ANALYSIS OF REMAINING SERVICE LIFE OF PAVEMENT ON THE SUMENGKO – BANDUNGREJO ROAD SECTION BOJONEGORO REGENCY STA 0+000 TO 2+770

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ABSTRACT

Bojonegoro Regency is located in East Java Province, west of the provincial capital. The regency covers an area of 230,706 hectares and borders seven other regencies. [1]. Bojonegoro as a contributor of 25 percent of national production has made Bojonegoro designated as the location for implementing the National Strategic Program (PSN) for the construction of a bioethanol factory [2]. The planned location is in Gayam District, Bojonegoro Regency. The location has been visited by two investors [2]. The road section that is the main access point for the planned bioethanol factory location is the Sumengko – Bandungrejo road section STA 0+000 - 2+770. Due to the importance of this road section to support the National Strategic Project (PSN), it is necessary to estimate the remaining planned life of the road and estimate the cost of road rehabilitation for current conditions. The remaining planned life is calculated using the AASHTO 1993 method dan Manual Desain Perkerasan Jalan (MDP) 2024 with LHR data in 2023 which will then be calculated to be actual CESAL in 2027 and 2033. Furthermore, the analysis of road rehabilitation costs is calculated according to the guidelines SE Direktur Jenderal Bina Konstruksi 30/SE/Dk/2025 with unit price data and technical data. The remaining services life of the road based on the actual CESAL in 2027 is 67.54% and based on the actual CESAL in 2033 it is 46.43%. The road rehabilitation costs required are Rp. 1,828,617,800.00 to overlay asphalt on spot 2 (STA 0+750 to 1+900) and repair of road shoulders with gabions amounting to Rp. 141,563,400.00 on spot 3 (STA 2+000 to 2+020).

KeyFindings: Remaining Life,, Road Rehabilitation, Rigid Pavement

1. INTRODUCTION

Bojonegoro Regency, located in the western part of East Java Province with an area of 230,706 hectares, is known for its abundant natural and cultural wealth [1]. One of its leading sectors is oil and gas, especially since the signing of the Cepu Block Production Sharing Contract (PSC) in 2005 between ExxonMobil Cepu Limited, PT Pertamina EP Cepu, and the local government, which made Bojonegoro a supplier of more than 25% of the national crude oil [3].
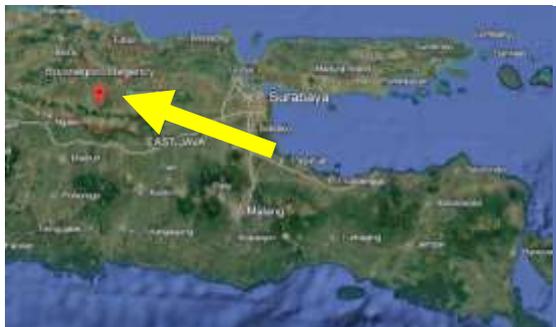
Figure 1. Location of Bojonegoro Regency
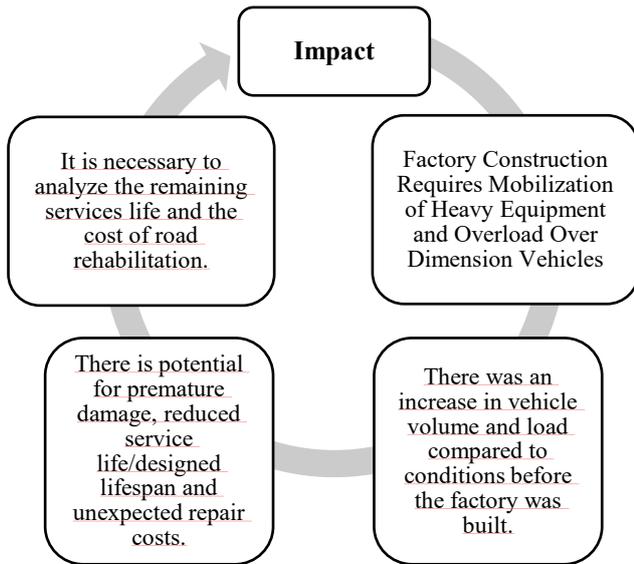Source: Processed by researchers 2025, Google Earh.

In 2027 Bojonegoro will be the location of the National Strategic Program in the form of the construction of a bioethanol factory by two Japanese investors, namely PT Butonas Petrochemical Indonesia (BPI) in Bandungrejo Village and the Japan International Cooperation Agency (JICA) in Katur Village [2]. The construction of a large-scale bioethanol factory by JICA on 1,400 hectares of land requires the readiness of supporting infrastructure, especially main road access.

The 2.77 km Sumengko–Bandungrejo road section is a vital route to the project location, with the existing condition being a 20 cm thick and 5 meter wide rigid pavement that completely constructed in 2022. However, increased heavy vehicle activity during the construction and operational periods is expected to significantly increase the road load. Therefore, it is necessary to analyze the Remaining Service Life (RSL) of the road pavement in 2027 and 2033 when the road pavement age reaches 10 years then estimated rehabilitation costs to ensure that the road remains sound and suitable to support the success of this national strategic project.

1.1. Impact Of Factory Construction

There are at least four impacts of the factory construction plan, the description of which is in Figure 2.

Figure 2. Impact Of Factory Construction
Source: Processed by researchers 2025.

The impact will be felt by the Sumengko - Bandungrejo road section at STA 0+000 to STA 2+770 which is marked in white in Figure 3. Meanwhile, the orange color is a village road section which is not part of the Sumengko - Bandungrejo road section.
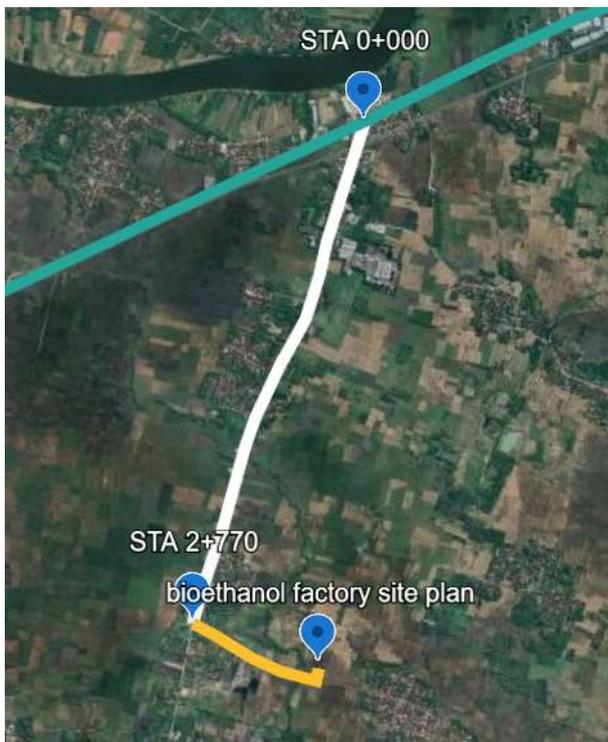
Figure 3. Route To The Factory Location
Source: Processed by researchers 2025, Google Earh.

1.2. Pavement Section

The type of pavement on this road section is rigid pavement, some of which has been overlaid using hotmix as shown in Figure 4.

Figure 4. Type Of Road Pavement Leading To The Factory Location
Source: Processed by researchers 2025, Google Earh.

This road section starts from the starting point where it meets the national road. From STA 000+ to 2+770, there is one level crossing with a railway and one bridge. The starting point of this section is shown in Figure 5.

Figure 5. Starting Point Of The Road Section
Source: Processed by researchers 2025.

While the end of the section reviewed by STA 2+770 is in Figure 6.

Figure 6. End Of The Section STA 2+770
Source: Processed by researchers 2025

2. LITERATURE REVIEW

2.1. Remaining Services Life

According to AASHTO 1993, Remaining Life (RL) of a pavement is the percentage of remaining service life of a road pavement before it reaches failure or requires major rehabilitation, based on a comparison between the actual traffic load (actual CESAL) and the design load (design CESAL). Conceptually, Remaining Life (RL) indicates how long the pavement can withstand passing traffic loads without experiencing significant structural damage [4]. Therefore, the longer a pavement structure is subjected to loads, the shorter its service life, as shown in Figure 7.
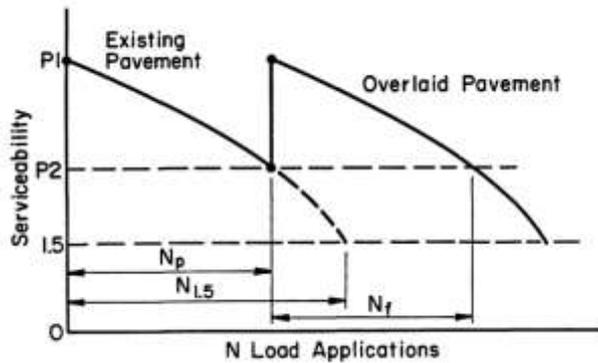
Figure 7. Pavement Serviceability
Source: AASHTO 1993

To determine the remaining service life, the actual amount of traffic that the pavement can withstand until it "fails" must first be determined along with the design traffic load. Both traffic amounts must be expressed in 18-kip ESAL. The difference between these values, expressed as a percentage of the total traffic until it "fails", can then be defined as the remaining service life according to formula (1):

$$RL = 100 \times \left[1 - \frac{N_p}{N_{1,5}} \right] \quad (1)$$

Where:
RL   : Remaining Service Life (%)
Np   : Tital Traffic to date, (18-kip ESAL)

$N_{1,5}$: Total Traffic to pavement failure
         (18-kip ESAL)

To analyze the Remaining Service Life of rigid pavement, there is a reference from research on the rigid pavement of the Solo–Ngawi toll road section. The toll road section experienced a decline in function due to damage and an analysis of the remaining life value of the pavement was carried out to determine the appropriate maintenance method. The research method uses a quantitative approach with secondary data, referring to the 1993 AASHTO standard. Based on the analysis results, the design CESAL value was obtained at 22,913,047 ESAL, while the actual CESAL on the Solo–Ngawi route was 8,239,688 ESAL and on the Ngawi–Solo route was 4,270,023 ESAL. From these results, the remaining life of the pavement was 64.04% on the Solo–Ngawi route and 81.37% on the Ngawi–Solo route. This research provides important benefits in determining the level of durability and remaining life of the Solo–Ngawi toll road pavement. The results can be used as a reference for toll road managers to develop preventive maintenance and structural rehabilitation strategies to extend the service life of roads and improve the comfort of toll road users [5].

2.2. Pavement Rehabilitation Cost

In the study on the Gresik – Lamongan Highway, road damage on the pavement above soft soil was observed. The cause of the damage was caused by many factors. From vehicle loads exceeding the plan to the influence of soil bearing capacity. In analyzing this road damage, the PCI (Pavement Condition Index) method was used with the intention of finding the value of the damage that occurred on the Gresik – Lamongan Highway and selecting alternative handling to repair the damage and planning the budget for repairs. The results of this study obtained an average PCI value of 35.03 which is categorized as a bad condition with alternative handling of rehabilitation maintenance or additional layers (overlay) and planning a budget for overlay repairs which obtained a cost of Rp. 10,334,242,000 [6].

The research on the cost of road rehabilitation is on the French Highway in Tangerang City, with the important role of this road section as a connector for industrial areas, warehouses, and access to Soekarno-Hatta Airport which is now experiencing complete damage due to the high volume of heavy vehicles. This study uses a visual survey method to assess the condition of the road surface to calculate the volume of damage and estimate repair costs based on a unit price analysis of work. Based on the analysis results, the total volume of damage was found to be 854.28 m2 with a road condition value of 23%, so it was concluded that this road section requires handling in the form of Heavy Works (PK)

rehabilitation or reconstruction with an estimated cost of Rp 12,492,200,000 [7].

To prepare a budget plan, volume calculations and unit price analysis of the work are required. The analysis is influenced by coefficients, wage prices, material prices and equipment prices which are compiled based on the instruction guidelines of the SE Direktur Jenderal Bina Konstruksi 30/SE/Dk/2025 which are adjusted to conditions and data in the field according to the project location. Example of a calculation table for road rehabilitation budget plans as shown in Figure 8

Code	Works	Units	Volume	Unit Price	Cost
				Amount	....
				Tax	....
		Amount Including Tax			....

Figure 8. Cost Analysis Form
Source: processed by researchers 2025

3. RESEARCH METHODOLOGY

The research flow will be divided into two parts, a flowchart for calculating the remaining services life, and a flowchart for calculating road rehabilitation costs. Figure 10 is a description of the stages of calculating the remaining life of road pavement.
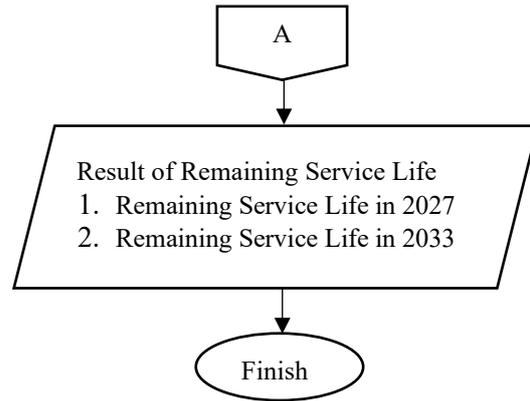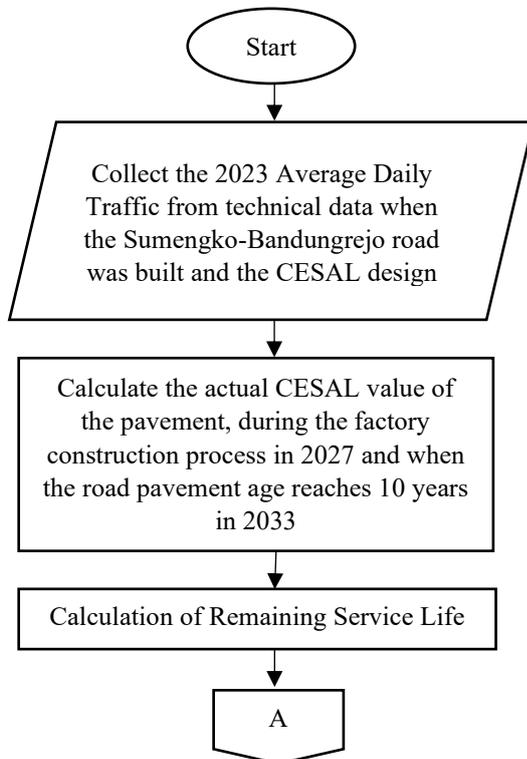
Figure 9. Analys Remaining Services Life Flowchart
Source: processed by researchers 2025

The remaining design life of the road is calculated using the AASHTO 1993 method by comparing the actual traffic load (Actual CESAL) with the traffic load design (CESAL design) based on the technical data obtained. To calculate the two CESAL values, average daily traffic data is used, grouped by type of commercial vehicle. Furthermore, the Actual CESAL and CESAL design are calculated using the Manual Desain Perkerasan jalan (MDP) 2024 method sub chapter 4.8. Based on the calculation results, the remaining design life is obtained using equation (1). And as a final analysis, the analysis of road rehabilitation costs is shown in Figure 10.
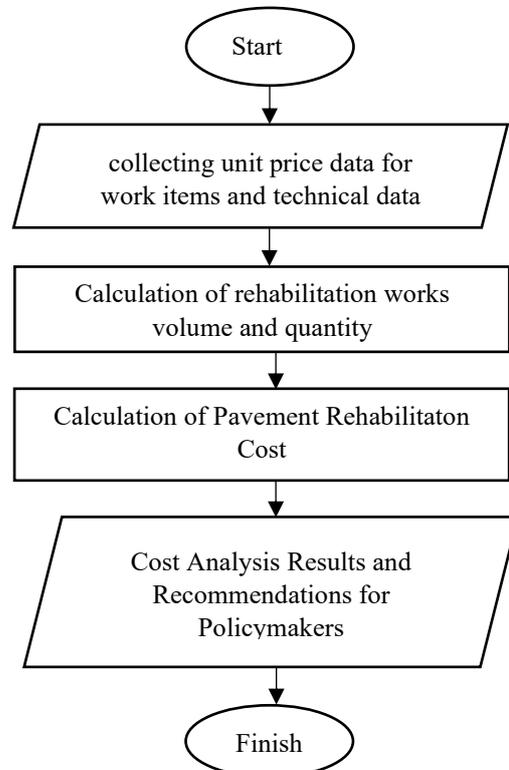
Figure 10. Road Rehabilitation Costs Analys Flowchart
Source: processed by researchers 2025

4. RESULTS AND DISCUSSION

4.1. Cumulative Design Load (CESAL Design)

Based on technical data carried out in 2021, the rigid pavement of the Sumengko – Bandungrejo Road Section was designed with a CESAL value of 2,340,560.98 and the rigid pavement completed the construction period and began to receive vehicle loads at the end of 2022. So that until now in 2025 the section has entered the construction age or operational age of 3 years.

The Sumengko-Bandungrejo road section is a collector road, connecting activity centers with local and arterial roads within the road network system. It also serves as a collector road for local roads and a channel for arterial roads, and vice versa, distributing traffic from arterial roads to local roads. Therefore, the traffic growth rate factor (i) for this road section, with its collector road function and in the Java region according to Manual Desai Perkerasan Jalan (MDP) 2024 sub chapter 4.4 is 3.5%. Therefore, the actual CESAL calculation data is as follows:

- Road section : Sumengko – Bandungrejo
- Road function : Collector
- lane : 2 Lane 2 Way undivided
- Directional Distribution Factor (DD) : 0,5 (for 2-way roads) (MDP 2024)
- Lane distribution factor (DL) : 100%, for number of lanes in each direction = 1 (MDP 2024)
- Cumulative traffic growth multiplier (R) :
  1. 2023 – 2025 (2 years)
  $$R = \frac{(1+0,01\ i)^{UR}-1}{0,01\ i}$$
  $$= \frac{(1+0,01 \times 3,5)^{2}-1}{0,01 \times 3,5}$$
  $$= 2,04$$
  2. 2025 – 2027 (2 years), when the bioethanol plant construction has begin.
  $$R = \frac{(1+0,01\ i)^{UR}-1}{0,01\ i}$$
  $$= \frac{(1+0,01 \times 3,5)^{2}-1}{0,01 \times 3,5}$$
  $$= 2,04$$
  3. 2027 – 2033 (6 years) pavement at age 10 years

$$R = \frac{(1+0,01\ i)^{UR}-1}{0,01\ i}$$
$$= \frac{(1+0,01 \times 3,5)^{6}-1}{0,01 \times 3,5}$$
$$= 6,55$$

- vehicle damage factor (VDF) : In East Java Province – Pantura (MDP 2024)

4.2. Cumulative Actual Load (Actual CESAL)

To obtain the actual CESAL by calculating the average daily traffic in 2025 and 2027 as in figure 11.

Description	Type	LHR		
		2023	2025	2027
(1)	(2)	(3)	(4)	(5)
2-axle trucks - light trucks	6A	24	26	28
2-axle trucks - medium trucks	6B	123	132	141
3-axle trucks - heavy trucks	7A1	14	15	16
4-axle trucks - heavy trucks	7A2	32	34	37
5-axle trucks - heavy trucks	7A3	6	6	7

Figure 11. Average daily traffic in 2023, 2024 and 2025
Source: processed by researchers 2025

Where.

$$(4) = (3) \times \left[1+\frac{i}{100}\right]^{(2025-2023)}, i = 3{,}5\%$$

$$(5) = (3) \times \left[1+\frac{i}{100}\right]^{(2027-2023)}, i = 3{,}5\%$$

The type of vehicle taken into account is a commercial vehicle according to the data in figure 11.

4.2.1. Calculation of the factual CESA5 2023-2025 and the normal CESA5 2025-2027

The factual CESA5 calculations for 2023-2025 are available at figure 12. The formula used to calculate the cesal is as follows.

$$CESAL = \left(\sum LHR_{jk} \times VDF_{jk}\right) \times 365 \times DD \times DL \times R \quad (2)$$

Where.
LHR = Average Daily Traffic
VDF = Vehicle Damage Factor
DD = Directional Distribution Factor
DL = Lane distribution factor
R = Cumulative traffic growth multiplier

Type	LHR 2023	Factual VDF 5	DD	DL	R	Factual CESA 5
(2)	(3)	(4)	(5)	(6)	(7)	(8)
6A	24	0,4	0,5	1	2,04	3.574
6B	123	5,5	0,5	1	2,04	251.861
7A1	14	33,6	0,5	1	2,04	175.130
7A2	32	9,6	0,5	1	2,04	114.371
7A3	6	21,5	0,5	1	2,04	48.027
amount						592.962

Figure 12. Nactual CESA5 2023-2025
Source: processed by researchers 2025

Where.

(8) = (3) ×(4) ×(5) ×(6) × (7) ×365

The normal CESA5 calculation for 2025-2027 is shown in table figure 13.

Type	LHR 2025	VDF 5 normal	DD	DL	R	CESA 5 Normal
(2)	(3)	(4)	(5)	(6)	(7)	(8)
6A	26	0,4	0,5	1	2,04	3.829
6B	132	0,7	0,5	1	2,04	34.338
7A1	15	6,3	0,5	1	2,04	35.176
7A2	34	5,7	0,5	1	2,04	72.744
7A3	6	8,6	0,5	1	2,04	20.579
amount						166.666

Figure 13. Normal CESA5 2023-2025
Source: processed by researchers 2025

Where.

(8) = (3) ×(4) ×(5) ×(6) × (7) ×365

According to the CESA5 calculations in figure 12 and figure 13, to obtain the actual CESAL when the bioethanol plant is under construction in 2027 as follows.

$$CESAL_{2027} = CESA5_{faktual} + CESA5_{normal}$$
$$= 592.962 + 166.666$$
$$= 759.628$$

Calculation of factual CESA5 2025-2027 and normal CESA5 2027-2033 and the calculation of factual CESA5 for 2025-2027 is shown in figure 14.

Type	LHR 2025	Factual VDF 5	DD	DL	R	Factual CESA 5
(2)	(3)	(4)	(5)	(6)	(7)	(8)
6A	26	0,4	0,5	1	2,04	4.101
6B	132	5,5	0,5	1	2,04	289.016
7A1	15	33,6	0,5	1	2,04	200.966
7A2	34	9,6	0,5	1	2,04	131.243
7A3	6	21,5	0,5	1	2,04	55.112
Amount						680.438

Figure 14. Factual CESA5 2025-2027
Source: processed by researchers 2025

Where.

(8) = (3) ×(4) ×(5) ×(6) × (7) ×365

The normal CESA5 calculation for 2027-2033 is shown in figure 15.

Type	LHR 2023	VDF 5 normal	DD	DL	R	CESA 5 Normal
(2)	(3)	(4)	(5)	(6)	(7)	(8)
6A	28	0,4	0,5	1	6,55	13.169
6B	141	0,7	0,5	1	6,55	118.105
7A1	16	6,3	0,5	1	6,55	120.986
7A2	37	5,7	0,5	1	6,55	250.202
7A3	7	8,6	0,5	1	6,55	70.781
amount						573.242

Figure 15. Normal CESA5 2027-2033
Source: processed by researchers 2025

Where.

(8) = (3) ×(4) ×(5) ×(6) × (7) ×365

Based on the CESA5 calculations in figure 14 and figure 15, to obtain the actual CESAL when the pavement age has reached 10 years since the road was opened as follows.

$$CESAL_{2033} = CESA5_{faktual} + CESA5_{normal}$$
$$= 680.438 + 573.242$$
$$= 1.253.680$$

4.3. Remaining Services Life

After obtaining the actual CESAL value at the time of the start of construction of the bioethanol factory in 2027 and the actual CESAL when the road pavement has reached 10 years since the road was opened and the Planned CESAL, the Remaining Services Life of the pavement is calculated as follows.

1. Remaining service life of the bioethanol plant during construction.

$$RL = 100 \times \left[1 - \frac{N_p}{N_{1,5}}\right]$$
$$= 100 \times \left[1 - \frac{759.628}{2340560,98}\right] = 67,54\%$$

2. Remaining service life when the pavement reaches 10 years since the road was opened.

$$RL = 100 \times \left[1 - \frac{N_p}{N_{1,5}}\right]$$
$$= 100 \times \left[1 - \frac{1.253.680}{2340560,98}\right] = 46,43\%$$

4.4. Road Rehabilitation Cost

Based on the results of field observations, the Sumengko – Bandungrejo road section STA 0+000 to STA 2+770, at STA 0+750 to 1+900 there are quite a lot of corner crack damage with mild to high severity levels and at STA 2+000 to 2+020 there are points that experience a decrease in the road shoulder due to landslides so that it needs to be handled. so that to increase the remaining design life, road serviceability and

road stability, as in figure 7, road rehabilitation is needed. the types of road rehabilitation work required include asphalt overlay at STA 0+750 to 1+900 and at the landslide point on the road shoulder at STA 2+000 to 2+020 will be handled by constructing gabions. The results of the road rehabilitation cost analysis at STA 0+750 to 1+900 as figure 16.

Description	Unit	Volume	Unit price (Rp)	Cost (Rp)
(1)	(2)	(3)	(4)	(5)
GENERAL				
Mobilization	Lump Sum	1,00	9.850.000,00	9.850.000,00
CONSTRUCTION SAFETY MANAGEMENT SYSTEM (SMKK)				
Preparation of SMKK Implementation Documents	Lump Sum	1,00	1.500.000,00	1.500.000,00
Socialization, Promotion and Training	Lump Sum	1,00	1.065.000,00	1.065.000,00
Work Protective Equipment and Personal Protective Equipment	Lump Sum	1,00	1.110.000,00	1.110.000,00
Insurance	Lump Sum	1,00	3.850.000,00	3.850.000,00
Construction Safety Personnel	Lump Sum	1,00	3.500.000,00	3.500.000,00
Facilities, Infrastructure, and Medical Equipment	Lump Sum	1,00	250.000,00	250.000,00
Traffic Signs and Equipment	Lump Sum	1,00	2.525.000,00	2.525.000,00
Activities and Equipment related to Construction Safety Risk Control	Lump Sum	1,00	4.000.000,00	4.000.000,00
ASPHALT PAVEMENT				
Adhesive Layer - Liquid Asphalt/Emulsion	Liter	1150,00	28.637,95	32.933.642,50
Asphalt Concrete Wearing Course (AC-WC)	Ton	1048,80	1.460.259,14	1.531.519.786,03
Amount				1.647.403.428,53
Tax				181.214.377,1
Total Amount				1.828.617.805,67
Rounded Amount				1.828.617.800,00

Figure 16. Rehabilitation cost result in STA 0+750 to 1+900 (asphalt overlay)
Source: Processed By Researchers 2025

Where.

(5) = (3) x (4)

According to figure 16, rehabilitation cost for STA 0+750 to 1+900 is Rp. 1,828,617,800.00 and the typical of cross-sectional design as in the figure 17.
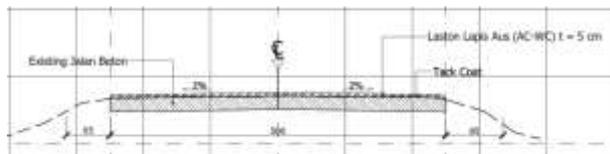

Figure 17. Typical cross-sectional design in STA 0+750 to 1+900 (asphalt overlay)
Source: processed by researchers 2025

Then the cost of the gabion work on STA 2+000 to 2+020 which are shown in the figure 18.

| Description	Unit	Volume	Unit price (Rp)	Cost (Rp)
(1)	(2)	(3)	(4)	(5)
GENERAL				
Mobilization	Lump Sum	1,00	9.850.000,00	9.850.000,00
CONSTRUCTION SAFETY MANAGEMENT SYSTEM (SMKK)				
Preparation of SMKK Implementation Documents	Lump Sum	1,00	1.500.000,00	1.500.000,00
Socialization, Promotion and Training	Lump Sum	1,00	1.065.000,00	1.065.000,00
Work Protective Equipment and Personal Protective Equipment	Lump Sum	1,00	1.065.000,00	1.065.000,00
Insurance	Lump Sum	1,00	1.110.000,00	1.110.000,00
Construction Safety Personnel	Lump Sum	1,00	3.850.000,00	3.850.000,00
Facilities, Infrastructure, and Medical Equipment	Lump Sum	1,00	3.500.000,00	3.500.000,00
Traffic Signs and Equipment	Lump Sum	1,00	250.000,00	250.000,00
Activities and Equipment related to Construction Safety Risk Control	Lump Sum	1,00	2.525.000,00	2.525.000,00
PEKERJAAN TANAH DAN GEOSINTETIK				
Galian Biasa	m3	6,68	16.752,71	111.908,10
Timbunan Biasa dari Hasil Galian (Termasuk Pemadatan)	m3	16,00	15.726,96	251.631,36
Timbunan Pilihan dari Sumber Galian Menggunakan Peddel (Termasuk Pemadatan)	m3	11,00	205.754,45	2.263.298,95
STRUKTUR				
Bronjong dengan kawat yang dilapisi Galvanis	m3	100,00	864.930,00	86.493.000,00
Beton, fc'15 Mpa	m3	9,24	1.061.669,99	9.809.830,71
1 m² bekisting biasa lantai beton biasa dengan multiflex 12 mm atau 18 mm (TP)	m2	9,28	102.902,93	954.939,19
			Amount	97.257.769,90
			Tax	127.534.608,31
			Total Amount	14.028.806,91
			Rounded	141.563.415,22
			Amount	141.563.400,00

Figure 18. Rehabilitation cost result in on STA 2+000 to 2+020 (gabions)
Source: Processed By Researchers 2025

Where.

(5) = (3) x (4)

Thus, according to the figure 18 the cost of the gabion work at on STA 2+000 to 2+020 is Rp. 141,563,400.00 and the typical of cross-sectional design as in the figure 19.
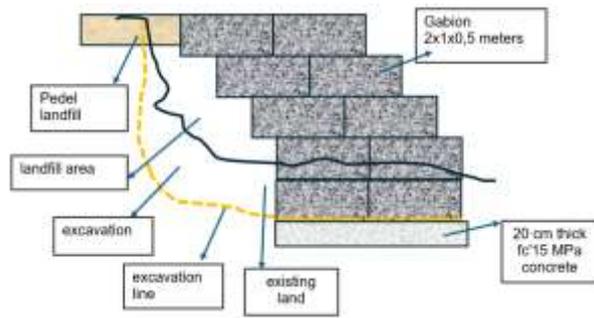
Figure 19. Typical cross-sectional design in STA 2+000 to 2+020 (gabions)
Source: Processed By Researchers 2025

4.5. Discussion of analysis results

The analysis results are discussed as follows.

- The remaining service life of the Sumengko-Bandungrejo Road Section was calculated using the planned CESAL of 2,340,560.98, the actual CESAL in 2027 (when the bioethanol plant is planned to begin construction) of 759,628, and the actual CESAL in 2033 (when the pavement is 10 years old since the road was built) of 1,253,680. Based on each actual CESAL value, the remaining service life of the pavement in 2027 was 67.54% and in 2033 it was 46.34% (less than 50%). The analysis results indicate a decrease in road service life, with the pavement age decreasing by 32.46% in the fourth year, 2027, and by 53.66% in the tenth year, 2033.

- Considering the remaining service life and the damage occurring at points STA 0+750 to 1+900 and STA 2+000 to 2+020, road rehabilitation efforts are necessary. Based on the figure 7, which illustrates the decline in pavement life, it indicates that a pavement experiencing a decline in serviceability or design life can be restored through road rehabilitation. For the pavement which corner breaks damage as shown in figure 20, road rehabilitation was carried out using an asphalt overlay (AC-WC).
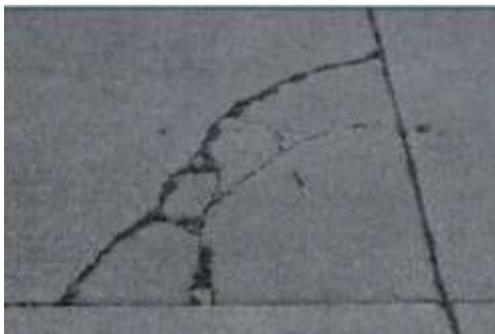
Figure 20. Corner Breaks Damage Sample
Source: Pd 01-2016-B Kementerian PUPR

The STA 0+750 to 1+900 has a length 1150 meters. The thickness design for this section is 8 cm, exceeding the 5 cm thickness of the previously implemented overlay, taking into account the operational loads of project vehicles that will pass through. The 8 cm thickness prevents cracks from rapidly reaching the pavement surface, resulting in a cost estimate of Rp 1,828,617,800.00.

- Damage to STA 2+000 to 2+020 occurred at points where the shoulder subsidence occurred due to landslides. Therefore, a 2.5-meter-high and 20-meter-long gabion structure was planned for this repair, costing Rp 141,563,400.00. the road shoulder existing condition as shown in figure 21.

Figure 21. Shoulder landslides condition STA 2+000 to 2+020
Source: Processed By Researchers 2025

5. CONCLUSION

Upon completion of this research, it is expected to produce the following results:

- The remaining service life of the Sumengko – Bandungrejo Road Section STA 0+000 to 2+770 is calculated using the AASTHO 1993 formula at the time when the bioethanol plant is planned to start the construction phase in 2027 at 67.54% and in 2033 when the pavement reaches 10 years of age since the road was opened at 46.34% (less than 50%).

- The cost of road rehabilitation at STA 0+750 to 1+900 using a single-layer Asphalt Concrete Wearing Course (AC-WC) overlay is Rp. 1,828,617,800.00.

- The cost of road rehabilitation at on STA 2+000 to 2+020 using shoulder embankment management using gabions is Rp. 141,563,400.00.

6. SUGGESTION

The suggestions that can be conveyed are as follows.

- For the remaining services life analysis in subsequent research, if data on deflection tests on rigid pavements is available, it should be used in the remaining design life analysis to obtain a more accurate remaining design life value based on field conditions.
- The analysis of road rehabilitation costs in subsequent studies can be supplemented with calculations of necessary supplementary structures, including retaining walls and gabions, as well as an analysis of the design thickness of the overlay above the rigid pavement.

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