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Feasibility Evaluation of the Citereup-Tanjung Lesung Road Expanding Project: A Cost-Benefit and Sensitivity Analysis Approach

Gatot Subagyo[1], Dr. Ir. Fitri Suryani. MT[2], Dr. Ir. Dwi Dinariana. MT[3]

[1]Master of Civil Engineering Management and Construction Engineering, Faculty of Civil Engineering, Universitas Persada Indonesia-YAI
Email: *gsubagyo3334@gmail.com*

[2]Master of Civil Engineering, Faculty of Civil Engineering, Persada Indonesia University-YAI,
Email: *suryani.fitri21@yahoo.com*

[3]Head of Master Civil Engineering Programes, Faculty of Civil Engineering, Persada Indonesia University-YAI,
Email: *dwidinariana@yahoo.com*

Abstract: ***This study evaluates the economic and technical feasibility of widening the Citereup–Tanjung Lesung road section from 5 to 8.2 meters using a 20-year concrete pavement design. It employs cost-benefit analysis, sensitivity testing, and financial viability metrics such as NPV, BCR, and EIRR to assess project outcomes. The research reveals notable reductions in travel time and vehicle operating costs, alongside substantial gains in land and property tax revenues. Despite confirmed feasibility, sensitivity analysis exposes the project's vulnerability to marginal changes in costs, benefits, or interest rates. The findings highlight both the economic potential and inherent risks of public infrastructure investments, particularly in the context of strategic economic zones.***

Keywords: Road expanding, infrastructure feasibility, cost-benefit analysis, travel time savings, land value appreciation

1. Introduction

The establishment of the Tanjung Lesung Special Economic Zone (ZES) aims to accelerate local and national economic growth through strategic sector development. Within this framework, transportation infrastructure serves as a critical enabler, evidenced by Fitria & Sarma's (2016) research demonstrating that roads and bridges contribute 87.10% to economic growth.

This aligns with Miro's (2005) theory positing that regional economic development correlates directly with transportation infrastructure demand. As Banister & Berechman (2003) assert: "Quality infrastructure enhances productivity and reduces production costs."

However, the Citereup-Tanjung Lesung connector road – a vital artery for ZES – exhibits severe deterioration. International Roughness Index (IRI) data reveals accelerated pavement degradation, escalating from 4.07 meters/ kilometers (2015) to 11.37 meters/kilometers (2019). In addition, the current road width of 5 meters falls short of Indonesia's minimum national standard of 7 meters. These deficiencies trigger three operational impacts: reduced vehicle speeds (below design speeds of 40-60 kilometers per hour), increased travel time, and Surging Vehicle Operating Costs (VOC) due to excessive fuel consumption and accelerated vehicle wear.

To support Indonesia's National Strategic Project (NSP) and accommodate projected traffic growth, this study proposes 6.1-kilometers road expanding intervention. The solution involves expanding the carriageway from 5 to 8.2 *meters* using rigid concrete pavement with a 20-year service life. This study aims to evaluate the technical and economic feasibility of widening the Citereup–Tanjung Lesung road section, assessing its impact on travel time, vehicle costs, and regional land valuation. The project holds strategic importance not only for improving transportation efficiency but also for catalyzing regional economic growth, as evidenced by substantial increases in land value and tax revenue post-implementation.

2. Formulation of the problem

a) How does the road expanding project affect travel time efficiency for all vehicle types?
b) What are the economic benefits (quantified) generated by the road expanding project?
c) Is the road expanding project economically feasible based on standard financial indicators (NPV, BCR, EIRR)?
d) How sensitive is the project's feasibility to changes in key parameters (costs, benefits, traffic volume)?
e) How does the road expanding project affect the increase in land value in the surrounding area?

3. Research purposes

a) To analyze the reduction in travel time after the road widening project for all vehicle types.
b) To evaluate the economic benefits of the project in terms of property tax (PBB) revenue, vehicle operating cost savings, and travel time savings.
c) To assess the economic feasibility of the project using NPV, BCR, and EIRR.
d) To determine the sensitivity of the project's feasibility to variations in costs, benefits, and traffic volume.

e) To examine the impact of the project on land values (both assessed value and transaction value).

4. Theoretical Basis

1) Cost-Benefit Analysis (CBA)

This study adopts Boardman's (2018) framework from "Cost-Benefit Analysis: Concepts and Practice", evaluating all **social costs** against three community benefits:

- Property tax (PBB) revenue,
- Vehicle Operating Cost (VOC) savings,
- Travel time efficiency gains.

2) Economic Feasibility Metrics

Following Boardman (2018), project viability is assessed using:

- Net Present Value (NPV) to quantify net economic worth,
- Benefit-Cost Ratio (BCR) to measure efficiency,
- Economic Internal Rate of Return (EIRR) to determine return relative to capital costs.

3) Sensitivity Analysis

"Sensitivity analysis as a way of investigating the robustness of net benefit estimates to different resolutions of uncertainty, and the value of information as a benefit category for Cost Benefit Analyst (CBA) and as a guide for allocating analytical effor" (Boardman, 2018).

4) Trend and Comparative Analysis

Land value appreciation is quantified through:

- Property assessment values (NJOP),
- Land transaction records (AJB), while investment patterns (2012–2025) are evaluated using percentage-based tren analysis.

5. Research Methodology

1) Study Location

The research was conducted on the 6.1 kilometers Citereup-Tanjung Lesung road section (STA 0+000 to STA 6+100), spanning Citereup and Tanjung Jaya villages in Panimbang District, Pandeglang Regency, Banten Province, Indonesia.

2) Data Collection Methods

a) Literature Study

A systematic literature review was conducted to examine prior research relevant to road infrastructure feasibility studies. This literature review revealed several gaps in previous research gaps:

- **Locational novelty:** First comprehensive study of the Citereup-Tanjung Lesung corridor
- **Methodological distinction:** Application of standardized Bina Marga (Indonesian Directorate General of Highways) analytical frameworks
- **Temporal uniqueness:** Multi-year implementation scheduling

The study contributes novelty insights through:

- **Land value impact assessment:** Comparative analysis of tax assessment values (NJOP) versus market transaction prices (AJB)
- **Investment attraction metrics:** Quantification of infrastructure development effects on investor interest within the study area

b) Field Observation

Travel Time Survey

Origin-Destination (OD) Survey

Roadside interviews were conducted using stratified sampling across vehicle types to determine trip patterns and purposes.

Floating Car Method

Researchers traversed the study corridor (STA 0+000 to STA 6+100) within traffic flow, recording:

- Travel speed (kilometers per hour)
- Journey time (minutes)
- Road surface conditions using GPS-enabled devices during the peak and off-peak hours

c) Survey of Vehicle Operating Costs (VOC)

"Vehicle Operating Costs (VOC) encompass variable expenses (fuel, lubricants, tires) and fixed costs (insurance, taxes, depreciation) incurred during vehicle operation on a road section" (Department of Public Works, 2005). This study adopts the following VOC components:

- Fixed Costs (Standing Cost)
- Tax Expenses
- Depreciation Costs
- Insurance Costs
- Variable Costs (Running Cost)
- Fuel Consumption Costs
- Lubricant Consumption Costs
- Spare Parts Consumption Costs
- Maintenance Labor Costs
- Required Maintenance Hours
- Tire Consumption Costs
- Unit Vehicle Price
- Unit Lubricant Price
- Total Variable Costs

d) Property Tax Assessment (PBB-NJOP) Survey

The study examined property tax assessment increases among residents affected by the road development project. The research cohort comprised 188 residents located along both sides of the project corridor.

Sampling Methodology

- Population Size 188 affected residents
- Sampling Technique Slovin's Formula
- Margin of Error 5% (e = 0.05)

Sample Size Calculation a representative sample of 128 residents was selected for structured interviews regarding PBB-NJOP valuation changes.

Land Transaction Value Analysis

For market transaction price (AJB) appreciation:

- Data Source: Certified Sale-Purchase Deeds (AJB) and Transaction Affidavits
- Sample Coverage: 20 verified transactions (2017-2022) within the Citereup-Tanjung Lesung project area
- Census Approach: All 20 transactions were incorporated into the analysis

6. Research Analysis Types and Methods

This study employs a quantitative methodology integrating four analytical approaches to assess the road widening project's feasibility:

1) Benefit Analysis

Aligned with the *Guidelines for the Economic Analysis of Projects* (ADB, 2017), benefits were quantified through:

a) **Counterfactual scenario modeling**: Annualized comparison of without-project versus with-project conditions
b) **Benefit stream isolation**: Separation of project-induced impacts from exogenous economic variables

2) Economic Feasibility Assessment

Cash flow analysis Classification of financial streams into

- *Cash Inflows*: Operational revenues
- *Cash Outflows*: Investment, maintenance, taxes (VAT, income, property), financing costs

Financial metrics calculation**:**

- Net Present Value (NPV)
- Benefit-Cost Ratio (BCR)
- Economic Internal Rate of Return (EIRR) using discounted cash flow techniques at 6% social discount rate.

3) Sensitivity Analysis

Following ADB (2017) and Merna & Al-Thani (2008) protocols:

a) Parameter variation ranges:

- *Optimistic case* +5% benefits
- *Pessimistic case* -10% benefits (risk tolerance threshold)

b) Testing techniques:

- One-at-a-Time (OAT) perturbation
- Multi-variable combinatorial shifts
- Extreme worst-case stress testing across **eight scenarios** covering cost-benefit-traffic volume fluctuations.

4) Trend and Comparative Analysis

a) **Land value appreciation**:

- Longitudinal assessment of property tax valuations (NJOP) and market transaction prices (AJB)
- Percentage-based growth rate computation (2012–2025)

b) Investment pattern correlation:

- Time-series regression of infrastructure development against investor activity metrics

Table 1: Sensitivity Analysis Classification

EIRR Deviation	Risk Level	Recommendation
>3%	Normal	Approved
1-3%	Moderate-High	Approved conditionally
0.5-1%	Moderate-High	Design revision required
<0.5%	Extreme	Rejected/Deferred

Source: Adapted from Boardman (2018) and World Bank (2020).

7. Discussion of Research Findings

a) Travel Time Survey

The travel time survey results are summarized in Table 2 below:

1) Data

Table 2: Benefits From Time Savings

Year	2016	2017	2018	2019	2020
Time	Minutes	Minutes	Minutes	Minutes	Minutes
Private car	14	12,84	11,68	10,52	9,36
Utility	17	15,63	14,26	12,89	11,52
Medium Bus	20	18,38	16,76	15,14	13,52
Large Bus	25	22,98	20,96	18,94	16,92
Medium Truck	18	16,54	15,08	13,62	12,16
Large Truck	25	22,98	20,96	18,94	16,92
Heavy Truck	32	29,41	26,82	24,23	21,64

Source: Processed Research Data (2025)

Tahun	2021	2022	2023	2024	2025
Waktu	Minutes	Minutes	Minutes	Minutes	Minutes
Private car	8,2	7,04	6,11	5,67	5,22
Utility	10,15	8,78	8,06	7,7	7,33
Medium Bus	11,9	10,28	9,36	8,9	7,44
Large Bus	14,9	12,88	11,66	10,99	8,31
Medium Truck	10,7	9,24	8,18	7,65	7,12
Large Truck	14,9	12,88	11,66	10,99	9,68
Heavy Truck	19,05	16,46	14,92	13,68	10,43

Source: Processed Research Data (2025)

2) Discussion

Table 3: Time Saving Benefits

Vehicle Type	Travel Time		Travel Time Savings (minutes)	Travel Time Savings (%)
	Without Project (minutes)	With project		
Private car	5,22	14	8,78	62,74
Utility	7,33	17	9,68	56,91
Medium Bus	7,44	20	12,56	62,78
Large Bus	8,31	25	16,69	66,78
Medium Truck	7,12	18	10,88	60,43
Large Truck	9,68	25	15,32	61,29
Heavy Truck	10,43	32	21,57	67,40

Source: Processed Research Data (2025)

All vehicle categories experienced over 50% reductions in travel time. This demonstrates that development has improved road conditions, significantly reducing travel times.

b) Property Tax (PBB) Revenue Benefit Analysis

1) Data

Table 4: Benefits of PBB

Year	PBB-NJOP		Benefit Differential (IDR)
	Without Project (IDR)	With project (IDR)	
2017	-	-	-
2018	9.862.125	17.340.000	7.477.875
2019	21.696.675	50.864.000	29.167.325
2020	41.420.925	112.276.500	70.855.575
2021	62.979.530	190.378.750	127.399.220
2022	83.295.508	305.111.750	221.816.242
2023	103.611.485	379.529.250	275.917.765
2024	127.645.287	453.946.750	326.301.463
2025	127.645.287	467.565.153	339.919.866
2026	127.645.287	467.565.153	339.919.866

Year	PBB-NJOP		Benefit Differential (IDR)
	Without Project (IDR)	With project (IDR)	
2027	131.474.645	481.592.107	350.117.462
2028	131.474.645	481.592.107	350.117.462
2029	131.474.645	481.592.107	350.117.462
2030	135.418.885	496.039.870	360.620.986
2031	135.418.885	496.039.870	360.620.986
2032	135.418.885	496.039.870	360.620.986
2033	139.481.451	510.921.066	371.439.615
2034	139.481.451	510.921.066	371.439.615
2035	139.481.451	510.921.066	371.439.615
2036	143.665.895	526.248.698	382.582.804
2037	143.665.895	526.248.698	382.582.804
2038	143.665.895	526.248.698	382.582.804
2039	147.975.871	542.036.159	394.060.288
2040	147.975.871	542.036.159	394.060.288
2041	147.975.871	542.036.159	394.060.288
2042	152.415.148	558.297.244	405.882.096
2043	152.415.148	558.297.244	405.882.096
2044	152.415.148	558.297.244	405.882.096
		Total	8.532.884.949
Source: Processed Research Data (2025)			

2) Discussion of Property Tax (PBB) Benefits

"The most significant impact of the road construction.occurred within a 500-meters-wide area on both sides of the road, measured from the road shoulder" (Dr. Zainuri, S.T. [Expert in Engineering], 2021). In this study, the magnitude of the tax is calculated within the impacted zone around the road: 350 meters on the right side (coastal side) and 500 meters on the left side.

The period from 2018 to 2024 experienced continuously increasing benefit growth, while the period 2025-2044 shows stable benefits. The Total Cumulative Benefit (2018–2044) amounts to IDR 8,532,884,949.

The road construction successfully created sustainable benefits with a growth rate of 16.6% per year and effectively generated vehicle operational cost efficiency, achieving the following results.

c) Benefit from Vehicle Operating Cost (BOK) Savings

1) Data

This study measures savings in vehicle operating costs (BOK) resulting from road improvements, using a "before and after project implementation" comparison methodology (Asian Development Bank, 2017).

Table 5: Vehicle Operating Cost (BOK) Savings Benefits

Tahun	BOK		Benefit BOK (IDR)
	Tanpa Ada Proyek (IDR)	Dengan Proyek (IDR)	
1	2	3	4=2-3
2017	259.570.851,68	259.570.851,68	-
2018	311.717.963,80	275.913.321,53	35.804.642,27
2019	332.910.314,61	305.514.062,56	27.396.252,05
2020	338.555.708,75	264.391.375,29	74.164.333,46
2021	398.531.459,26	305.018.987,39	93.512.471,88
2022	594.191.468,33	440.636.420,37	153.555.047,96
2023	682.575.202,56	470.517.093,41	212.058.109,15
2024	938.938.825,58	578.049.108,79	360.889.716,78
2025	967.106.990,34	595.390.582,06	371.716.408,29
2026	996.120.200,05	613.252.299,52	382.867.900,53
2027	1.026.003.806,06	631.649.868,51	394.353.937,55
2028	1.056.783.920,24	650.599.364,56	406.184.555,68
2029	1.088.487.437,84	670.117.345,50	418.370.092,35
2030	1.142.911.809,74	690.220.865,86	452.690.943,88
2031	1.177.199.164,03	710.927.491,84	466.271.672,19
2032	1.212.515.138,95	732.255.316,59	480.259.822,36
2033	1.248.890.593,12	754.222.976,09	494.667.617,03
2034	1.286.357.310,91	776.849.665,37	509.507.645,54
2035	1.324.948.030,24	800.155.155,33	524.792.874,90
2036	1.364.696.471,15	824.159.809,99	540.536.661,15
2037	1.405.637.365,28	848.884.604,29	556.752.760,99
2038	1.447.806.486,24	874.351.142,42	573.455.343,82
2039	1.491.240.680,83	900.581.676,70	590.659.004,13
2040	1.535.977.901,25	927.599.127,00	608.378.774,25
2041	1.582.057.238,29	955.427.100,81	626.630.137,48
2042	1.629.518.955,44	984.089.913,83	645.429.041,61
2043	1.678.404.524,10	1.013.612.611,25	664.791.912,85
2044	1.728.756.659,82	1.044.020.989,58	684.735.670,24
			11.350.433.350,37

Source: Processed Research Data (2025)

2) Discussion Vehicle Operating Cost (BOK)

- Savings Benefits, data Observations Total Cumulative Savings (2018–2044): IDR 11,350,433,350,
- Growth Phase (2018–2024), savings surged from IDR 35.8 million (2018) to IDR 360.9 million (2024) – a 10x increase.
- Peak growth occurred in 2024 (IDR 360.9 million), driven by immediate post-project efficiency gains.
- Stabilization Phase (2025–2044): Annual savings stabilized between IDR 371.7 million (2025) and IDR 684.7 million (2044).
- Cost Reduction: Without the project, BOK would have reached IDR 1.73 billion (2044).

With the project, 2044 BOK was IDR 1.04 billion – saving IDR 684.7 million/year.

d) Travel Time Savings Benefits

1) Data

Table 6: Travel Time Savings Benefits

Year	Time Benefits		Benefit	Annual Average Daily Traffic (AADT)	Annual Time Savings Value (IDR)
	Wihout Projects (IDR)	With Projects (IDR)	Time Difference (IDR)		
1	2	3	4=3-2	5	6=4x5
2017	46.115	46.115	-	12.960	-
2018	47.498	42.377	5.121	15.567	79.725.802
2019	48.923	38.638	10.284	16.623	170.958.037
2020	50.391	34.900	15.490	16.905	261.860.831
2021	51.902	31.162	20.740	19.896	412.640.750
2022	53.459	27.424	26.035	28.623	745.199.247
2023	55.063	23.686	31.377	34.080	1.069.320.941
2024	56.715	21.362	35.353	46.881	1.657.371.512

Year	Time Benefits		Benefit	Annual Average Daily Traffic (AADT)	Annual Time Savings Value (IDR)
	Wihout Projects (IDR)	With Projects (IDR)	Time Difference (IDR)		
1	2	3	4=3-2	5	6=4x5
2025	58.417	20.028	38.389	48.287	1.853.694.499
2026	59.585	17.426	42.159	49.736	2.096.827.697
2027	60.777	17.774	43.002	51.228	2.202.927.178
2028	61.992	18.130	43.862	52.765	2.314.395.293
2029	63.232	18.492	44.740	54.348	2.431.503.695
2030	64.497	18.862	45.634	55.978	2.554.537.782
2031	65.786	19.239	46.547	57.658	2.683.797.394
2032	67.102	19.624	47.478	59.387	2.819.597.542
2033	68.444	20.017	48.428	61.169	2.962.269.178
2034	69.813	20.417	49.396	63.004	3.112.159.998
2035	71.209	20.825	50.384	64.894	3.269.635.294
2036	72.634	21.242	51.392	66.841	3.435.078.840
2037	74.086	21.667	52.420	68.846	3.608.893.829
2038	75.568	22.100	53.468	70.912	3.791.503.857
2039	77.079	22.542	54.537	73.039	3.983.353.952
2040	78.621	22.993	55.628	75.230	4.184.911.662
2041	80.193	23.453	56.741	77.487	4.396.668.192
2042	81.797	23.922	57.875	79.812	4.619.139.602
2043	83.433	24.400	59.033	82.206	4.852.868.066
2044	85.102	24.888	60.214	84.672	5.098.423.191
					70.669.263.859

Source: Researcher-Processed Data, 2025

2) Discussion

Analysis of Time Savings Benefits (2017-2044) In 2017, no savings occurred (Difference = IDR 0), indicating the project had not yet impacted travel efficiency due to ongoing land acquisition processes. During the 2018-2021 period, the road became partially operational, and the benefits of construction began to materialize. This was reflected in a growing time savings difference (from IDR 5,121 **to** IDR 20,740**),** demonstrating progressively improved travel time efficiency with the project's implementation. The 2022-2030 period saw a significant acceleration in time savings (difference surging from 26,035 to 45,634), driven by the full operationalization of the 6.1 kilometers functional road by 2024. From 2031 to 2044, savings stabilized consistently, peaking in 2044 at IDR 5,098,423,191**.**

Data analysis reveals two critical trends:

a) The time difference multiplier effect – a 10-fold increase from 2018 (5,121) to 2044 (60,214) – confirms optimal project performance.
b) **Cumulative economic impact** – total savings from 2018-2044 reached **IDR 70.669 billion**, underscoring the project's long-term value.

This trajectory illustrates how phased implementation (land clearance → partial operation → full capacity) directly enabled measurable gains in travel efficiency, with the most substantial benefits emerging after complete infrastructure deployment.

e) Total Benefit

The total benefits received from 2017 to 2044 are:

Table 7: Total Benefit

Benefit Category	Value (IDR)
a. Tax (Land and Building Tax/PBB)	8,532,884,949
b. Vehicle Operating Costs (BOK)	11,350,433,350
c. Travel Time Savings	70,669,263,859
Total Benefit (a+b+c)	90,552,582,158

Source: Processed Research Data (2025)

f) The Cost-Benefit Analysis (CBA)

The Cost-Benefit Analysis (CBA) in this study adopts an *Ex Post (Retrospective)* approach, as the project has already been completed. This methodology, aligned with Boardman (2018), evaluates the effectiveness of the implemented road project policy. Benefit data is derived from the total quantified advantages of the project, while cost data reflects actual road construction expenditures.

Key inputs for the analysis include Total Benefits (B) of IDR 90,552,582,158, Total Costs (C) of IDR 41,764,750,399, and a Discount Factor (DF) of 6%. The feasibility assessment yields three critical outcomes: First, the Net Present Value (NPV) is IDR 76,220,610. Since this exceeds zero (NPV > 0), the project is deemed "Feasible". Second, the Economic Internal Rate of Return (EIRR) stands at 6.07%, surpassing the Discount Factor (6.07% > 6%), which further confirms feasibility. Third, the Benefit-Cost Ratio (BCR) is 1.002. With this ratio exceeding 1 (BCR > 1), the project conclusively meets the "Feasible" criteria across all standardized economic parameters.

g) Sensitivity Analysis

Testing was conducted across eight scenarios: Scenario1 (Baseline), Scenario 2 (Costs Increase +1%), Scenario 3 (Benefits Decrease -1%), Scenario 4 (Benefits Decrease -1% + Costs Increase +1%), Scenario 5 (Benefits Increase +5%), Scenario 6 (Discount Factor Rises from 6% to 7%), Scenario 7 (DF Rises 6%→7% + AADT Increases +10%), and Scenario 8 (AADT Decreases -1%).

1) Data

Based on sensitivity analysis results across these 8 scenarios, the outcomes are summarized in the table below:

Table 8: Sensitivity Analysis

Scenario	NPV (IDR)	BCR	EIRR (%)
• Scenario 1 (Baseline, DF=6%)	76,220,610.03	1.002	6.07
• Scenario 2: Costs Increase +1% (DF=6%)	-264,353,502.04	0.992	5.76
• Scenario 3: Benefits Decrease -1% (DF=6%)	-265,115,708.14	0.992	5.75
• Scenario 4: Benefits Decrease -1% + Costs increase +1% (DF=6%)	-605,689,820.21	0.982	5.43
• Scenario 5: Benefits Increase +5% (DF=6%)	1,782,902,200.89	1.052	7.50
• Scenario 6: DF Increase 6% to 7%	-3,271,210,858.02	0.900	3.43

• Scenario 7: DF Increase 6% to 7% + AADT increase +10%	62,764,392.63	1.002	7.06
• Scenario 8: AADT decrease -1% (DF=6%)	-307,501,666.92	0.991	5.71

Source: Processed Research Data (2025)

2) Discussion of Sensitivity Analysis Results

The sensitivity testing yielded the following key findings for each scenario:

a) Scenario 1 (*Baseline*)
With a *discount rate* (DF) of 6%, the project shows a positive NPV of + IDR 76.2 million and an EIRR of 6.07% (0.07% deviation from DF). The project is "Feasible" but carries extreme risk due to marginal viability (EIRR ≈ DF).

b) Scenarios 2 & 3 (Costs Increase +1%/ Benefits Decrease -1%)
Both scenarios resulted in negative NPV (-IDR 264.4 million and - IDR 265.1 million, respectively), rendering the project "Not Feasible"**.** This indicates that the project is highly sensitive to even small changes in cost or benefit variables.

c) Scenario 4 (Costs Increase +1% + Benefits Decrease -1%)
The compounded effect intensified losses, yielding an NPV of - IDR 605.6 million. This confirms non-viability ('Not Feasible') under simultaneous adverse conditions.

d) Scenario 5 (Benefits Increase +5%)
Demonstrated robust viability with an NPV of + IDR 1.78 billion. The project is "Feasible" with low risk, indicating high upside potential from benefit improvements.

e) Scenario 6 (DF Increase 6% to 7%)
The discount rate increase caused severe deterioration **(**NPV: - IDR 3.27 billion**),** resulting in "Not Feasible**"** status. This underscores critical exposure to financing cost volatility.

f) Scenario 7 (DF Increase 7% + AADT Increase +10%)
Despite higher DF (7%), increased traffic volume (AADT +10%) delivered a positive NPV of + IDR 62.7 million and EIRR of 7.06% (0.057% above DF). The project remains "Feasible" but with high risk due to tight margins.

g) Scenario 8 (AADT Decrease -1%)
A minor traffic reduction triggered negative NPV (-IDR 307.5 million), confirming "Not Feasible" outcomes. This reveals vulnerability to demand fluctuations.

h) Impact of Road Infrastructure Development on Land Value Appreciation

This study investigates the effect of the Citereup-Tanjung Lesung road expanding project on Land and Building Tax (PBB) and Tax Object Sales Value (NJOP) through rigorous trend analysis and comparative assessment. The research population encompassed 188 landowners directly impacted by land acquisition for the infrastructure initiative. Employing Slovin's sampling formula with a 5% margin of error (e = 0.05%), a representative cohort of 128 property owners was systematically derived:

$n = \frac{N}{1+Ne^2} = n\ \frac{188}{1+188x0{,}005^2} = \frac{188}{1{,}47} = 127{,}89$ rounded to 128 sample.

Where: n = required sample size
N = population size
e = margin of error (5% or 0.05)

Empirical evidence was gathered through authenticated Deeds of Sale (AJB) and Purchase Declaration Letters, with 20 verifiable transactions recorded between 2017–2022 within the project corridor serving as primary data.

Pre-construction analysis revealed stagnant land valuation patterns, with negligible fluctuations in both PBB-NJOP assessments and market transactions. Subsequent to phased project implementation (2017–2024) culminating in full operationalization of the 6.1 km roadway, significant appreciation emerged. Trend quantification demonstrated an annualized PBB-NJOP increase of 12.08%, while comparative assessment of pre/post-construction AJB transactions confirmed a 76.30% aggregate premium in land sale values. This appreciation manifested bilaterally along the transportation corridor, confirming the infrastructure's role as a catalyst for spatial economic transformation.

The 76.3% transaction premium and sustained 12.08% annual tax valuation growth provide empirical evidence that transport infrastructure induces substantial land value uplift. These findings underscore the project's dual economic externalities: immediate wealth generation for landowners and long-term fiscal enhancement through expanded tax bases for regional administrations. Future research should employ spatial hedonic modeling to isolate distance-decay gradients and quantify value capture potential.

8. Conclusion

This study demonstrates that the Citereup-Tanjung Lesung road infrastructure project delivers substantial socioeconomic benefits while exhibiting critical financial sensitivities. Key conclusions are synthesized as follows:

1) **Infrastructure Efficiency**

Travel time reductions exceed **50% for all vehicle types**, confirming enhanced mobility efficiency through optimized transport connectivity.

2) Economic Value Generation

Quantifiable benefits include:

- IDR 8.53 billion in land tax (PBB) revenue growth
- IDR 11.35 billion in vehicle operating cost (BOK) savings
- IDR 70.67 billion in travel time savings Total economic benefits (IDR 90.55 billion) significantly offset construction and maintenance expenditures.

3) Project Viability

Rigorous cost-benefit analysis confirms feasibility through:

- Positive Net Present Value (NPV = IDR 76.22 million)>0,

- Economic Internal Rate of Return (EIRR = 6.07%) exceeding the 6% discount rate
- Benefit-Cost Ratio (BCR = 1.002)>1.

4) Operational Sensitivity

The project shows **high fragility** to marginal (±1%) changes:

- Benefit reductions, cost increases, or traffic volume (AADT) declines render it economically unviable,
- Discount rate hikes to 7% cause severe NPV deterioration (-IDR 3.27 billion).

5) Property Value Appreciation

Infrastructure development induced significant land value uplift:

- 12.08% annual increase in property tax valuations (PBB-NJOP),
- 76.30% premium in post-construction land transactions (AJB).

9. Recommendations

1) **For Pandeglang Regency Government**: Maximize economic returns by strategically leveraging the Citereup-Tanjung Lesung corridor to attract investment, enhance local entrepreneurship, and integrate surrounding communities into regional value chains.
2) **For Future Research:** Investigate catalytic effects of national infrastructure projects on new economic zone development, with emphasis on optimized placement of rest areas, MSME hubs, and tourism facilities along transport arteries.

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