

Analysis of Investment Feasibility Study of Bandung Intra Urban Toll Road in Bandung City

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This study aims to analyze the investment feasibility of the Bandung Intra Urban Toll Road (BIUTR) construction project using Net Present Value (NPV), Internal Rate of Return (IRR), Payback Period (PP), and Benefit-Cost Ratio (BCR) methods. The research employs a quantitative descriptive approach, analyzing investment and operational costs projected over a 45-year concession period. Data were processed into project cash flows and evaluated using investment feasibility indicators. The results show that under the Rp1,600 tariff scenario, the project yields a positive NPV of Rp90.66 billion and an IRR of 11.04%, which exceeds the Minimum Attractive Rate of Return (MARR) of 9.31%. The payback period is reached in year 22, month 7, and day 14, indicating the project begins to generate net profit before the concession ends. A BCR value greater than 1 also indicates that the financial benefits outweigh the incurred costs. These findings are expected to serve as a reference for the government and investors in making strategic decisions regarding toll road infrastructure investments based on financial feasibility.

Keywords: BIUTR Toll Road; investment feasibility; NPV; IRR; payback period; BCR.

I. INTRODUCTION

A business feasibility study is a comprehensive assessment that explores the viability of a proposed business idea. It provides a solid basis for decision-making and strategic planning (Syahputra et al., 2022). The investment analysis of toll road projects aims to determine the feasibility of constructing, operating, and maintaining toll roads by considering alternative toll tariff variations (Badriansyah et al., 2024). To reduce congestion and promote economic growth in Indonesia, the Indonesian government can carry out infrastructure development, including in the transportation sector. To meet the increasing demand for transportation in line with population and economic growth, transportation construction, especially toll roads, plays an important role in facilitating economic activity in Indonesia. The development plan for the Bandung Intra Urban Toll Road (BIUTR) toll road project is considered a solution for reducing congestion in Bandung City, which connects several strategic points. A re-discussion of the inner-city toll road project contract is planned for the coming year.

According to the TomTom Traffic Index Report (2024), a geolocation technology specialist company, Bandung is the most congested city in Indonesia in 2024, with an average travel time of 32 minutes and 37 seconds per ten kilometers and a congestion rate of 48%. Several main roads in Bandung experience overcapacity (volume capacity ratio >1), and

several main intersections are oversaturated, resulting in poor road service performance in the city of Bandung.

The Indonesian government collaborates with several private parties to finance development projects, especially the construction of toll roads. Toll roads are expressways that are part of the road network system, and users must pay toll rates to use them. As part of the planning and decision-making standards in infrastructure projects, including toll road construction, an investment feasibility analysis needs to be carried out. The main objective of the study is to prevent errors that could cause significant discrepancies between the expected and actual results after construction and operation begin (Mulyawan & Adetya, 2022).

II. LITERATURE REVIEW

The document (Decree of the Minister of Public Works and Public Housing Number: 2790/KPTS/2024 Concerning the General Plan for Government Cooperation Projects with Business Entities and Creative Financing in the Toll Road Sector for 2025-2029) discusses toll road development funding. One section explains the toll road investment ecosystem Figure 1 and how it supports the acceleration of targeted toll road development. To achieve this, the government must take several strategic steps to secure funding sources outside the state budget, such as applying private investment through PPPs and creative financing.

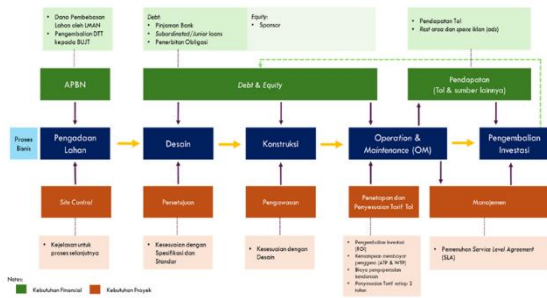


Figure 1. Flow of investment toll road ecosystem in Indonesia

Source: DJPI Review Result (2024)

The time value of money is a financial concept recognizing that money's value changes over time due to factors such as inflation, interest rates, and investment returns (Parikesit et al., 2024). Consequently, the current value of money is considered more valuable than the same amount at a future date. This is due to changes in exchange rates caused by inflation.

III. METHOD

This research utilizes a quantitative descriptive method. This is a method used to analyze a study based on samples and data collection. The goal of this method is to analyze quantitative or statistical data to test predetermined hypotheses. This study location is on BIUTR project is designed as an elevated toll road. It is within the city of Bandung. The project is meant to reduce congestion. Starting from Pasteur, it will connect strategic points of the city by crossing Jalan Dr. Djunjunan, Cihampelas, Balubur, and Gasibu before heading east through Ujungberung and ending in the Gedebage area. The project aims to improve connectivity, reduce travel time, and decrease the traffic load on surface roads. This study estimates the operational cost requirements and investment costs of the Bandung Intra Urban Toll Road (BIUTR) and projects these costs for the 45-year operating period using the NPV, IRR, PP, and BCR investment feasibility methods. The research involves processing data into cash-flow calculations, which are then analyzed using investment feasibility methods to obtain the desired output. It is expected that this research will describe the process of forming an optimal overall investment strategy.

IV. RESULTS AND DISCUSSION

1. Traffic projection

In accordance with the provisions of the division of vehicle classes according to (Decree of the Minister of Public Works No. 370/KPTS/M/2007) the vehicle class category is divided into 5 groups as follows:

Category 1: Sedans, Jeeps, Pick-ups, Small Trucks, and Mini Buses

Category 2: Medium Buses, Trucks with 2 Axles

Category 3: Large Buses, Trucks with 3 Axles

Category 4: Trucks with 4 Axles

Category 5: Trucks with 5 axles

The adjustment of the division of vehicle categories refers to PKJI 2023 for a special four-lane two-way divided inner-city freeway category having a traffic composition for MP = 63%; KS = 25%; BB = 8%, and TB = 4% (Without SM) (Description: MP = Passenger Car; KS = Medium Vehicle; BB = Large Bus; TB = Large Truck; SM = Motorcycle). Distribution of composition per class in 2029 are follows:

Category 1: $22,404 \times 63\% = 14,114$ vehicles/hour

Category 2: $22,404 \times 25\% = 5,601$ vehicles/hour

Category 3: $22,404 \times 8\% = 1,792$ vehicles/hour

Category 4: $22,404 \times 3\% = 627$ vehicles/hour

Category 5: $22,404 \times 1\% = 269$ vehicles/hour

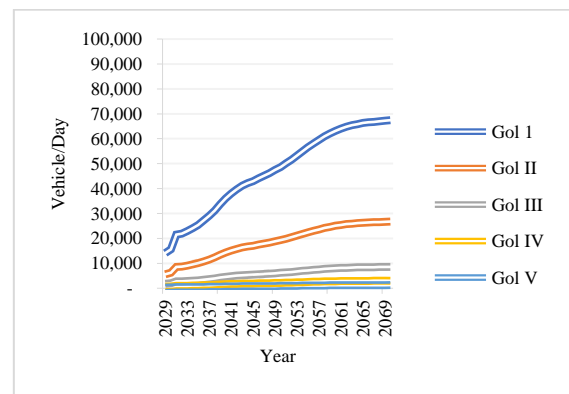


Figure 2. Traffic growth in each biutr vehicle categories
Source: PT. X (2024)

2. Vehicle Operation Cost

Vehicle operating costs can be calculated using an empirical model developed by Pacific

Consultants International (PCI). The BOK calculation is intended to evaluate the improvement of a road construction project according to economic criteria so that the level of benefit provided by the allocated costs can be determined. The direct benefit taken into account is the savings in travel costs, or the difference in total travel costs with and without the project.

Speed on toll roads: 60 km/h

Speed on arterials: 25 km/h

Table 1. Resume of parameters cost savings

Categories	Car Oil	Lubricant	Tires	Sparepart	Mechanics
Car	Rp759,81	Rp10,96	-Rp30,04	-Rp48,97	-Rp2,16
Small Bus	Rp3.812,75	Rp310,01	-Rp56,15	-Rp1.065,83	-Rp13,79
Medium Bus	Rp3.812,75	Rp310,01	-Rp56,15	-Rp1.065,83	-Rp13,79
Small Truck	Rp3.967,06	Rp95,94	-Rp199,51	-Rp602,47	-Rp9,01
Large Truck	Rp3.967,06	Rp95,94	-Rp199,51	-Rp602,47	-Rp9,01
Categories	Depreciation	Interest	Assurance	Time Travel	Overhead
Car	Rp185,49	Rp765,14	Rp430,74		-Rp233,24
Small Bus	Rp312,90	Rp410,21	Rp554,87	Rp397,73	-Rp654,88
Medium Bus	Rp312,90	Rp410,21	Rp554,87	Rp397,73	-Rp654,88
Small Truck	Rp461,15	Rp604,57	Rp831,41	Rp397,73	-Rp772,46
Large Truck	Rp461,15	Rp604,57	Rp831,41	Rp397,73	-Rp772,46

Table 2. Resume of vehicle operational cost savings

Categories	BOK Arteri	BOK Tol	Savings	
Car	Rp4.843,69	Rp2.565,63	Rp2.278,06	/km
Small Bus	Rp12.332,68	Rp7.203,71	Rp5.128,96	
Medium Bus	Rp12.332,68	Rp7.203,71	Rp5.128,96	/km
Small Truck	Rp14.598,55	Rp8.497,01	Rp6.101,55	
Large Truck	Rp14.598,55	Rp8.497,01	Rp6.101,55	/km

3. Toll Tariffs

In determining the applicable toll rates in Indonesia, there are several methods, one of which is the BKBOOK method. According to a 1996 study by the Institute for Development and Research (LAPI) at ITB, toll rates are adjusted to savings of less than 70% of the total BKBOOK price, and then projected from 2025 to 2029.

Savings calculation:

$$\text{Car} : 0,7 \times \text{Rp } 2.278,06 = \text{Rp } 1.836,94$$

$$\text{Bus} : 0,7 \times \text{Rp } 5.128,96 = \text{Rp } 4.119,92$$

$$\text{Truck} : 0,7 \times \text{Rp } 6.101,55 = \text{Rp } 4.901,17$$

$$\text{Future Value (FV)} = (1+i)^{(2029 - 2025)}$$

Table 3. 70% BKBOOK efficiency saving resume

Vehicle Categories	% Efficiency	Year Acuan	Year Operation
		70% BKBOOK Year 2025	70% BKBOOK Year 2029
Car	47,03%	Rp1.594,64	Rp1.829,89
Bus	41,59%	Rp3.590,27	Rp4.119,92
Truck	41,80%	Rp4.271,08	Rp4.901,17

Toll tariff adjustments fall within the scope of the BPJT's authority, as outlined in the BPJT Governance Study Report on Toll Road Implementation (2022). According to this report, one of the BPJT's responsibilities is to recommend the initiation and adjustment of toll tariffs to the minister (Hermawan, 2009). Several studies in a journal entitled Review of Tariff Determination and Toll Road Vehicle Classification System in Indonesia concluded that the government accepted Bina Marga's proposal because it was considered lighter and more easily accepted by the public. The weighting of vehicle tariff classes is presented in the following Table 4.

Table 4 Weight tariffs rate of vehicle categories

No	Categories	Origin Weigt	Bina Marga Proposal
1	Categories I	1	1
2	Categories II	1,5	1,5
3	Categories III	2	2
4	Categories IV	2	2,5
5	Categories V	2	3

From Table 4 based on the proposal from Bina Marga, the tariffs are divided as follows:

Categories 1 Tariff = Rp 1.600 per km

Categories 1 Tariff = Rp 2.400 per km

Categories 1 Tariff = Rp 3.200 per km

Categories 1 Tariff = Rp 4.000 per km

Categories 1 Tariff = Rp 4.800 per km

4. Cashflow Analysys

The cash flow projection for the BIUTR toll road project was developed for a 45-year concession period and incorporates both capital (CAPEX) and operational (OPEX) expenditures. Revenue estimates were derived by multiplying projected traffic volumes by a tariff rate of IDR 1,600 per kilometer for the first category. Annual cash flows were calculated by subtracting operational costs from annual revenues, followed by the deduction of the initial investment in the first year. The cash flow model served as the foundation for subsequent investment feasibility assessments, which were used to determine the viability of different investment opportunities. Investment components as follow:

No	Investment Parameters	Add	Price	
I	Technical Aspects			
	Toll Road Length	18,3	km	
	Implementation Schedule			
	1. Land Acquisition			
	2. Planning			
	3. Construction Phase			
	4. Operational			
	II	Financial Aspects		
		1. Construction Cost		Rp50.911.514.686.313,90
		2. Design Cost		Rp76.913.232.752,56
3. Supervision			Rp152.734.544.058,94	
3. Escalation			Rp101.823.029.372,63	
4. Overhead			Rp550.732.957.097,09	
Construction Cost				
1. Interest set During Construction (IDC)			Rp495.278.381.529,57	
2. Financial Cost			Rp72.196.303.694,36	
Financial Cost				
Total Investment Cost			Rp6.774.587.199.728,27	
Interest rate		5,75	%	
Capital Structure				
1. Equity		70%		
2. Debt/Loan		30%	Include IDC	
Inflation (yoy)	3,5%			
Bank Indonesia Certificate (SBI)	5,75			
Safe Rate + Risk	1,50			
MARR	9,31	WACC		
%				
III	Operational Aspects			
	Initial Toll Tariff			
	Categories I		Rp1.600	
	Categories II		Rp2.400	
	Categories III		Rp3.200	
	Categories IV		Rp4.000	
Categories V		Rp4.800		
IV	Project Feasibility			
	Concession Period	45	Year	
	Income Tax (PPh)	25%		

4.1. Net Present Value

The Net Present Value (NPV) is calculated by adding the cash flows from the 0th to the 45th year of investment, with an ATL value of 13 km.

$$\begin{aligned}
 NPV &= \sum_{t=0}^{45} (t=45)^n (\text{Revenue} / ((1+i)^t)) - \sum_{t=0}^{45} (t=45)^n (\text{Cost} / ((1+i)^t)) \\
 &= \text{Rp}6.465.441.833.625,57 - \text{Rp}6.374.777.734.031,39 \\
 &= \text{Rp}90.664.099.594,18
 \end{aligned}$$

$$\begin{aligned}
 \text{Cost} &= \text{Investment cost} + \text{Construction Cost} + \text{Operational Cost} + \text{Bank Installment} \\
 \text{Revenue} &= \text{Toll rate revenue} + \text{non-toll rate revenue (space \& ad)} \\
 &= \sum (\text{Operation LHR Data} \times \text{Each Class Tariff}) + (1\% \times \text{toll rate revenue})
 \end{aligned}$$

The Net Present Value (NPV) calculation utilized a discount rate of 9.31% as the Minimum Attractive Rate of Return (MARR). The analysis produced a positive NPV of IDR 90.66 billion, suggesting that the present value of future net benefits exceeds the initial investment costs. This result indicates that the project adds economic value and is considered financially feasible under the given assumptions.

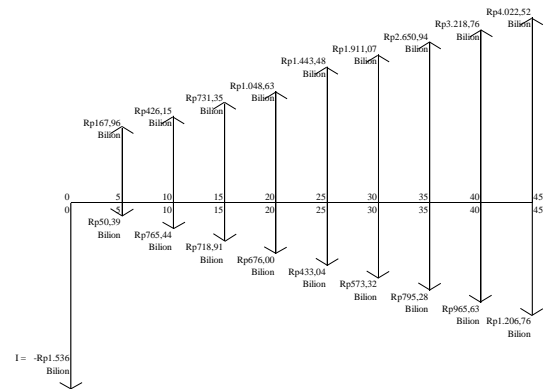


Figure 3. Cashflow diagrams for BIUTR investment

This amount shows that, at present, the investment project has a profit of Rp90,664,099,594.18 until the end of the concession period. In the context of the BIUTR project, a positive net present value (NPV) indicates that the project is financially

favorable. Despite the project's long-term nature and the complexities of financing and construction, this value indicates that it can still exceed the total investment and operational costs minus the time value of money. Therefore, the BIUTR project will provide added value and be profitable in the long run.

4.2. Interest Rate of Return

The IRR value is calculated by finding the point where the net present value (NPV) is zero. This is done by trial and error to find the positive NPV value and the negative NPV value.

$$NPV = -Investment - Cost \left(\frac{P}{F}, i, n \right) + Revenue \left(\frac{P}{F}, i, n \right)$$

$$IRR = -iNPV1(positive) + \left(\frac{NPV1(positive)}{NPV1(positive) + NPV2(negative)} \right) x \frac{NPV1(positive)}{iNPV(positive) + iNPV2(negative)}$$

$$\begin{aligned} \text{If } i_1 &= 9,31\% \\ \text{So,} \\ NPV_{1(positif)} &= -Rp1.535.711.795.564,63 - \\ &Rp4.839.065.938.466,76 + \\ &Rp6.465.441.833.625,57 \\ &= Rp90.664.099.594,18 \end{aligned}$$

$$\begin{aligned} \text{If } i_2 &= 12\% \\ NPV_{2(negative)} &= -Rp1.535.711.795.564,63 - \\ &Rp3.436.844.813.911,81 + \\ &Rp3.947.079.876.187,0 \\ &= -Rp1.025.476.733.289,41 \end{aligned}$$

$$\begin{aligned} IRR &= 9,31\% + \\ &\left(\frac{Rp90.664.099.594,18}{Rp90.664.099.594,18 + (-Rp1.025.476.733.289,41)} \right) x \\ &(9,31\% + 12\%) \\ &= 11,04\% \end{aligned}$$

The internal rate of return (IRR) was determined based on the project's cash flow data. The IRR was calculated at 11.04%, surpassing the minimum acceptable rate of return (MARR) threshold of 9.31%. This result indicates that the project is expected to generate a return above the minimum acceptable rate, making it more attractive to public and private investors.

4.3. Payback Period

To determine the payback period (PBP) of the BIUTR project, the time required to recover the initial investment amount from the generated cash flow must be analyzed. The PBP calculation uses the investment value divided by the annual net cash accumulation, with the following formula:

$$PBP = \left(\frac{\text{Investment}}{\text{Revenue Cost}} \right)$$

Table 7 shows that the accumulated net value changes from negative to positive in years 22 and 23. This means that the break-even point is between years 22 and 23, with a value ranging from -Rp348,376,778,809.7 to Rp570,811,930,505.4.

Table. 6 Cashflow BIUTR

Year	Year to	Spending	Income	NET CF	Σ NET CF
		(e)	(h)	(i)	
2047	22	Rp385.237,7	Rp1.284.125,8	Rp898.888,0	-Rp348.376,8
2048	23	Rp393.938,0	Rp1.313.126,7	Rp919.188,7	Rp570.811,9

$$\begin{aligned} \text{Interpolation} &= 22 + \\ &\left(\frac{Rp570.811.930.505,4 - 0}{Rp570.811.930.505,4 - (-Rp348.376.778.809,7)} \right) x (23 - \\ &22) \\ &= 22,621 \text{ Year} \\ &= 22 \text{ Year } 7 \text{ Month } 14 \text{ Day} \end{aligned}$$

The payback period, which is defined as the time it takes to recover the initial investment through positive cash flow, was reached in the 23rd year, specifically in July of the 22nd year. Although the project has a long return horizon, the remaining 12 years of the concession period allow for the generation of net profit, which contributes to the investment's long-term financial sustainability.

4.4. Benefit Cost Ratio

The benefits obtained from a project can be analyzed using the BCR method. In this method, the benefits obtained in the form of project benefits at present value are divided by the expenses incurred. The financial benefit value is the profit in rupiah over time, or the BIUTR toll road project revenue.

$$B/C = \text{Benefit} / \text{Cost}$$

$$\frac{B}{C} = \frac{Rp6.465.441.833.625,57}{Rp6.374.777.734.031,39}$$

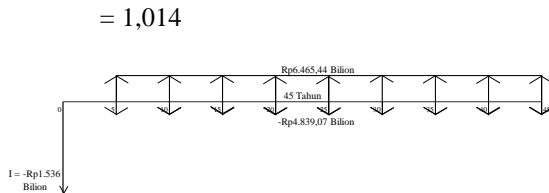


Figure 4. Cost and benefit diagrams

The benefit-cost ratio (BCR) analysis yielded a value greater than one, confirming that the project's expected benefits outweigh its associated costs. A BCR above 1 aligns with standard investment appraisal criteria and further validates the financial desirability of the BIUTR toll road project.

V. CONCLUSION

The Bandung Intra Urban Toll Road (BIUTR) investment feasibility study demonstrates that the project is financially viable under the proposed conditions. The project is planned in two phases: the first segment (Pasteur–Ujung Berung) will begin in 2029, and the second segment (Ujung Berung–Gedebage) will open in 2031. Toll rates are set below 70% of Vehicle Operating Costs (VOC), resulting in a differentiated tariff structure based on vehicle classification: The rates are IDR 1,600/km for Category I, IDR 2,400/km for Category II, IDR 3,200/km for Category III, IDR 4,000/km for Category IV, and IDR 4,800/km for Category V. These rates will be adjusted every two years. This tariff scheme was determined through trial and error to optimize traffic flow and investment returns. At the IDR 1,600 tariff level, financial indicators show a positive net present value (NPV) of IDR 90.66 billion and an internal rate of return (IRR) of 11.04%, which exceeds the minimum attractive rate of return (MARR) of 9.31%. The project will achieve a payback period in year 22, month 7, and day 14, with a remaining profit-generating period of approximately 13 years before the end of the 45-year concession. The BCR value is greater than one, confirming that the financial benefits outweigh the project costs. These results validate the financial feasibility of the BIUTR toll road and support its implementation as a strategic infrastructure investment.

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