328	207331	37705	34933	87000	43500	15819	36156	52	54
Indrapuri - Blang Bintang	2441599	1992669	468537	440648	41032	44914	55364	36156	13559	19208	53
Blang Bintang - Kuta Baro	8978016	6081695	468537	382460	34378	38814	68922	42370	32202	23728	43
Kuta Baro - Baitussalam	24794244	15827235	473528	301674	34378	14417	64403	2260	0	20338	50

Table 2. VOC Components

Type	Vehicle	Vehicle Price (RP)	Fuel (RP)	Lubricants (RP)	Tire Type	Tire Price (RP)	Wages (RP)
Type I (LV)	Xpander GLS M/T	Rp258,200,000	Rp10,000	Rp84,271	Turanza	Rp1,088,000	Rp23,187
Type I (MHV)	HI ACE Premio 2.8 M/T	Rp636,900,000	Rp10,000	Rp84,271	Continental	Rp1,100,000	Rp23,187
Type I (LB)	Hino RN 285	Rp980,300,000	Rp6,800	Rp140,000	Bridgestone	Rp3,677,000	Rp23,187
Type II	Hino Dutro 110 SD	Rp270,433,000	Rp6,800	Rp140,000	Bridgestone	Rp3,677,000	Rp23,187
Type III	Hino Ranger Cargo FLE	Rp923,000,000	Rp6,800	Rp140,000	Bridgestone	Rp3,677,000	Rp23,187
Type IV	Hino Ranger Cargo FL	Rp1,070,000,000	Rp6,800	Rp140,000	Bridgestone	Rp3,677,000	Rp23,187
Type V	Hino Ranger FM 285 T/H	Rp1,490,000,000	Rp6,800	Rp140,000	Bridgestone	Rp3,677,000	Rp23,187

c. Benefit Cost Ratio (BCR)
d. Net Present Value (NPV)
e. Economic Internal Rate of Return (EIRR)

2) Financial feasibility analysis based on several parameters, namely:

a. Benefit Cost Ratio (BCR)
b. Net Present Value (NPV)
c. Internal Rate of Return (IRR)
d. Payback Period

DATA ANALYSIS AND RESULT

A. Vehicle Volume

Vehicle volume data obtained from previous studies (year 2024) and diversion percentage as follows:

a. Section 1
Fixed volume on existing roads (Except SM) = 50.09 % Volume shifted to toll roads 49.91%
b. Section 2
Fixed volume on existing roads (Except SM) = 50.20 % Volume shifted to toll roads 49.80 %
c. Section 3
Fixed volume on existing roads (Except SM) = 50.53 % Volume shifted to toll roads 49.47 %
d. Section 4
Fixed volume on existing roads (Except SM) 50.54 %
Volume shifted to toll roads 49.46 %
e. Section 5
Fixed volume on existing roads (Except SM) 50.32% Volume shifted to toll roads 49.68 %
f. Section 6
Fixed volume on existing roads (Except SM) 50.25 % Volume shifted to toll roads 49.75 %

B. Vehicle Operating Costs

VOC analysis will be one of the parameters to determine the economic feasibility of the Sigli - Banda Aceh Toll Road. The result of the VOC benefit is the VOC saving which comes from the difference between the VOC value before the toll road construction (without project) and the VOC value after the toll road construction (with project). This feasibility study final project will use the Jasa Marga method in finding the value of Vehicle Operating Costs [6]. There are 8 VOC components in the Jasa Marga method:

Total VOC = Total Movement Costs (fuel consumption + Engine oil consumption + tire usage + Depreciation) + Total fixed costs (Interest Cost Capital + insurance fee)

And how to calculate the total operating costs is:

Total = VOC price (Rp/km) * Distance (km) * Volume Vehicle /year

The following is an example of VOC calculation for the Sigli - Seulimum National Road in Type I – Passenger Cars (LV) without project conditions in 2024.
Travel Speed = 50.53 km/hour
VOC = (-9.057) V 3 +2418.4 V 2 – 183007 V + 7 x 106
= (-9.057) (50.53) 3 + 2328.9 (50.53) 2 – 174893 (50.53) + 7 x 106
VOC = Rp 2,759,035.42 / 1000 km / vehicle

In Jasa Marga's method, VOC on motorbikes (MC) is not taken into calculation. Therefore, the method from ND Lea Consultant is used to calculate the VOC of a motorbike in this Final Project. In this method, the VOC for motorbikes is used as an additional cost for auto

Table 3. Vehicle Volume

	K*Base Time Value		Minimum Time Value		MAX	
Type I	Rp	14,897.16	Rp	38,243.75	Rp	38,243.75
Type II	Rp	22,471.22	Rp	57,690.70	Rp	57,690.70
Type III	Rp	16,692.77	Rp	42,852.13	Rp	42,852.13
Type IV	Rp	16,692.77	Rp	42,852.13	Rp	42,852.13
Type V	Rp	16,692.77	Rp	42,852.13	Rp	42,852.13

vehicles (passenger cars, pick-ups, small buses, and delivery vehicles). So that the VOC for motorbikes will be added to the VOC in Type I. In this method, it is assumed that the operating cost of one motorcycle unit is 18% of the VOC of an auto vehicle. Thus, it is necessary to calculate the adjustment factor from the ratio of motorcycle vehicle volume to class I volume. The following is an example of a calculation to determine the adjustment factor due to motorbikes on the Sigli – Seulimum National-road section without project conditions in 2024.

Motorcycle Volume = 1,189,230 vehicles/year
Auto Vehicle Volume = 1,010,816 +487,944 + 305,629 + 18,853 +33,269 + 135,584+ 61,578 + 30,507 +22,033
= 2,026,845 vehicles/year
Comparison MC/Auto = 1,189,230/(2,026,845) = 0.55
Adjustment factor = 18% x 0.55 = 0.102

From this adjustment factor, it can be calculated VOC for Type I - Passenger Cars (LV) due to the presence of motorbikes on the Sigli - Seulimum National Road section in conditions without project in 2024.

VOC Type I = Rp 3,039,445.32
VOC per year = VOC x Length of Road x Vol . LV Vehicle
= Rp 3,039,445.32 x 45.9 x (1,010,816+ 487,944+ 305,629) veh/year
VOC per year = Rp 251,731,284,344.42

Therefore, the calculation of VOC with project conducted the with the same method. The following is an example of calculating VOC per year for the National Road Sigli - Seulimum in Type I – Passenger Cars (LV) without projects in 2024.

1. Existing Road

VOC Type I = Rp3,303,122.56
VOC /year =VOC x Length of Road x Vol.LV Vehicle (Total Type I)
= Rp3,305,058.15 x 45.9 x (506,284+ 244,395+ 153,080 vehicles/year
VOC per year = Rp137,021,907,434.47/ year

2. Toll Road

The following is an example of calculating VOC per year for the National Road Sigli - Seulimum in Type I – Passenger Cars (LV) without projects in 2024. Vehicle (LV) volume is obtained from:

VOC Type I = Rp3,468,989.81
VOC per year = VOC x Length of Road x Vol. LV Vehicle
= Rp 3,465,981.79 x 45.9 x (504,532+ 243,549+ 152,550) vehicles/year

Table 4. Toll Tariff

Year	Tariff (Rp)				
	Type I	Type II	Type III	Type IV	Type V
Tariff Seulimum-B. Bintang	42,500	64,000	64,000	85,500	85,500
Tariff/Km	1,141.55	1,719.04	1,719.04	2,296.54	2,296.54
ROUNDUP Tariff/km	1,150.00	1,750.00	1,750.00	2,300.00	2,300.00

VOC per year = Rp77,075,981,756.41/ year

The amount of VOC savings is obtained by: VOC per year on the without project condition minus the VOC on the with condition project. The condition without project is the condition where the Sigli - Banda Aceh Toll Road is not yet operational, and with the project the condition when it is already operational. The calculation of total VOC savings is obtained from,

VOC Without Project = VOC Existing Road Without Project
VOC With Project = VOC Existing with Project + VOC Toll Road
Total Savings = VOC Without Project – VOC With Project

a) Wihout Project = Rp1,552,024,662,175.64
b) With Project = Rp77,075,981,756.41 + Rp137,021,907,434.47
c) Total Saving = Rp1,552,024,662,175.6408 + Rp1,486,807,888,327.34
= Rp65,216,773,848.29 (year 2024)

C. Time Value Analysis

Based on Transportation Planning and Modeling (Tamin, 2014), time value is the amount of money a person is prepared to spend (or save) to save one unit of travel time [7]. Formula as follows:

Time Value = Max {(K x Base Time Value); Minimum Time Value}

The following is the basic time value used in calculating the time value which is a reference from PT. Jasa Marga (1990 -1996).

a) Type I = RP 12,287.00/hour/vehicle
b) Type IIa = RP 18,534.00/hour/vehicle
c) Type IIb = RP 13,768.00/hour/vehicle

Then the following is the amount of the minimum time value used in the calculation and is also a reference from PT. Jasa Marga (Other than DKI Jakarta).

a) Type I = RP 6,000.00/hour/vehicle
b) Type IIa = RP 9,051.00/hour/vehicle
c) Type IIb = RP 6,723.00/hour/vehicle

A comparison value will be sought between the dollar exchange rate in 1996 and 2023, where this value will be a calibration factor to find the base and minimum time values in 2023.

1996 Dollar Exchange Rate =Rp2,365.50
2023 Dollar Exchange Rate =Rp15,077,60
Comparison Value = 6.37

The following an example of equating it to 2023:

Base Time Value 2023 = Comparison Value x Base Time Value 1996 = 6.37 x Rp 12,287.00 = Rp 78,316.83

K factor is obtained from the correction of GRDP per capita for Pidie, Aceh Besar, Banda Aceh and DKI Jakarta in 2023. The following are the steps for calculating the k factor value

GDP per capita Pidie (Sigli) = Rp 27,840,000.00
GDP per capita Aceh Besar = Rp 37,840,000.00
GDP per capita Banda Aceh = Rp 83,670,000.00
GDP per capita DKI Jakarta = Rp 260,440,000.00
DKI Jakarta k value = 1

The value of k Pidie $= \frac{GDP\ per\ capita\ Pidie\ x\ K\ value\ DKI\ Jakarta}{GDP\ perkapita\ DKI\ Jakarta}$ (5)

$= \frac{\text{Rp } 27{,}840{,}000.00\ x\ 1}{\text{Rp } 260{,}440{,}000.00} = 0.11$

K value Aceh Besar = 0.14
K value Banda Aceh = 0.32
K used = Average of K Pidie,Banda Aceh,
Aceh Besar = 0.19

Calculation of time value with the following equation,

Time Value = Max {(K x Base Time Value); Minimum Time Value } (6)

Type I = k x Base Time Value
= 0.19 x Rp 78,316.83
= Rp 14,897.16

The time value will increase in price every year due to the inflation rate during the planned life of the toll road.

The amount of time value savings is obtained by means the time value per year in the without project condition is reduced by the time value in the with condition project. The condition without project is the condition where the Sigli – Banda Aceh Toll Road is not yet operational, and with the project the condition when it is already operational. Calculation of the total time value savings is obtained from,

Time Value Without Project = Time Value Existing Running Time Value Without Project
Time Value With Project = Time Value Existing With Project + Time Value Toll Road
Total Savings = Time Value Without Project – Time Value With Project (7)

The following is an example of calculating Time Value savings in 2024. Sigli – Seulimum section

Saving Time Value 2024 = Rp73,125,251,931.65 – (Rp37,723,713,328 + Rp12,991,659,488.08)
Saving Time Value 2024= Rp25,944,906,506.88

D. Toll Revenue

First step is calculationg the the toll rate which is the amount of costs that must be incurred by toll road users when passing through the toll road. In this final project, the amount of toll road costs is taken from the investment plan data for the Sigli - Banda Aceh Toll Road.

The toll tariff per kilometer used is based on calculations from toll roads that are already in operation, there are sections 2, 3, and 4.

Toll Road Length Sigli – Blang Bintang = 37.23 Km
Toll Road Tarrif Sigli – Blang Bintang Type I = Rp 42,500

Tariff Type I =Rp42,500/37.23 Km
=Rp1,141.55»Rp 1,150,00/km

The average of these inflation values is used to calculate the prediction of the time value from 2023 until the end of the concession. The inflation value (rate = 3.12%). is obtained from average inflation from Jan-2016 until April 2023 [8].

$Pn = P0\ (1 + i)\ n$ (8)

Po = Rp 38,243.75
r = 3.12 %
n = 2024 – 2023 = 1
Pn = Po x (1 + r) n
= Rp 38,243.75 x (1 + 3.12%)1
= Rp39,436.38

Total calculation of toll tariff at table 3. Below

After the calculation of toll tariff conducted, then calculate revenue of the toll road.

Toll Road revenue comes from multiplying the toll rates for each class of vehicles by the annual volume of vehicles passing through the toll road. The Sigli - Banda Aceh Toll Road Section I (Sigli – Seulimum, Main Road length = 24.67 km) toll road fares are as follows according to the calculations in the previous sub-chapter

a. Type I
Road length = 24.67 km
Tariff/Km = Rp 1,150.00
= 24.67 x 1,150
= Rp 28,370.50 /vehicle
b. Type II = Rp43,172.50 /vehicle
c. Type III = Rp43,172.50 /vehicle
d. Type IV = Rp56,741.00 /vehicle
e. Type V = Rp56,741.00 /vehicle

The following is an example of calculating income for the Sigli - Banda Aceh Toll Road Section I (Sigli – Seulimum in 2024.

Revenue (Type I) =Toll Tariff x Vehicle Volume (vehicle/year)
=Rp28,370.50 x (504,532 + 243,549 + 152,550)vehicles/year
= Rp26,289,438,714
Type II = Rp2,831,517,085
Type III = Rp1,285,980,676
Type IV = Rp837,320,052
Type V = Rp604,731,149
Total Revenue Section 1 =Rp31,848,987,676

Using the same calculation method, toll road revenues are obtained for other vehicle classes in all toll road sections during the 2024 - 2064 concession period.

FEASIBILITY ANALYSIS

A. Economic feasibility

Economic feasibility analysis is an analysis that aims to find economic benefits for users of the Sigli - Banda Aceh Toll Road. The parameters used to find the feasibility of the economic aspect are the Benefit Cost

Ratio (BCR), Net Present Value (NPV), and the Economic Internal Rate of Return (EIRR). The cost or cost aspect in this analysis is taken from the amount of costs to build and maintain toll road infrastructure. Meanwhile, benefits are taken from the amount of VOC savings and Time Value during the concession period which has been calculated in the previous chapter [9].

The value of benefits and costs need to be converted into present value or present value, so interest rate data is needed which is obtained from the average BI rate (i=4.64%).Cost which is the parameter of the analysis :

a. Investment costs = Rp12,350,000,000,000 (PUPR)
b. Maintenance costs = Interpolation (Semarang – Demak Toll Road)

- Semarang – Demak(O/M) = Rp 24,295,000,000
- Semarang – Demak Road Length = 24.43 Km
- Sibanceh Length = 74.21 Km
- O/M Cost = 74.21 Km/24.43 Km
  = 2.955
  = 2. 955 x Rp 24,295,000,000
  = Rp71,810,968,072.04

c. Interest rate = 4.64 %
d. Profit (Benefit) = VOC Savings and Time Value
e. Cost (Cost) = Investment Cost

1. BCR

The results of a comparison between the Benefit and Cost of the economic aspects of the Sigli - Banda Aceh Toll Road are as follows

Benefit = Rp9,568,168,064,049
Cost = Rp14,545,850,732,687
B/C = $\frac{B}{C}$
= $\frac{Rp9{,}568{,}168{,}064{,}049}{\text{Rp14,545,850,732,687}}$
= 0.658

2. NPV

Net Present Value analysis aims to determine the feasibility of the Sigli - Banda Aceh Toll Road development plan from an economic aspect. Calculation of this analysis is done by calculating the difference between the benefits namely the amount of savings and investment Cost

NPV = Benefit – Cost (10)
= Rp9,568,168,064,049 - Rp14,545,850,732,687
= (-Rp5,191,247,611,134)

It was found that the value of the BCR < 1 and NPV <0, so it can be concluded that based on the analysis of the Sigli - Banda Aceh Toll Road project "Loss" from an economic aspect.

3. EIRR

Economic Internal Rate of Return (EIRR) analysis shows the economic rate of return on investment when cash inflows equal cash outflows or NPV = 0. In this analysis, experiments are carried out to obtain two interest rates that produce the smallest positive NPV and negative NPV, linear interpolation is carried out in the following way :

i1 = 2.46% → NPV1 = Rp8,184,974,657
i2 = 2.47% → NPV2 = -Rp24,185,765,132Then

$$IRR = i_1 + (i_2 - i_1)\frac{NPV_1}{NPV_1 - NPV_2} \quad (11)$$

$$IRR = 2.46\% + (2.47\ \% - 2.46\ \%)\ x\ \frac{\text{Rp8,184,974,657}}{\text{Rp8,184,974,657} - (-\text{Rp24,185,765,1}}$$

EIRR = 2.46 %
Interest Rate = 4.64 %
So that EIRR < Interest Rate (Not OK)

B. Financial Feasibility Analysis

Financial feasibility analysis is an analysis that aims to find financial benefits for the initiator or investor in the construction of the Sigli - Banda Aceh Toll Road. The parameters used to look for the feasibility of the financial aspects are Benefit Cost Ratio (BCR), Net Present Value (NPV), Financial Internal Rate of Return (FIRR), and Payback Period (PP) [10].

The cost or cost aspect in this analysis is taken from the amount of costs to build and maintain toll road infrastructure. Meanwhile, benefits are taken from the amount of income earned as a result of the payment of toll rates by toll road users which has been calculated in the previous chapter.

In the financial feasibility analysis, there are 2 discount rates that are used to change the value of benefits and costs into present value, namely the Bank Indonesia interest rate and the company's Minimum Attractive Rate of Return (MARR) derived from the BI interest rate and the government bond interest rate. the government of the Republic of Indonesia. MARR is the rate of return expected by the company in investing.

a. Investment costs = Rp12,350,000,000,000
b. Maintenance costs =Interpolation (Semarang – Demak Toll Road)

- Semarang – Demak(O/M) = Rp 24,295,000,000
- Semarang – Demak Length = 24.43 Km
- Sibanceh Length = 74.21 Km
- O/M = 74.21 Km/24.43 Km
  = 2.955
  = 2. 955 x Rp 24,295,000,000
  = Rp71,810,968,072.04

c. Interest rate = 4.64 %
d. Marr

According to Peraturan Menteri Pekerjaan Nomor 6/PRT/M/2010 pasal 8 ayat 2 [11], the project is stated feasible if the value of the financial feasibility of the project at least 4% (four percent) above the average interest rate on government bank loans.Interest rate = 4.64.% (BI Interest Rate) + 4 % (Minimum) = 8.64 %
e. Profit (Benefit) = Toll Revenue

1. BCR

BCR (Benefit Cost Ratio) analysis of financial aspects as follows:

Benefits = Rp16,853,104,437,575
Cost = Rp14,545,850,732,687
B/C =Rp16,853,104,437,575/ Rp14,545,850,732,687 = 1.159 (Ok)

2. NPV

Interest Rate
Benefit = Rp16,853,104,437,575
Cost = Rp14,545,850,732,687
NPV = Benefit – Cost
= Rp16,853,104,437,575-Rp14,545,850,732,687
= Rp2,307,253,704,888

Based on predetermined criteria, the BCR and NPV values for this toll road are declared feasible.

3. FIRR

Financial Internal Rate of Return (FIRR) analysis shows the Financial rate of return on investment when cash inflows equal cash outflows or NPV = 0. In this analysis , experiments are carried out to obtain two interest rates that produce the smallest positive NPV and negative NPV . The following is the data used in the EIRR analysis for the Sigli - Banda Aceh Toll Road.

a. Min Positif IRR = 5.34 %
b. Min Positive IRR = 5.35 %
i1 = 5.34 % → NPV1 = Rp405,560,266
i2 = 5.35% → NPV2 = -Rp29,385,985,778

$$IRR = 5.34\ \% + (5.35\ \% - 5.34\ \%)\ x\ \frac{\text{Rp}405,560,266}{\text{Rp}405,560,266 - (-Rp29,385,985,77}$$

FIRR = 5.34 %
Interest Rate = 4.64 %

So that FIRR > Interest Rate (OK), we can conclude that it is financially feasible.

4. Payback Period

Payback Period Analysis aims to find out how long it takes for cash inflows to equal outflows (NPV = 0) or in other words the investment experiences a Break Even Point (BEP). The following is the data used in the FIRR analysis for the Sigli - Banda Aceh Toll Road

.n1 = 36 → NPV1 = -Rp566,548,767,859
n2 = 37→ NPV2 = Rp5,157,860,350

$$n = i_1 + (i_2 - i_1)\frac{NPV_1}{NPV_1 - NPV_2}$$

$$= 36 + (37 - 36)\frac{-Rp566,548,767,859}{-Rp566,548,767,859 - Rp5,157,860,350}$$

n = 37

From these calculations it is known that NPV = 0 or the BEP (Break Even Point) condition occurs in the 37 th year, so that the BEP condition occurs before the 40-year concession period ends (OK).

5. Viability Gap Funding analysis

Funding Viability Gap Analysis aims to find out how much feasibility support needs to be provided by the government to investors so that the Sigli - Banda Aceh Toll Road construction project has the expected rate of return by investors (MARR). The government can provide support of monetary contributions in the form of financial assistance to Cooperation Projects [12]. Based on the calculations in the FIRR chapter, it is found that

MARR = 8.64 %
FIRR = 5.34%
VGF = MARR – FIRR
= 3.30 %

Based on the Financial NPV analysis using MARR as the discount rate, it was found that the Viability Gap Funding is 3.3%.

CONCLUSIONS

Based on the results of the analysis and calculations, it can be concluded that:

1. Based on the results of the calculation of Vehicle Operating Costs (VOC) and VOT total savings in 2064 reached Rp1,626,215,068,394
2. Based on the calculation results and feasibility analysis from the economic aspect, the following results are obtained:
   Present worth benefit = Rp9,568,168,064,049
   Present worth cost = Rp14,545,850,732,687
   So, the results are obtained:
   BCR = 0.425 < 1 (Not OK)
   NPV = -Rp5,191,247,611,134 < 0 (Not OK)
   IRR = 2.46 % < Interest rate 4.64% (Not OK)

   From the results of the feasibility analysis, it was concluded that the construction of the Sibanceh Toll Road is economically not feasible.

3. Based on the results of calculations and feasibility analysis from the financial aspect, when using the interest rate (4.64%) as the discount rate, the following results are obtained:
   Present worth benefit = Rp16,853,104,437,575
   Present worth cost = Rp14,545,850,732,687
   So, the results are obtained:
   BCR =1.159 >1 (OK)
   NPV = Rp2,307,253,704,888>0 (OK)
   IRR = 5.34 % >Interest Rate 4.64% (OK)
   PP = The BEP (Break Even Point) condition occurs in the 37th year, so that the BEP condition occurs before the 40-year concession period ends (OK).

Therefore, we can conclude that Sibanceh Toll Road is financially feasible with MARR=3.30% needed to meet the rate of return desired by investors (FIRR = MARR).

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