

BENEFIT COST RATIO ANALYSIS OF SUKOREJO – BATU PASS ROAD PROJECT

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ABSTRACT

Sukorejo - Batu Road is one of the efforts of local government of East Java Province, to build new road access network that will have a big impact on community activities and beneficial to the development of economy, tourism, regional development, industry, services and agriculture especially in Malang, Batu City as well as the surrounding area which will generally have an impact for East Java Province.

Road construction, which requires a relatively large cost, will have an impact on spatial structure and regional development in general. The greater the amount of funds needed in the investment, the more important it is to develop an analysis of the benefits of the project with the aim of avoiding too much investment increment for unprofitable activities. One of the analytical methods used to determine the feasibility of a proposed project is the method of Benefit Cost Ratio (B/C Ratio).

This study aims to analyze the benefits of the Sukorejo - Batu toll road development project using the Benefit Cost Ratio (B / C Ratio) Method, taking into account the components of the cost, the job cost component (construction cost and land acquisition), and the components of the traffic accident cost. Benefit-Cost Ratio (B/C Ratio) is a comparison between benefits / benefits that have been present-value with the cost that has been in-present value.

From this research, it is found that the selected project is worth Rp 1,296,050,611,000 where the total intangible benefits and intangible benefits are Rp 8,281,018,856,509 while the value of benefit cost ratio is 6.4 which means that the construction of Sukorejo - Batu is worth it, because its value is more than 1.

Keywords : project, benefit cost ratio, present value, effect

INTRODUCTION

Sukorejo - Batu Road is one of the efforts of East Java provincial government to build new road access network which has a big impact on community activity and beneficial for economic development, tourism, regional development, industry, services and agriculture in Malang, Kota Batu and the surrounding area and in general in East Java (Bina Marga Service of East Java Provinces, 2012). The development of the road will affect the spatial structure and regional development in general. The objectives of this research are to predict the impact of increasing Sukorejo - Batu road to economic benefits and trade activities for producers, traders and consumers for agricultural commodities, fisheries, small businesses, handicrafts and industries.

In addition, Sukorejo - Batu passenger road will shorten the travel route so that there are savings on travel expenses, increased local revenue, especially the potential increase in land and building tax (PBB).

The Sukorejo - Batu development project has a significant investment value and is planned to be funded by the regional budget, where land acquisition uses the district / city revenue budget and the cost of construction and maintenance will be financed by the regional income budget of East Java Province. Some emerging alternatives are related to financial analysis using an economic engineering approach that will produce several alternatives where the best alternative is selected by judging on certain criteria.

LITERATURE REVIEW

Existing Condition of Sukorejo and Batu Road

Sukorejo is Pasuruan Regency whereas Batu is a municipality of Batu. To go to Batu from the direction of Sukorejo or vice versa required distance of approximately 56 Km with normal travel time 1,5 hours. But if the trip is done during the holiday season or at the time of departure and work hours home from work it can take 3 hours more. Traffic for Sukorejo Road - Simpang Tiga Karanglo is relatively diverse and dense every day, while the traffic for Simpang Tiga Karanglo - Batu is diverse and less crowded. On holidays the number of vehicles that travel on these three road segments, and tend become very crowded and jammed, so need to be addressed.

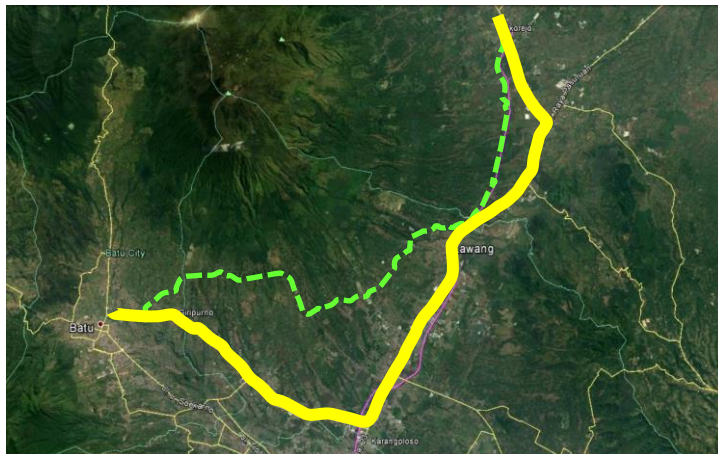


Figure 1. Existing Condition of Sukorejo and Batu Road (www.petajatim.jatim.co.id)

Impact of Pass Road Sukorejo Batu Project

Direct Impact

The development of Sukorejo - Batu as a strategic mega project is the most appropriate solution to overcome traffic jam in Surabaya - Malang - Batu vital lane. Ease of access will be able to move the economic activities of agriculture, tourism, and services. So that can synergize the development of East Java region with rapid growth. The objectives of regional governments to promote and stimulate economic activity will be realized. The rapid growth and development in East Java which has a lot of agricultural potential, manufacturing and service industries, tourism, mining, marine and so on will make East Java economic actors make the area the main target market, especially the marketing of agricultural products from Batu City region which is a necessary commodity Community of East Java.

Indirect Impact

Construction of Sukorejo - Batu access road - This stone will provide easy access for economic actors or farmer groups to market agricultural products. Indirectly will make the economy of

East Java in general and Malang, Surabaya and Batu in particular squirm, economic centers with agricultural commodities and agro industry will be more enthusiastic and alive because East Java is a potential market and easy to reach. Subjects that indirectly have a positive impact are farmer groups and industrial business actors. Increase the stretching of community activities which then impact on increasing income and community productivity. Activity structure will be more solid, because of the ease of access between East Java Province. The output is the improvement of people's quality of life as an estuary of income increase (Tourism Department of East Java Province, 2015).

Benefit Cost Ratio (BCR)

BCA is the most common technique for calculating costs and benefits of a project. Basically, the cost-benefit measurement and analysis method is based on management's way and perspective in assessing project performance implemented (Indrajit, 2010).

$$BCR = Total PW_{(Benefit)} / Total PW_{(Investment)} \dots\dots\dots (1)$$

There are several criteria of BCR value associated with the above formulation, namely; First if the BCR index value is greater than 1 (BCR > 1) then the project is said to be feasible to work, second if the BCR index value <1 (BCR <1) then the project is not feasible to work considering the cost is greater than the benefit (Benefit) received. While the components of BCR, among others, as follows:

1. Procurement Cost. Procurement costs are all costs incurred in relation to project procurement. Among them are the cost of project material procurement consultation, purchase cost or leasing of machinery and project support tools, project installation cost, capital cost for procurement and project work, and expenses related to management and staff for project work.
2. Start Up Cost. Is an operational cost that is all costs incurred in an effort to make the project ready for operation. These costs include purchase costs, networking, reorganization, management and personnel.
3. Project Related Cost. Is a cost associated with the cost of system development and its application. Project costs include documentation costs, meeting fees, system cost analysis, managerial and personnel.
4. Ongoing Cost. Is the operating cost of the system for the system to operate properly. Including maintenance cost system. Costs that include ongoing costs include personnel costs, overhead costs (telephone, electricity, etc.), project maintenance, managerial costs in system operations. These costs occur routinely over the operational life of the system.

Some of the tangible benefits gained from the construction of Sukorejo - Batu passage are:

1. Reduction of Vehicle Operating Cost (BOK)
 - a. Fuel consumption. The cost of fuel consumption is determined by calculating the fuel used (liter / 1.000 Km) multiplied by the price of each liter.

$$Y = 0,05693 S^2 - 6,42593 S + 269,18567 \dots\dots (2)$$
 - b. Oil / lubricant usage. The use of oil / lubricant oil for the type of passenger car according to the following equation:

$$Y = 0,00037 S^2 - 0,04070 S + 2,20403 \dots\dots\dots (3)$$
 - c. Use of tires. The use of tires for the type of passenger car according to the following equation:

$$Y = 0,0008848 S - 0,004533 \dots\dots\dots (4)$$
 - d. Cost of vehicle maintenance. The cost of vehicle maintenance consists of the cost of parts and mechanics, according to the following equation:
 - (1) Spare parts

$$Y = 0,0000064 S + 0,0005567 \dots\dots\dots (5)$$

(2) Vehicle Depreciation Cost

$$Y = 1 / (2,50 S + 125) \dots\dots\dots (6)$$

(3) Assurance

$$Y = 38 / (500 S) \dots\dots\dots (2.8)$$

(4) Capital Interest

$$Y = 150 / 500 S \dots\dots\dots (2.9)$$

2. Reduced Fee Charges

The delay is the time lost by being influenced by an element that can not be controlled by the rider either within the traffic flow itself or from other traffic flows (Pignataro, 2003).

3. Accidents

Technically traffic accidents are defined as incidental events caused by many unintentional factors (random multy factor events).

RESEARCH METHODS

In this study there are several stages of the methodology that will be described as follows:

1. Data Collection

a. Field Research. In this field research, interviews and questionnaires were conducted on the concept of the Sukorejo - Batu project implementation of the Year 2017 implementation.

b. Library Research. Done by looking for references in journals, books, and previous research on project management, ratios and financial aspects.

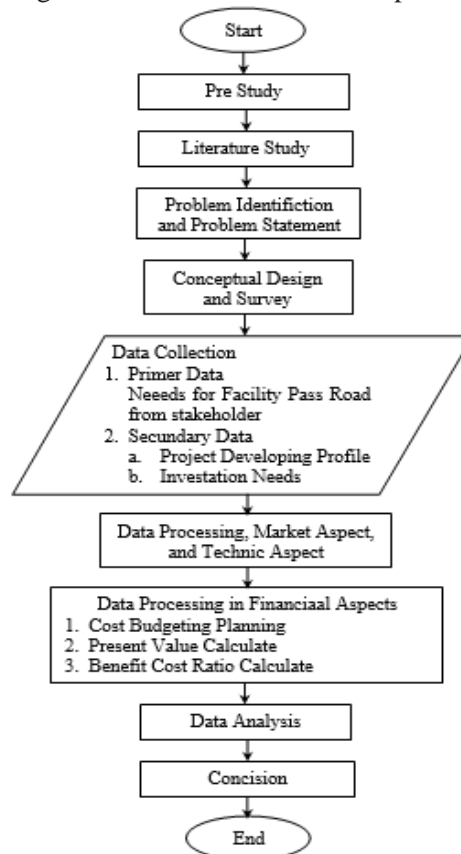


Figure 2. Research Methodology

2. Data Analysis Method
 - f. Conducting quantitative and qualitative analysis of project feasibility using capital budgeting and sensitivity analysis method
 - g. Perform cost of capital calculation
 - h. Analyze the project based on benefit cost ratio method
3. Benefit Cost Ratio Analysis

Benefit-Cost Ratio (B / C Ratio) is a comparison between present-value benefits with present-value costs. The larger the B / C Ratio, the greater the comparison between benefit and cost, which means the project is relatively more profitable. A project will be selected if $B / C \text{ Ratio} > 1$, if $B / C \text{ Ratio} < 1$ then the project proposal will be rejected.
4. Stage of Withdrawal Conclusion and Suggestion

Conclusions are drawn to the results obtained that are tailored to the objectives of this study. Furthermore, they try to give suggestions on the application of research results as well as efforts to avoid project failures.

Result and Discussion

Alternate Route

1. Route Alternate 1

This route is through Desa Karangsono (Kecamatan Sukorejo), Desa Summersuko – Desa Pager – Desa Sekarmojo – Desa Tejowangi (Kecamatan Purwosari), Desa Capang – Desa Gajahrejo – Desa Parerejo – Desa Sentul (Kecamatan Purwodadi, Kabupaten Pasuruan), Desa Turirejo – Desa Wonorejo – Desa Ketindan – Kelurahan Kalirejo – Desa Bedali (Kecamatan Lawang), Desa Toyomarto – Desa Gunungrejo – Desa Klampok – Desa Langlang (Kecamatan Singosari), Desa Girimoyo - Desa Ngenep – Desa Bocek – Desa Donowarih – Desa Tawangargo (Kecamatan Karangploso, Kabupaten Malang), Desa Giripurno (Kecamatan Bumiaji, Kota Batu).

2. Route Alternate 2

This route is through Desa Karangsono (Kecamatan Sukorejo) - Desa Pager - Desa Sekarmojo - Desa Tejowangi (Kecamatan Purwosari), Desa Capang - Desa Gajahrejo - Desa Parerejo - Desa Sentul (Kecamatan Purwodadi, Kabupaten Pasuruan) - Desa Turirejo - Desa Ketindan - Desa Bedali (Kecamatan Lawang), Desa Toyomarto - Desa Klampok - Desa Langlang (Kecamatan Singosari), Desa Ngenep - Desa Bocek - Desa Tawangargo (Kecamatan Karangploso, Kabupaten Malang) - Desa Giripurno (Kecamatan Bumiaji, Kota Batu).

3. Route Alternate 2

This route is through Desa Karangsono (Kecamatan Sukorejo) - Desa Pager - Desa Sekarmojo - Desa Tejowangi (Kecamatan Purwosari), Desa Capang - Desa Gajahrejo - Desa Parerejo - Desa Sentul (Kecamatan Purwodadi, Kabupaten Pasuruan) - Desa Turirejo - Desa Ketindan - Desa Bedali (Kecamatan Lawang), Desa Toyomarto - Desa Klampok - Desa Langlang (Kecamatan Singosari), Desa Ngenep - Desa Bocek - Desa Tawangargo (Kecamatan Karangploso, Kabupaten Malang) - Desa Giripurno dan Desa Pandanrejo (Kecamatan Bumiaji, Kota Batu).

Table 1. Description Alternative Route 1 of Pass Road Sukorejo – Batu (Mono Heksa, 2017)

No.	Parameter	Line					Total
		Sentul – Rel KA	Rel KA – Perum AL	Perum AL Dalam	Bedali – Ngenep	Genep – Bocek – Giripurno	
1.	Segment length (m)	10365	3398	3671	8552	7921	33907
2.	Alinement horizontal $\geq 45^\circ$	5 bend	3 bend	7 bend	2 bend	2 bend	19 bend
3.	Alinement vertical $\geq 6\%$	-	-	1 cllimb	4 cllimb	1 cllimb	6 cllimb
4.	Crossing a plot by public road	26 units	5 units	19 units	33 units	42 units	125 units
5.	Crossing with rel KA	-	-	-	-	-	-
6.	Crossing with high way	1 units	-	-	-	-	1 units
7.	Bridge	3 units	3 units	2 units	1 units	2 units	11 units (510 m)
8.	Planning Speed (Km/Hour)	60	60	40	60	60	Average 56 Km/Hour
9.	Predicted travel time (minute)	10,37	3,40	5,51	8,55	7,92	35,75
10.	Length of land cleared (m)	Residence (1448 m), sawah (4560 m) Ground Field (4357 m)	Ground Field (3312 m), Residence (86 m)	Residence (1423 m), tegalan (2248 m)	Ground Field (7976 m) Residence (576 m)	Residence (7289 m), Ground Field (632 m)	Ground Field (25082 m), Residence (4165 m), Rice Fields (4560 m),
11.	Social Facilities	Mosquito 1 unit	-	Mosquito 1 unit	Mosquito 1 unit	Mosquito 1 unit, Sekolah 1 unit	Mosquito 4 unit, Sekolah 1 unit
12.	Land acquisition costs (Rp. Milyar)	158,85	32,53	45,62	84,71	90,83	412,54
13.	Costruction Cost (Rp. Milyar)	425,96	72,76	88,6	186,14	184,24	957,46
14.	Land Cost Total + Construction (Rp. Milyar)	584,81	105,29	134,22	270,85	275,07	1370,00

Tabel 2. Description Alternative Route 2 of Pass Road Sukorejo – Batu (Mono Heksa, 2017)

No.	Parameter	Line					Total
		Karangsono – Sentul	Sentul – Perum AL	Perum AL Atas – Bedali	Bedali – Ngenep	Ngenep – Giripurno	
1.	Segment length (m)	10500	4300	1500	10500	5700	32500
2.	Alinement horizontal $\geq 45^\circ$	6 bend	4 bend	1 bend	2 bend	2 bend	15 bend
3.	Alinement vertical $\geq 6\%$	5 cllimb	8 cllimb	1 cllimb	3 cllimb	24 cllimb	41 cllimb
4.	Crossing a plot by public road	17 units	4 units	3 units	12 units	12 units	48 units
5.	Crossing with rel KA	-	-	-	-	-	-
6.	Crossing with high way	1 units	-	-	-	-	1 units
7.	Bridge	3 units	3 units	2 units	1 units	2 units	11 buah (660 m)
8.	Planning Speed (Km/Hour)	50	40	50	40	40	Average 44 Km/Jam
9.	Predicted travel time (minute)	11,25	4,85	1,30	10,75	6,55	34,70
10.	Length of land cleared (m)	Residence (1580 m), Grass Ground (4435 m) Tegalalan (4485 m)	Residence (89 m), Tegalalan (4211 m)	Ground Field (1500 m)	Residence (453 m), Ground Field (10048 m)	Residence (78 m), Ground Field (5622 m)	Residence (2200 m), Rice Field (4435 m) Ground Field (25865 m)
11.	Social Facilities	Mosquito 1 unit	-	-	Mosquito 1 unit	Schools 2 Unit	Mosquito 2 unit Schools 2 unit
12.	Land acquisition costs (Rp. Milyar)	159,78	41,01	14,06	102,01	62,57	379,43
13.	Costruction Cost (Rp. Milyar)	141,39	92,90	31,30	115,96	251,27	632,82
14.	Land Cost Total + Construction (Rp. Milyar)	301,17	133,91	45,36	217,97	313,84	1012,25

Tabel 3. Description Alternative Route 3 of Pass Road Sukorejo – Batu (Mono Heksa, 2017)

No.	Parameter	Line					Total
		Karangsono – Sentul	Sentul – Perum AL	Perum AL Atas – Bedali	Bedali – Ngenep	Ngenep – Pandanrejo	
1.	Segment length (m)	10500	4300	1500	10500	6668	33468
2.	Alinement horizontal $\geq 45^\circ$	6 bend	4 bend	1 bend	2 bend	3 bend	16 bend
3.	Alinement vertical $\geq 6\%$	5 cllimb	8 cllimb	1 cllimb	3 cllimb	21 cllimb	38 cllimb
4.	Crossing a plot by public road	17 units	4 units	3 units	12 units	11 units	47 units
5.	Crossing with rel KA	-	-	-	-	-	-
6.	Crossing with high way	1 units	-	-	-	-	1 units
7.	Bridge	3 units	3 units	2 units	1 units	2 units	11 units (660 m)
8.	Planning Speed (Km/Hour)	50	40	50	40	50	Average 46 Km/Jam
9.	Predicted travel time (minute)	11,25	4,85	1,30	10,75	6,55	34,70
10.	Length of land cleared (m)	Rumah (1580 m), Rice Filed (4435 m) Ground Land (4485 m)	Residence (89 m), Ground Land (4211 m)	Ground Land (1500 m)	Residence (453 m), Ground Land (10048 m)	Residece (58 m), Tegalan (6609 m)	Residece (2180 m), Rice Filed (4435 m) Ground Land (26853 m)
11.	Social Facilities	Mosquito 1 unit	-	-	Mosquito 1 unit	-	Mosquito 2 unit
12.	Land acquisition costs (Rp. Milyar)	159,78	41,01	14,06	102,01	72,96	389,82
13.	Costruction Cost (Rp. Milyar)	141,207	92,785	31,262	116,281	116,391	497,932
14.	Land Cost Total + Construction (Rp. Milvar)	300,987	133,795	45,322	218,291	189,351	887,746

Cost of Road Works Tembus Sukorejo – Batu

Table 4 Costs of Land Acquisition, Construction and Maintenance of Pass Road Sukorejo - Batu for 2 Line Alternating 1

No.	Years	Cost of Land Acquisitio (Rp)	Cost of Costruction (Rp)	Cost of Regular Maintenance (Rp)	Cost of Schedule Maintenance (Rp.)	Total Cost (Rp.)
1.	2017	123.764.580.000				123.764.580.000
2.	2018	165.019.440.000	287.238.000.000			452.257.440.000
3.	2019		382.984.000.000	1.017.210.000		507.765.790.000
4.	2020	123.764.580.000	287.238.000.000	2.375.490.000		289.611.490.000
5.	2021			3.390.700.000		3.390.700.000
6.	2022			3.390.700.000		3.390.700.000
7.	2023			3.390.700.000		3.390.700.000
8.	2024			3.390.700.000	25.430.250.000	28.820.950.000
9.	2025			3.390.700.000	33.907.000.000	37.297.700.000
10.	2026			3.390.700.000	25.430.250.000	28.820.950.000
11.	2027			3.390.700.000		3.390.700.000
12.	2028			3.390.700.000		3.390.700.000
13.	2029			3.390.700.000	25.430.250.000	28.820.950.000
14.	2030			3.390.700.000	33.907.000.000	37.297.700.000
15.	2031			3.390.700.000	25.430.250.000	28.820.950.000
16.	2032			3.390.700.000		3.390.700.000
17.	2033			3.390.700.000		3.390.700.000
18.	2034			3.390.700.000	25.430.250.000	28.820.950.000
19.	2035			3.390.700.000	33.907.000.000	37.297.700.000
20.	2036			3.390.700.000	25.430.250.000	28.820.950.000
21.	2037			3.390.700.000		3.390.700.000
22.	2038			3.390.700.000		3.390.700.000
23.	2039			3.390.700.000	25.430.250.000	28.820.950.000
24.	2040			3.390.700.000	33.907.000.000	37.297.700.000
25.	2041			3.390.700.000	25.430.250.000	28.820.950.000
Total		400.831.000.000	287.238.000.000	74.595.400.000	43.680.000.000	1.783.674.000.000

Table 5 Costs of Land Acquisition, Construction and Maintenance of Pass Road Sukorejo - Batu for 2 Line Alternating 2

No.	Teras	Cost of Land Acquisition (Rp)	Construction (Rp)	Maintenance (Rp)	Maintenance Schedule (Rp)	Total Cost (Rp)
1.	2017	113.826.982.500				113.826.982.500
2.	2018	151.769.310.000	189.846.062.400			341.615.372.400
3.	2019	113.826.982.500	253.128.083.200	975.000.000		367.930.065.700
4.	2020		189.846.062.400	2.275.000.000		192.121.062.400
5.	2021			3.250.000.000		3.250.000.000
6.	2022			3.250.000.000		3.250.000.000
7.	2023			3.250.000.000		3.250.000.000
8.	2024			3.250.000.000	24.375.000.000	27.625.000.000
9.	2025			3.250.000.000	32.500.000.000	35.750.000.000
10.	2026			3.250.000.000	24.375.000.000	27.625.000.000
11.	2027			3.250.000.000		3.250.000.000
12.	2028			3.250.000.000		3.250.000.000
13.	2029			3.250.000.000	24.375.000.000	27.625.000.000
14.	2030			3.250.000.000	32.500.000.000	35.750.000.000
15.	2031			3.250.000.000	24.375.000.000	27.625.000.000
16.	2032			3.250.000.000		3.250.000.000
17.	2033			3.250.000.000		3.250.000.000
18.	2034			3.250.000.000	24.375.000.000	27.625.000.000
19.	2035			3.250.000.000	32.500.000.000	35.750.000.000
20.	2036			3.250.000.000	24.375.000.000	27.625.000.000
21.	2037			3.250.000.000		3.250.000.000
22.	2038			3.250.000.000		3.250.000.000
23.	2039			3.250.000.000	24.375.000.000	27.625.000.000
24.	2040			3.250.000.000	32.500.000.000	35.750.000.000
25.	2041			3.250.000.000	24.375.000.000	27.625.000.000
Total		400.831.000.000	189.846.062.400	71.500.000.000	45.680.000.000	1.408.743.483.000

Table 6. Costs of Land Acquisition, Construction and Maintenance of Pass Road Sukorejo - Batu for 2 Line Alternating 3

No.	Teras	Cost of Land Acquisition (Rp)	Cost of Construction (Rp)	Cost of Regular Maintenance (Rp)	Cost of Maintenance Schedule (Rp)	Total Cost (Rp)
1.	2017	116.942.760.000				116.942.760.000
2.	2018	152.923.680.000	149.379.243.300			305.303.223.300
3.	2019	116.942.760.000	199.172.724.400	1.004.040.000		317.119.524.400
4.	2020		149.379.243.300	2.342.760.000		151.722.003.300
5.	2021			3.346.800.000		3.346.800.000
6.	2022			3.346.800.000		3.346.800.000
7.	2023			3.346.800.000		3.346.800.000
8.	2024			3.346.800.000	25.101.000.000	28.447.800.000
9.	2025			3.346.800.000	33.468.000.000	36.814.800.000
10.	2026			3.346.800.000	25.101.000.000	28.447.800.000
11.	2027			3.346.800.000		3.346.800.000
12.	2028			3.346.800.000		3.346.800.000
13.	2029			3.346.800.000	25.101.000.000	28.447.800.000
14.	2030			3.346.800.000	33.468.000.000	36.814.800.000
15.	2031			3.346.800.000	25.101.000.000	28.447.800.000
16.	2032			3.346.800.000		3.346.800.000
17.	2033			3.346.800.000		3.346.800.000
18.	2034			3.346.800.000	25.101.000.000	28.447.800.000
19.	2035			3.346.800.000	33.468.000.000	36.814.800.000
20.	2036			3.346.800.000	25.101.000.000	28.447.800.000
21.	2037			3.346.800.000		3.346.800.000
22.	2038			3.346.800.000		3.346.800.000
23.	2039			3.346.800.000	25.101.000.000	28.447.800.000
24.	2040			3.346.800.000	33.468.000.000	36.814.800.000
25.	2041			3.346.800.000	25.101.000.000	28.447.800.000
Total		400.831.000.000	149.379.243.300	73.629.600.000	45.680.000.000	1.296.020.611.000

Table 7. Costs of Land Acquisition, Construction and Maintenance of Pass Road Sukorejo - Batu for 4 Line Alternating 1

No.	Yeras	Cost of Land Acquisition (Rp)	Cost of Construction (Rp)	Cost of Regular Maintenance (Rp)	Cost of Maintenance Schedule (Rp)	Total Cost (Rp)
1.	2017	206.274.300.000				206.274.300.000
2.	2018	275.052.400.000	603.551.000.000			878.383.400.000
3.	2019	206.274.300.000	804.468.000.000	2.034.420.000		1.012.776.720.000
4.	2020		603.551.000.000	4.746.980.000		608.097.980.000
5.	2021			6.781.400.000		6.781.400.000
6.	2022			6.781.400.000		6.781.400.000
7.	2023			6.781.400.000		6.781.400.000
8.	2024			6.781.400.000	20.860.200.000	27.641.900.000
9.	2025			6.781.400.000	67.814.000.000	74.295.400.000
10.	2026			6.781.400.000	20.860.200.000	27.641.900.000
11.	2027			6.781.400.000		6.781.400.000
12.	2028			6.781.400.000		6.781.400.000
13.	2029			6.781.400.000	20.860.200.000	27.641.900.000
14.	2030			6.781.400.000	67.814.000.000	74.295.400.000
15.	2031			6.781.400.000	20.860.200.000	27.641.900.000
16.	2032			6.781.400.000		6.781.400.000
17.	2033			6.781.400.000		6.781.400.000
18.	2034			6.781.400.000	20.860.200.000	27.641.900.000
19.	2035			6.781.400.000	67.814.000.000	74.295.400.000
20.	2036			6.781.400.000	20.860.200.000	27.641.900.000
21.	2037			6.781.400.000		6.781.400.000
22.	2038			6.781.400.000		6.781.400.000
23.	2039			6.781.400.000	20.860.200.000	27.641.900.000
24.	2040			6.781.400.000	67.814.000.000	74.295.400.000
25.	2041			6.781.400.000	20.860.200.000	27.641.900.000
Total		400.831.000.000	603.551.000.000	149.190.800.000	42.680.000.000	3.226.081.800.000

Table 8. Costs of Land Acquisition, Construction and Maintenance of Pass Road Sukorejo - Batu for 4 Line Alternating 2

No.	Tahun	Cost of Acquisition (Rp)	Construction Cost (Rp)	Cost of Regular Maintenance (Rp)	Cost of Maintenance Schedule (Rp)	Total Cost (Rp)
1.	2017	189.711.637.500				189.711.637.500
2.	2018	252.948.850.000	499.233.537.300			752.182.387.300
3.	2019	189.711.637.500	665.644.716.400	1.950.000.000		857.306.353.900
4.	2020		499.233.537.300	4.550.000.000		503.783.537.300
5.	2021			6.500.000.000		6.500.000.000
6.	2022			6.500.000.000		6.500.000.000
7.	2023			6.500.000.000		6.500.000.000
8.	2024			6.500.000.000	48.750.000.000	55.250.000.000
9.	2025			6.500.000.000	65.000.000.000	71.500.000.000
10.	2026			6.500.000.000	48.750.000.000	55.250.000.000
11.	2027			6.500.000.000		6.500.000.000
12.	2028			6.500.000.000		6.500.000.000
13.	2029			6.500.000.000	48.750.000.000	55.250.000.000
14.	2030			6.500.000.000	65.000.000.000	71.500.000.000
15.	2031			6.500.000.000	48.750.000.000	55.250.000.000
16.	2032			6.500.000.000		6.500.000.000
17.	2033			6.500.000.000		6.500.000.000
18.	2034			6.500.000.000	48.750.000.000	55.250.000.000
19.	2035			6.500.000.000	65.000.000.000	71.500.000.000
20.	2036			6.500.000.000	48.750.000.000	55.250.000.000
21.	2037			6.500.000.000		6.500.000.000
22.	2038			6.500.000.000		6.500.000.000
23.	2039			6.500.000.000	48.750.000.000	55.250.000.000
24.	2040			6.500.000.000	65.000.000.000	71.500.000.000
25.	2041			6.500.000.000	48.750.000.000	55.250.000.000
Total		400.831.000.000	499.233.537.300	143.000.000.000	45.680.000.000	3.089.483.916.000

Table 9. Costs of Land Acquisition, Construction and Maintenance of Pass Road Sukorejo - Batu for 4 Line Alternating 3

No.	Tahun	Cost of Aquisition (Rp)	Construction Cost (Rp)	Cost of Regular Maintenance (Rp)	Cost of Maintenance Schedule (Rp)	Total Cost (Rp)
1.	2017	194.904.600.000				194.904.600.000
2.	2018	259.872.800.000	447.193.093.800			707.065.893.800
3.	2019	194.904.600.000	596.257.458.400	2.008.080.000		793.170.138.400
4.	2020		447.193.093.800	4.685.520.000		451.878.613.800
5.	2021			6.693.600.000		6.693.600.000
6.	2022			6.693.600.000		6.693.600.000
7.	2023			6.693.600.000		6.693.600.000
8.	2024			6.693.600.000	50.202.000.000	56.895.600.000
9.	2025			6.693.600.000	66.936.000.000	73.629.600.000
10.	2026			6.693.600.000	50.202.000.000	56.895.600.000
11.	2027			6.693.600.000		6.693.600.000
12.	2028			6.693.600.000		6.693.600.000
13.	2029			6.693.600.000	50.202.000.000	56.895.600.000
14.	2030			6.693.600.000	66.936.000.000	73.629.600.000
15.	2031			6.693.600.000	50.202.000.000	56.895.600.000
16.	2032			6.693.600.000		6.693.600.000
17.	2033			6.693.600.000		6.693.600.000
18.	2034			6.693.600.000	50.202.000.000	56.895.600.000
19.	2035			6.693.600.000	66.936.000.000	73.629.600.000
20.	2036			6.693.600.000	50.202.000.000	56.895.600.000
21.	2037			6.693.600.000		6.693.600.000
22.	2038			6.693.600.000		6.693.600.000
23.	2039			6.693.600.000	50.202.000.000	56.895.600.000
24.	2040			6.693.00.000	66.936.000.000	73.629.600.000
25.	2041			6.693.600.000	50.202.000.000	56.895.600.000
Total		400.831.000.000	447.193.093.800	147.259.200.000	45.680.000.000	2.956.944.846.000

Benefit of Pass Road Sukorejo – Batu Project

Table 10. Tangible Benefit of Pass Road Sukorejo – Batu Project

No.	Years	Saving Variables			Total (Rp)
		Vehicle Operating Saving (Rp)	Delay (Rp)	Accident (Rp)	
1.	2017				
2.	2018				
3.	2019				
4.	2020				
5.	2021	109.236.633.509	72.820.463.608	1.800.000.000	183.857.097.117
6.	2022	116.258.431.322	77.501.407.680	1.900.000.000	195.659.839.002
7.	2023	123.735.383.561	82.485.771.541	2.050.000.000	208.271.155.102
8.	2024	131.697.230.051	87.793.380.664	2.250.000.000	221.740.610.715
9.	2025	140.175.668.519	93.445.365.718	2.350.000.000	235.971.034.237
10.	2026	149.204.484.397	99.464.249.099	2.550.000.000	251.218.733.496
11.	2027	158.819.689.288	105.874.037.239	2.700.000.000	267.393.726.527
12.	2028	169.059.668.681	112.700.319.071	2.900.000.000	284.659.987.752
13.	2029	179.965.339.518	119.970.371.074	3.100.000.000	303.035.710.592
14.	2030	191.580.318.297	127.713.269.334	3.350.000.000	322.643.587.631
15.	2031	203.951.100.409	135.960.009.092	3.550.000.000	343.461.109.501
16.	2032	217.127.251.454	144.743.632.285	3.800.000.000	365.670.883.739
17.	2033	231.161.611.360	154.099.363.618	4.050.000.000	389.310.974.978
18.	2034	246.110.512.158	164.064.755.735	4.350.000.000	414.525.267.893
19.	2035	262.034.010.322	174.679.844.111	4.650.000.000	441.363.854.433
20.	2036	278.996.134.673	185.987.312.305	5.000.000.000	469.983.446.978
21.	2037	297.065.150.880	198.032.668.289	5.350.000.000	500.447.819.169
22.	2038	316.313.843.682	210.864.432.585	5.400.000.000	532.578.276.267
23.	2039	336.819.818.021	224.534.339.008	5.350.000.000	566.704.157.029
24.	2040	358.665.820.368	239.097.548.875	5.300.000.000	603.063.369.243
25.	2041	381.940.081.595	254.612.879.567	5.200.000.000	641.752.961.162
Total		4.599.918.182.065	3.066.445.420.498	76.950.000.000	7.743.313.602.563

Table 11. Intangible Benefit of Pass Road Sukorejo – Batu Project

No.	Years	Saving Variables			Total (Rp)
		New Business Growth (Rp)	Increase of Regional Expenditure Budget (Rp)	Performance Increase (Rp)	
1.	2017				
2.	2018				
3.	2019				
4.	2020				
5.	2021	205.483.448.000	95.673.475.600	2.987.546.458	304.144.470.058
6.	2022	296.453.834.000	102.659.576.000	3.588.673.569	402.702.083.569
7.	2023	327.459.334.000	126.856.649.000	3.938.651.957	458.254.634.957
8.	2024	400.753.844.000	1.32.648.563.500	4.302.846.446	537.705.253.946
9.	2025	213.702.785.920	136.628.020.405	4.474.960.304	354.805.766.629
10.	2026	308.311.987.360	140.726.861.017	4.653.958.716	453.692.807.093
11.	2027	340.557.707.360	147.763.204.068	4.840.117.065	493.161.028.493
12.	2028	416.783.997.760	153.673.732.231	5.033.721.747	575.491.451.738
13.	2029	433.455.357.670	162.894.156.165	5.235.070.617	601.584.584.452
14.	2030	455.128.125.554	167.780.980.850	5.444.473.442	628.353.579.845
15.	2031	473.333.250.576	172.814.410.275	5.662.252.379	651.809.913.231
16.	2032	492.266.580.599	181.455.130.789	5.888.742.475	679.610.453.863
17.	2033	511.957.243.823	188.713.336.020	6.124.292.174	706.794.872.017
18.	2034	542.674.678.452	200.036.136.182	6.369.263.861	749.080.078.495
19.	2035	569.808.412.375	206.037.220.267	6.624.034.415	782.469.667.057
20.	2036	592.600.748.870	212.218.336.875	6.888.995.792	811.708.081.537
21.	2037	616.304.778.825	222.829.253.719	7.164.555.623	846.298.588.167
22.	2038	640.956.969.978	231.742.423.867	7.451.137.848	880.150.531.694
23.	2039	679.414.388.177	245.646.969.300	7.749.183.362	932.810.540.838
24.	2040	713.385.107.585	253.016.378.378	8.059.150.697	974.460.636.660
25.	2041	741.920.511.889	260.606.869.730	8.381.516.724	1.010.908.898.343

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Table 12. Benefit Cost Ratio Calculate of Pass Road Sukorejo – Batu Project 2 Line Alternating 1

No.	Years	Present Value from Total Cost (Rp)	Present Value from Benefit (Rp)	Benefit Cost Ratio
1.	2017	114.593.624.622		0
2.	2018	493.823.677.746		0
3.	2019	860.310.763.578		0
4.	2020	1.009.448.485.500		0
5.	2021	937.043.274.000	3.390.700.000	0.00
6.	2022	869.789.877.140	6.781.400.000	0.01
7.	2023	807.313.911.900	10.172.100.000	0.01
8.	2024	763.115.586.705	38.993.050.000	0.05
9.	2025	725.134.963.010	76.290.750.000	0.11
10.	2026	684.846.295.200	105.111.700.000	0.15
11.	2027	635.587.639.130	108.502.400.000	0.17
12.	2028	589.809.612.040	111.893.100.000	0.19
13.	2029	555.831.010.785	140.714.050.000	0.25
14.	2030	528.255.462.525	178.011.750.000	0.34
15.	2031	498.089.126.400	206.832.700.000	0.42
16.	2032	462.259.466.130	210.223.400.000	0.45
17.	2033	428.969.722.020	213.614.100.000	0.50
18.	2034	404.281.754.370	242.435.050.000	0.60
19.	2035	383.030.695.985	279.732.750.000	0.73
20.	2036	361.283.504.400	308.553.700.000	0.85
21.	2037	275.890.763.690	311.944.400.000	1.13
22.	2038	253.647.906.880	315.335.100.000	1.24
23.	2039	236.679.127.230	344.156.050.000	1.45
24.	2040	221.813.425.520	381.453.750.000	1.72
25.	2041	208.333.123.200	410.274.700.000	1.97
Rerata BCR				0.49

Table 13. Benefit Cost Ratio Calculate of Pass Road Sukorejo – Batu Project 2 Line Alternating 2

No.	Years	Present Value from Total Cost (Rp)	Present Value from Benefit (Rp)	Benefit Cost Ratio
1.	2017	105.392.403.097		0
2.	2018	390.450.730.856		0
3.	2019	653.593.027.472		0
4.	2020	746.387.710.005		0
5.	2021	693.356.814.530	3.390.700.000	0
6.	2022	644.060.292.987	6.781.400.000	0.01
7.	2023	598.229.572.331	10.172.100.000	0.02
8.	2024	568.864.841.365	38.993.050.000	0.07
9.	2025	544.526.965.197	76.290.750.000	0.14
10.	2026	517.043.981.326	105.111.700.000	0.20
11.	2027	480.150.754.859	108.502.400.000	0.23
12.	2028	445.841.437.099	111.893.100.000	0.25
13.	2029	422.900.270.109	140.714.050.000	0.33
14.	2030	403.873.343.462	178.011.750.000	0.44
15.	2031	382.571.945.842	206.832.700.000	0.54
16.	2032	355.240.397.688	210.223.400.000	0.59
17.	2033	329.831.813.455	213.614.100.000	0.65
18.	2034	312.216.694.447	242.435.050.000	0.78
19.	2035	297.414.402.511	279.732.750.000	0.94
20.	2036	281.655.100.148	308.553.700.000	1.10
21.	2037	215.182.583.167	311.944.400.000	1.45
22.	2038	197.925.071.147	315.335.100.000	1.59
23.	2039	185.391.776.957	344.156.050.000	1.86
24.	2040	174.573.376.251	381.453.750.000	2.19
25.	2041	164.541.238.814	410.274.700.000	2.49
Kerata BCR				0,64

Table 14. Benefit Cost Ratio Calculate of Pass Road Sukorejo – Batu Project 2 Line Alternating 3

No.	Years	Present Value from Total Cost (Rp)	Present Value from Benefit (Rp)	Benefit Cost Ratio
1.	2017	108.277.301.484		0
2.	2018	361.991.481.483		0
3.	2019	586.908.340.012		0
4.	2020	654.949.541.085		0
5.	2021	608.752.196.247	3.390.700.000	0.01
6.	2022	565.781.845.212	6.781.400.000	0.01
7.	2023	525.808.311.119	10.172.100.000	0.02
8.	2024	502.249.918.743	38.993.050.000	0.08
9.	2025	483.388.683.662	76.290.750.000	0.16
10.	2026	460.809.244.615	105.111.700.000	0.23
11.	2027	428.121.722.778	108.502.400.000	0.25
12.	2028	397.708.440.988	111.893.100.000	0.28
13.	2029	378.105.662.038	140.714.050.000	0.37
14.	2030	363.243.633.146	178.011.750.000	0.49
15.	2031	345.220.470.987	206.832.700.000	0.60
16.	2032	320.678.249.071	210.223.400.000	0.66
17.	2033	297.853.357.833	213.614.100.000	0.72
18.	2034	282.822.079.552	242.435.050.000	0.86
19.	2035	270.439.964.509	279.732.750.000	1.03
20.	2036	256.824.892.043	308.553.700.000	1.20
21.	2037	196.275.221.381	311.944.400.000	1.59
22.	2038	180.591.499.692	315.335.100.000	1.75
23.	2039	169.602.587.916	344.156.050.000	2.03
24.	2040	160.224.995.310	381.453.750.000	2.38
25.	2041	151.378.711.365	410.274.700.000	2.71
Kerata				0,697

Table 15. Benefit Cost Ratio Calculate of Pass Road Sukorejo – Batu Project 4 Line Alternating 1

No.	Years	Present Value from Total Cost (Rp)	Present Value from Benefit (Rp)	Benefit Cost Ratio
1.	2017	190.989.374.370		0
2.	2018	929.877.046.210		0
3.	2019	1.664.943.442.596		0
4.	2020	1.988.566.314.000		0
5.	2021	1.846.000.772.280	3.390.700.000	0.
6.	2022	1.713.573.795.040	6.781.400.000	0.
7.	2023	1.590.548.996.100	10.172.100.000	0.01
8.	2024	1.503.935.045.550	38.993.050.000	0.03
9.	2025	1.429.628.572.780	76.290.750.000	0.05
10.	2026	1.350.578.086.560	105.111.700.000	0.08
11.	2027	1.253.476.205.080	108.502.400.000	0.09
12.	2028	1.163.232.416.060	111.893.100.000	0.10
13.	2029	1.096.513.199.550	140.714.050.000	0.13
14.	2030	1.042.459.783.950	178.011.750.000	0.17
15.	2031	983.171.146.560	206.832.700.000	0.21
16.	2032	912.473.328.480	210.223.400.000	0.23
17.	2033	846.785.190.180	213.614.100.000	0.25
18.	2034	798.238.705.500	242.435.050.000	0.30
19.	2035	756.500.013.430	279.732.750.000	0.37
20.	2036	713.703.029.040	308.553.700.000	0.43
21.	2037	545.026.250.440	311.944.400.000	0.57
22.	2038	501.097.630.520	315.335.100.000	0.63
23.	2039	467.671.772.100	344.156.050.000	0.74
24.	2040	438.410.803.360	381.453.750.000	0.87
25.	2041	411.846.354.240	410.274.700.000	1.00
Kerata BCR				0,25

Table 16. Benefit Cost Ratio Calculate of Pass Road Sukorejo – Batu Project 4 Line Alternating 2

No.	Years	Present Value from Total Cost (Rp)	Present Value from Benefit (Rp)	Benefit Cost Ratio
1.	2017	175.654.005.161		0
2.	2018	807.485.747.461		0
3.	2019	1.428.205.260.612		0
4.	2020	1.692.693.178.260		0
5.	2021	1.571.834.753.230	3.390.700.000	0.00
6.	2022	1.459.533.063.863	6.781.400.000	0.00
7.	2023	1.355.169.364.986	10.172.100.000	0.01
8.	2024	1.284.689.634.815	38.993.050.000	0.03
9.	2025	1.225.106.804.783	76.290.750.000	0.06
10.	2026	1.160.076.949.891	105.111.700.000	0.09
11.	2027	1.076.961.001.572	108.502.400.000	0.10
12.	2028	999.692.863.044	111.893.100.000	0.11
13.	2029	944.450.620.564	140.714.050.000	0.15
14.	2030	900.361.648.398	178.011.750.000	0.20
15.	2031	850.877.330.323	206.832.700.000	0.24
16.	2032	789.876.705.080	210.223.400.000	0.27
17.	2033	733.184.402.495	213.614.100.000	0.29
18.	2034	692.487.025.783	242.435.050.000	0.35
19.	2035	657.850.498.337	279.732.750.000	0.43
20.	2036	621.735.145.157	308.553.700.000	0.50
21.	2037	474.891.067.049	311.944.400.000	0.66
22.	2038	436.704.084.183	315.335.100.000	0.72
23.	2039	408.264.733.625	344.156.050.000	0.84
24.	2040	383.527.166.982	381.453.750.000	0.99
25.	2041	360.851.721.389	410.274.700.000	1.14
Kerata BCR				0.28

Table 17. Benefit Cost Ratio Calculate of Pass Road Sukorejo – Batu Project 4 Line Alternating 3

No.	Years	Present Value from Total Cost (Rp)	Present Value from Benefit (Rp)	Benefit Cost Ratio
1.	2017	180.462.169.140		0
2.	2018	773.259.304.335		0
3.	2019	1.345.602.633.840		0
4.	2020	1.578.059.145.810		0
5.	2021	1.465.816.962.988	3.390.700.000	0.00
6.	2022	1.361.488.142.269	6.781.400.000	0.00
7.	2023	1.264.502.876.841	10.172.100.000	0.01
8.	2024	1.201.624.847.534	38.993.050.000	0.03
9.	2025	1.149.272.148.049	76.290.750.000	0.06
10.	2026	1.090.614.055.867	105.111.700.000	0.09
11.	2027	1.012.724.875.889	108.502.400.000	0.10
12.	2028	940.296.285.067	111.893.100.000	0.11
13.	2029	890.145.418.447	140.714.050.000	0.15
14.	2030	850.716.520.263	178.011.750.000	0.20
15.	2031	805.439.652.259	206.832.700.000	0.24
16.	2032	747.854.351.987	210.223.400.000	0.27
17.	2033	694.323.947.234	213.614.100.000	0.29
18.	2034	656.928.033.829	242.435.050.000	0.35
19.	2035	625.414.196.698	279.732.750.000	0.43
20.	2036	592.018.194.521	308.553.700.000	0.50
21.	2037	452.275.344.010	311.944.400.000	0.66
22.	2038	415.982.511.709	315.335.100.000	0.72
23.	2039	389.480.627.219	344.156.050.000	0.84
24.	2040	366.566.224.694	381.453.750.000	0.99
25.	2041	345.371.158.013	410.274.700.000	1.14
Rerata BCR				0,29

From the above calculation it can be seen that the value of all benefit cost ratios on 6 alternative is with the average value of BCR is the largest for the construction project of Sukorejo - Batu with 2 lanes alternative 3 which has an average of 6.97 where the value of ratio 1 is obtained After the useful life of the road is used for 15 years, which is also the fastest time of benefit associated with the ratio of BCR to a value of more than 1. This means that the construction of the Sukorejo - Batu passage with 2 alternative lanes 3 is feasible to choose on These factors are beyond the geographic and demographic conditions.

Managerial Implication

This research can have an impact on decision making for managerial related to decision making in Sukorejo - Batu road development with Benefit Cost Analysis Method. The highest consideration of the BCR ratio allows the project to have maximum benefits in the future and the most immediate beneficiary considerations after the project is completed.

CONCLUSION AND SUGGEST

CONCLUSION

1. Selection of Sukorejo road construction - This stone has three alternatives and the chosen one is the third alternative because of consideration: no crossing with railway, shorter route distance, shorter travel time and fewer bends or climbs. In addition, the cost required is less than the two other projects amounting to Rp 1,296,050,611,000.
2. The total tangible benefits consisting of the benefits of operating vehicle operating expenses, reduction of deferred costs and accident reduction amounted to Rp 7,743,313,602,563. While intangible benefits consist of new business growth, APBD increase and human resource

performance improvement is Rp 537,705,253,946. So the total intangible manfaat and intangible benefits of Rp 8.281.018.856.509.

3. The Sukorejo - Batu Strip construction project with 2 alternative lanes 3 being the best choice with the highest average BCR compared to other alternatives of 6.97 where the ratio value 1 was obtained after the useful life of the road was used for 15 years, This is also the fastest benefit time associated with the BCR ratio for values over 1.

SUGGESTION

2. This study only looks at cash flows on investments, while profit and loss posts are not overly discussed. Investors should be more strict in seeing the profit and loss of this project because it will determine dividends.
3. This research does not include risk analysis on Sukorejo - Batu road investment. Risk analysis of this investment to see how big the effect of risk on investment decisions.
4. The Sukorejo – Batu Road Construction Project- This stone should be careful in spending, the actual cost of the project should not exceed the RAB, and if there is an urgent fee that requires the cash outflow beyond the post in the RAB, then it should be adjusted to anticipate Cost over run, one example is the adjustment of design and quality of Sukorejo - Batu passage.

LIMITATION

1. This research is still using cost benefit analysis for Sukorejo - Batu toll road project development using 2 lane, in next research it is expected to do research with 4 lane.
2. This research does not analyze Payback Ratio and Break Event Point value nor value of Internal Rate of Return (IRR), so in other research it is possible to enter the variable.
3. This study incorporates the intangible benefits of three aspects of new business growth, an increase in APBD and an increase in HR performance so that in other studies it is possible to examine other aspects beyond those aspects.

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