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Evaluation of Structural Condition of Flexible Pavement Using The AASHTO 1993 and The MEPDG 2008 Method (Case Study: Cipatujah-Kalapagenep-Pangandaran National Road)

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Abstract

Flexible pavement on Cipatujah-Kalapagenep-Pangandaran National Road has a structural damage which marked by potholes and cracks on the pavement caused by excessive load trucks, so the pavement needs an overlay to improve the pavement condition. This analysis using AASHTO 1993 and MEPDG 2008 method. These methods used because the MEPDG 2008 was developed from AASHTO 1993 method, so the output will be more economic. But, the MEPDG 2008 has not applied yet in Indonesia, so the method will be studied to determine the method feasibility to be applied in Indonesia. This research was analyzed with two skenarios of CESAL, four trial thicknesses, and three CBR numbers. The overlay thickness value using the AASHTO 1993 was at 10 cm and 11 cm for scenario 1 and 2, while the overlay thickness using the MEPDG 2008 was at 10 cm for the two scenarios. The result from AASHTO 1993 was chosen because the MEPDG 2008 needs to studied further yet about suitable calibration factor for Indonesian pavement condition. The cause of difference result are structural damage assessment for AASHTO 1993 method based on deflection value from FWD while MEPDG 2008 method based on stresses and strains respond, material characteristics, and local calibration.

Keywords: AASHTO 1993, MEPDG 2008, stress and strain response, FWD deflection value, local calibration factors, overlay thickness.

Abstrak

Perkerasan lentur jalan Nasional Cipatujah-Kalapagenep-Pangandaran mengalami kerusakan struktural yang ditandai dengan lubang dan retak pada perkerasan badan jalan yang disebabkan oleh truk pengangkut pasir yang memiliki beban berlebih, sehingga diperlukan penambahan tebal lapis tambah pada perkerasan jalan eksisting untuk mengembalikan kondisi kemantapan jalan. Dalam penelitian ini dilakukan analisis terhadap kondisi struktural perkerasan jalan lentur eksisting menggunakan Metoda AASHTO 1993 dan Metoda MEPDG 2008 dengan pertimbangan bahwa MEPDG 2008 merupakan pengembangan dari AASHTO 1993. Namun, Metoda MEPDG 2008 belum diterapkan di Indonesia, maka perlu dilakukan kajian awal untuk mengetahui kelayakan metoda tersebut diterapkan di Indonesia. Analisis ini menggunakan dua skenario nilai CESAL, empat macam tebal dan tiga macam nilai CBR. Berdasarkan hasil analisis, diperoleh tebal overlay menggunakan metoda AASHTO 1993 sebesar 10 cm dan 11 cm untuk skenario 1 dan 2, sedangkan tebal overlay menggunakan metoda MEPDG 2008 diperoleh tebal overlay sebesar 10 cm untuk kedua skenario. Namun dalam penelitian ini dipilih hasil dari metoda AASHTO 1993 dikarenakan MEPDG 2008 masih memerlukan kajian lanjut terkait faktor kalibrasi berdasarkan kondisi perkerasan di Indonesia. Dari penelitian diketahui faktor yang menyebabkan perbedaan hasil adalah Metoda AASHTO 1993 berdasarkan nilai lendutan FWD, sedangkan MEPDG 2008 berdasarkan respon tegangan dan regangan, karakteristik material, dan kalibrasi lokal.

Kata-kata kunci: AASHTO 1993, MEPDG 2008, respon tegangan dan regangan, nilai defleksi FWD, faktor kalibrasi lokal, ketebalan lapisan.

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Diterima 3 November 2021, Direvisi 27 November 2021, Diterima untuk dipublikasikan 7 Desember 2021

1. Introduction

One area that has a fairly high economic growth is West Java. However, economic growth in West Java occurs unevenly, where the northern and central parts of West Java have faster economic growth than the southern part of West Java.

To equalize economic growth to realize the welfare of the people in the southern part of West Java, improvements were made to the national road in South West Java, namely the Cipatujah-Kalapagenep-Pangandaran-Pangandaran National Road, which suffers structural damage. This structural damage includes damage from pavement components which are marked by potholes and cracks in the pavement. Based on this background, this road rehabilitation activity includes activities to increase the thickness of the asphalt overlay to prevent further damage and restore road stability according to the initial plan.

In this study, an analysis of the structural condition of the existing flexible pavement using the AASHTO 1993 method and the MEPDG 2008 method was conducted. Both methods were chosen in this study with the consideration that the MEPDG method is a development of the AASHTO 1993 method, where the AASHTO 1993 method uses an empirical approach, while the MEPDG 2008 method uses an empirical mechanistic approach, so that the MEPDG 2008 method is expected to produce a more economical output than the AASHTO 1993 method. However, since the MEPDG 2008 method has never been implemented in Indonesia, a preliminary study was conducted to determine whether the method produces more economical output than the AASHTO 1993 method and to determine whether the MEPDG method can be applied in Indonesia.

The initial stage in this road pavement evaluation was the analysis of traffic data obtained from a survey in the field, to predict the repetition of traffic loads that cross the analyzed pavement. The next was the analysis of deflection data from the Falling Weight Deflectometer (FWD) test for structural evaluation using the AASHTO 1993 Method. Then, the stress-strain response was calculated using the KENPAVE program and the testing of material characteristics for structural evaluation was conducted using the MEPDG 2008 Method. After analyzing using the two methods, the next step was to choose the most economical overlay thickness and explain the factors that influence the difference in the results.

2. Literature Review

2.1 Flexible pavement structure

The structure of a road pavement is a mixture of aggregate and binder placed on a subgrade with a certain compaction that function to serve traffic loads. The existence of this road pavement structure aims to reduce strain or pressure due to wheel loads so as to reach a level of value that can be accepted by the ground that supports the load. Aggregate mixed with asphalt as a binder is called flexible pavement construction. This is because the function of this flexible layer is to carry and distribute traffic loads from the surface to the subgrade. The flexible pavement structure has a pavement structure or layer that has their respective roles.

a. Subgrade
b. Subbase
c. Base
d. Subbase

2.2 Criteria for damage to flexible pavement

The causes of damage to a road segment are various, including:

a. The road pavement receives a traffic load that exceeds the design traffic load.
b. Subgrade conditions are not good.
c. Poorly treated pavement structure material.
d. Asphalt content in a mixture that does not match the design asphalt content.
e. Poor drainage.

The types of flexible pavement damage that occur include:

a. Deformation, where the surface experiences depression or change in the road surface.
b. Cracks in the pavement due to the tensile strain in the asphalt exceeding the maximum tensile strain.
c. Raveling, polished aggregate, stripping.
d. Potholes in the pavement.
e. Lane/Shoulder drop-off.

2.3 Falling weight deflectometer (FWD)

Falling Weight Deflectometer (FWD) is one of the tools used to evaluate the strength of the structure without damaging the pavement structure. This tool is the result of a modification of the previous tool where this tool uses a computerized system. This tool has a working principle of impulse loading which gives an effect like the wheel load of a vehicle so as to produce a deflection on the pavement. The magnitude of the deflection that occurs is recorded using 9 (nine) deflectors mounted at a certain distance on the measuring rod so that the deflection would form a deflection bowl. The greatest deflection is at the bottom of the load.

2.4 Calculation of pavement stress and strain response using the KENPAVE program

KENPAVE Program is a software to analyze or deisgn pavement structure by calculating the stress and strain that occur in the subbase to the subgrade of the pavement. The stress and strain values become one of the inputs in calculating load repetitions until the final result obtained is the thickness requirement of the pavement layer.

Diterima 3 November 2021, Direvisi 27 November 2021, Diterima untuk dipublikasikan 7 Desember 2021

2.5 Asphalt overlay thickness analysis using AASHTO 1993 method

American Association of State Highway and Transportation Officials (AASHTO) guide for design of pavement structure 1993, widely known as AASHTO 1993, is a design method based on empirical methods that are often used for pavement thickness design throughout the world and is the adoption of design standards in various countries. The empirical method is an approach based on test results to establish correlations between inputs and outputs, such as the correlation between pavement design and pavement performance. This method uses the concept of back calculation to get the value of the overlay thickness.
The parameters needed in the analysis are as follows:

a. Design traffic loads
b. Deflection data from FWD test

2.6 Asphalt overlay thickness analysis using MEPDG 2008

Mechanistic-Empirical Design Guide (MEPDG), known as 2002 AASHTO Design Guide presented by the United States. MEPDG was formed by the National Cooperative Highway Research Program (NHRCP) under the auspices of the American Association of State Highway and Transportation Officials (AASHTO). This method is a further development of the AASHTO 1993 method, where the approach used is a mechanistic-empirical approach. The mechanistic-empirical approach is an approach that involves calculating the response of stress, strain, and deflection which then predicts the performance of the structure in the future. This design guide represents innovations in pavement design that have been conducted so far. The inputs used in this method include:

a. Traffic analysis.
b. Material characteristics.
c. Local calibration factors.
d. Temperature or climate factors.
e. Input data accuracy level.
f. Type of road damage that occurs.

3. Research Methodology

The method used in this study is an analytical method with an empirical and mechanistic-empirical approach. Data collection is secondary data obtained from PUSJATAN. The steps of this study can be seen from the flow chart in **Figure 1**.

4. Data Presentation and Analysis

4.1 General

The case study in this research is the Cipatujah-Kalapagenep-Pangandaran National Road section from Sta 180+100 to 211+000. The total length of this road is 50.22 km with the 2/2 TT road type, the width of the pavement is 7.00 m, and the width of the road shoulder is 1.00 m. The data used, such as traffic volume, existing pavement conditions, and deflection value are secondary data obtained from PUSJATAN. Then, the parameters

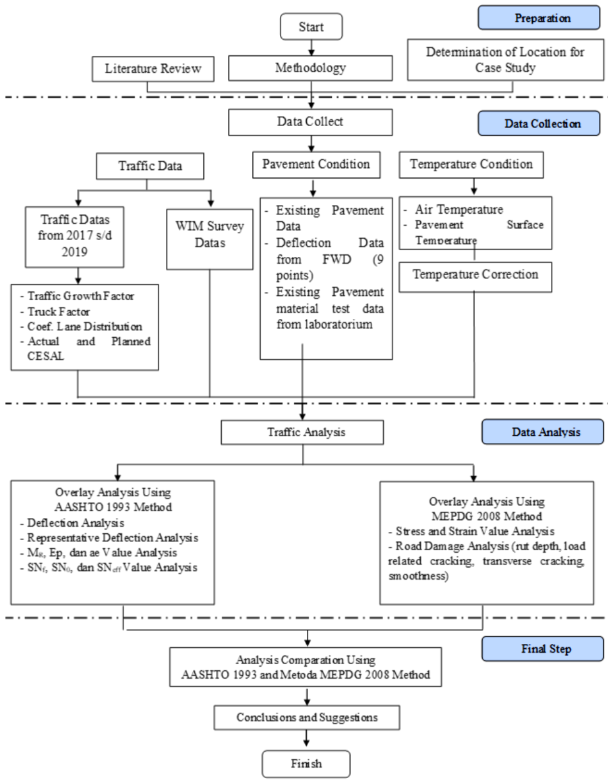

Figure 1. Study flowchart

that are the results of tests in the laboratory were taken from the previous results of tests in the laboratory as assumptions for this calculation.

4.2 Traffic data volume

The traffic data obtained is the traffic volume in 2016-2019, which would later be used to perform Cumulative Equivalent Single Axle Load (CESAL) analysis and calculate the overlay thickness.

4.3 Vehicle damage factor (VDF) value data

Vehicle Damage Factor (VDF) value is the output obtained from a survey conducted by the Directorate General of Highways using the Weight in Motion (WIM) tool. To get the output in the form of this VDF value, the Directorate General of Highways conducted a survey of the vehicle axle load in the field to find out the load carried by the vehicle experiencing overload which has an impact on the amount of deflection experienced by the road pavement. This data was only circulated in 2020 in the Circular Letter of the Directorate General of Highways. This VDF value was grouped based on each region in Indonesia. Since the research location was in the South Coast of West Java (PANSELA), the VDF value in the West Java (Central Highway/Route) area was chosen which was considered the closest to the road segment. The VDF value for the West Java (Central Highway/Route) region can be seen in **Table 1.**

4.4 Road pavement condition data

This pavement condition data is secondary data obtained from the West Java PUSJATAN which conducted a

Diterima 3 November 2021, Direvisi 27 November 2021, Diterima untuk dipublikasikan 7 Desember 2021

Table 1. VDF value

Condition	Group 5B	Group 6A	Group 6B	Group 7A1	Group 7A2	Group 7B1	Group 7B2	Group 7C1	Group 7C2A	Group 7C2B	Group 7C3
Factual	1.2	0.5	4.6	-	5.8	-	-	4.6	2.6	4.2	4.4
Actual	1.2	0.5	2.1	-	3.1	-	-	2.7	1.8	2.8	3.0

Source: SE Suplemen MDP, 2017

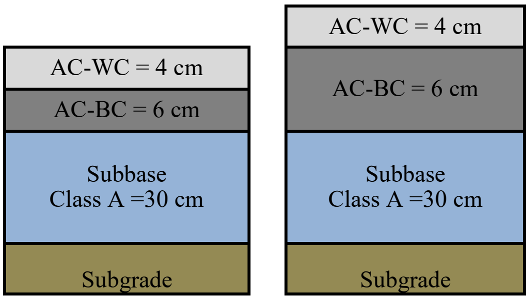

Figure 2. Existing pavement layer and overlay pavement modeling

Table 2. Calibration factors

Road Damage	Cakibration Coefficients	Global Calibration	Oregon
Cracking	C1 Bottom	1	0.56
	C1 Top	7	1.45
	C2 Bottom	1	0.23
	C2 Top	3.5	0.10
	C3 Bottom	6000	6000
	C3 Top	0	0
	C4 Top	1000	1000
Fatigue	BF1	1	1
	BF2	1	1
	BF3	1	1
Thermal Fracture	Level 3	1.5	1.5
Rutting	BR1	1	1.48
	BR2	1	1
	BR3	1	0.90
Rutting Subgrade	BS1 (granular)	1	1
IRI	J1 (asphalt)	40	40
	J2 (asphalt)	0.4	0.4
	J3 (asphalt)	0.008	0.008
	J4 (asphalt)	0.015	0.015

survey in 2018. The pavement condition data obtained is in the form of an As Built Drawing document which provides information on the type of pavement used, the thickness of the existing pavement layer, the thickness of the subbase, and the type of drainage used. Since the CBR value of the subgrade was unknown, a trial on the CBR value was conducted 3 (three) times. The selected CBR values are 6%, 10%, and 20%

4.5 Local calibration factor data

The global calibration factor is a predictive model that has been calibrated using a data set that covers the entire United States of America, while the local calibration factor is a more specific calibration factor where adjustments are made to climatic conditions in each state in America. Since the local calibration factor is obtained from the states in America, it is necessary to first select the state that will be used as the basis for inputting local calibration. In this analysis, the state of Oregon, America was selected.

4.6 Traffic growth factor calculation

The traffic growth factor is obtained from the growth in traffic volume that occur during the number of years under review. Based on the results of the calculation of traffic volume growth in 2016-2019, it can be determined the value of the traffic growth factor is in accordance with the increase in volume that occurred each year.

Based on the graph, the traffic growth factor cannot be used because the resulting value is too high so that the growth factor used in this analysis refers to the Central Statistics Agency (BPS) for 2015-2019, which is 6.13% for the South Coast area (PANSELA).

4.7 Cumulative equivalent single axle load (CESAL) calculation

The CESAL calculation was conducted using 2 (two) scenarios. Scenario 1 (one), where in 2020 traffic is considered uncontrolled (factual), but after 2020,

Table 3. Traffic growth factor

Traffic Growth Factor			
Year	Vehicles Volume		%
2016	7918	0	0
2017	18246	10328	130.4
2018	8833	9413	51.6
2019	11159	2326	26.3
			69

namely in 2021-2031 traffic is considered to be under control (normal). While scenario 2 (two), due to the 2020-2021 Covid-19 pandemic, the traffic condition in the field is out of control, so that in 2020-2025 traffic is considered uncontrolled (factual). After 2025, namely the years 2026-2031, the traffic condition in the field is considered to be more controlled (normal). Based on the results of the calculations, the actual CESAL value in 2021 for scenario 1 is 7,566,061 and scenario 2 is 13,238,567. Then, for the CESAL value in the 2032 plan year, the actual CESAL values in 2021 were obtained for scenario 1 of 16,208,484 and scenario 2 of 23,643,398.

4.8 Analysis of deflection data and representative deflection

From the uniformity process that was conducted, the maximum uniformity factor obtained was 29.99% which indicates that the uniformity factor in each segment is quite good, which can be seen in **Table 4.**

Diterima 3 November 2021, Direvisi 27 November 2021, Diterima untuk dipublikasikan 7 Desember 2021

Furthermore, from the analysis of the representative deflection, the deflection data d1 at the load center was selected as the representative deflection that has gone through the segmentation process. This representative deflection value was then multiplied by the Temperature Adjustment Factor (TAF) obtained from the plot results on the graph of the relationship between TAF and the asphalt mixing temperature which can be seen in **Table 5.**

4.9 Analysis of asphalt overlay thickness using AASHTO 1993 method

This step includes an overlay analysis that refers to the AASHTO 1993 method. In this method, the steps conducted after the traffic data analysis were calculating the value of the Resilient Modulus (MR), the Effective Modulus of all pavement layers above the subgrade (Ep), and the value of ae to obtain the required overlay thickness. These values are based on the type of material used in the existing pavement.

Next was the calculation of the structural capacity (SN). From the calculations that have been conducted, the CBR value affects the value of the structural capacity of component analysis (SN_{eff-2}) using a pavement layer (a) and a drainage system (m). However, in this calculation the minimum SN value is chosen, where the minimum SN value obtained is the SN_{eff} value based on the deflection test using FWD (SN_{eff-1}). So that in this calculation, the CBR value is not so influential because it still produces an SN value that is greater than the SN value based on the deflection test. Calculation of structural capacity (SN) can be seen in **Table 6** and **Table 7.**

From the calculation conducted, the required overlay thickness can be seen in **Table 8** and **Table 9**.

To facilitate implementation in the field, the selected overlay thickness is the maximum overlay thickness, which is 10 cm for scenario 1 and 11 cm for scenario 2.

4.10 Analysis of asphalt overlay thickness using MEPDG 2008 method

In the overlay analysis using the MEPDG 2008 method, the values of stress and strain at the surface course to the subgrade are required, so the stress and strain values are obtained from the analysis of the KENPAVE program. The calculation of the stress and strain response using the KENINP and KENLAYER programs was conducted with 4 (four) trial thickness variations, namely 5 cm, 8 cm, 10 cm, and 15 cm and 3 variations of the CBR value 3, namely 6%, 10%, and 20%. Then,

Table 4. Uniformity factor

Segment	FK %	Category
2+200 - 2+300	0.299	FAIR
4+700 - 4+800	0.287	FAIR
4+800 - 4+900	0.285	FAIR
9+700 - 9+800	0.284	FAIR
11+600 - 11+700	0.299	FAIR
12+000 - 12+100	0.277	FAIR

Table 5. Representative deflection values

Segment	D1 Representative (inch)	TAF (Graph)	D1 Rep. xTAF (inch)
2+200 - 2+300	0.0052	0.81	0.0042
4+700 - 4+800	0.0092	0.71	0.0065
4+800 - 4+900	0.0095	0.88	0.0084
9+700 - 9+800	0.0142	0.88	0.0125
11+600 - 11+700	0.0094	0.72	0.0067
12+000 - 12+100	0.0092	0.81	0.0074

Table 6 and 7. Recapitulation of SN and SN_{eff} values for scenario 1 and scenario 2

Scenario 1					Scenario 2				
Station	SNf	SN0	SNeff-1	SNeff-min	Station	SNf	SN0	SNeff-1	SNeff-min
2+200 - 2+300	4.048	3.823	2.608	2.608	2+200 - 2+300	4.048	3.823	2.608	2.608
4+700 - 4+800	3.734	3.542	1.954	1.954	4+700 - 4+800	3.734	3.542	1.954	1.954
4+800 - 4+900	3.833	3.630	2.087	2.087	4+800 - 4+900	3.833	3.630	2.087	2.087
9+700 - 9+800	4.284	4.036	3.139	3.139	9+700 - 9+800	4.284	4.036	3.139	3.139
11+600 - 11+700	3.951	3.736	2.221	2.221	11+600 - 11+700	3.951	3.736	2.221	2.221
12+000 - 12+100	3.734	3.542	1.954	1.954	12+000 - 12+100	3.734	3.542	1.954	1.954

Table 8 and 9. Recapitulation of required overlay thickness for scenario 1 and scenario 2

Station	SNf - SNeff min	Overlay Needs	Dol (cm)	Station	SNf - SNeff min	Overlay Needs	Dol (cm)
2+200 - 2+300	1.293	OVERLAY NEEDED	8	2+200 - 2+300	1.439	OVERLAY NEEDED	9
4+700 - 4+800	1.646	OVERLAY NEEDED	10	4+700 - 4+800	1.781	OVERLAY NEEDED	11
4+800 - 4+900	1.614	OVERLAY NEEDED	10	4+800 - 4+900	1.746	OVERLAY NEEDED	11
9+700 - 9+800	0.984	OVERLAY NEEDED	6	9+700 - 9+800	1.145	OVERLAY NEEDED	7
11+600 - 11+700	1.589	OVERLAY NEEDED	10	11+600 - 11+700	1.730	OVERLAY NEEDED	11
12+000 - 12+100	1.646	OVERLAY NEEDED	10	12+000 - 12+100	1.781	OVERLAY NEEDED	11

Diterima 3 November 2021, Direvisi 27 November 2021, Diterima untuk dipublikasikan 7 Desember 2021

Table 10. Recapitulation of thickness performance criteria of scenario 1 with variations in CBR value

Performance Criteria	Max Value At The End of Life Design	Using CBR 6% Value	Using CBR 10% Value	Using CBR 20% Value
		10 cm	8 cm	8 cm
Alligator cracking (bottom up cracking)	25.00%	4.35	4.17	3.50
Longitudinal cracking (top down cracking)	378.00 m/km	25.75	25.69	25.03
Total Cracking (Reflective + Alligator)	15.00%	5.17	9.39	8.73
Rut depth (Permanent deformation jalur roda)	12.70mm	8.21	12.06	9.18
Permanent deformation- total pavement (mm)	19.00mm	9.94	13.82	9.63
Transverse cracking length (thermal cracks)	132.57m/km	-0.14	-0.12	-0.12
IRI (smoothness)	3.10m/km	2.95	2.97	2.94

Table 11. Recapitulation of thickness performance criteria of scenario 2 with variations in CBR value

Performance Criteria	Max Value At The End of Life Design	Using CBR 6% Value	Using CBR 10% Value	Using CBR 20% Value
		10 cm	10 cm	8 cm
Alligator cracking (bottom up cracking)	25.00%	4.75	4.14	3.83
Longitudinal cracking (top down cracking)	378.00 m/km	26.10	25.55	25.37
Total Cracking (Reflective + Alligator)	15.00%	5.57	4.96	9.05
Rut depth (Permanent deformation jalur roda)	12.70mm	9.84	7.76	10.99
Permanent deformation- total pavement (mm)	19.00mm	11.92	9.66	11.54
Transverse cracking length (thermal cracks)	132.57m/km	-0.14	-0.14	-0.12
IRI (smoothness)	3.10m/km	2.96	2.95	2.96

note that in the analysis using the MEPDG method, the repetition value of the axle load is assumed to be the same as the CESAL value. The next stage was to analyze the road damage that occurred on the pavement under review. The analyzed road damage includes:

a. Permanent Deformation
b. Alligator Crack and Longitudinal Crack
c. Transverse Crack
d. Reflective Crack
e. IRI

After all types of road damage were calculated, the next step was to determine the overlay thickness. The selection of overlay thickness was based on the performance criteria determined by MEPDG 2008, so that the overlay thickness that could be used was the one that met all these requirements. The performance criteria for the analyzed overlay thickness can be seen in **Table 10** and **Table 11.**

From the recapitulation of the calculations above, it shows that the trial thickness that meets all the performance criteria applied by MEPDG 2008 varies. The variation of overlay thickness that meets the performance criteria is influenced by the CBR value of the subgrade. The larger the CBR value used, the smaller the stress and strain that occur in the surface course to the subgrade and the smaller the required overlay thickness. In addition, the overlay thickness is also influenced by the local calibration factor of the selected US state.

4.11 Comparison of analysis using AASHTO 1993 method and MEPDG 2008 method

After the overlay thickness from each method was obtained, the next step was to compare the overlay thickness to select the most economical thickness and explain the factors that influence the difference. The comparison of overlay thickness using both methods can be seen in **Figure 3** and **Figure 4**.

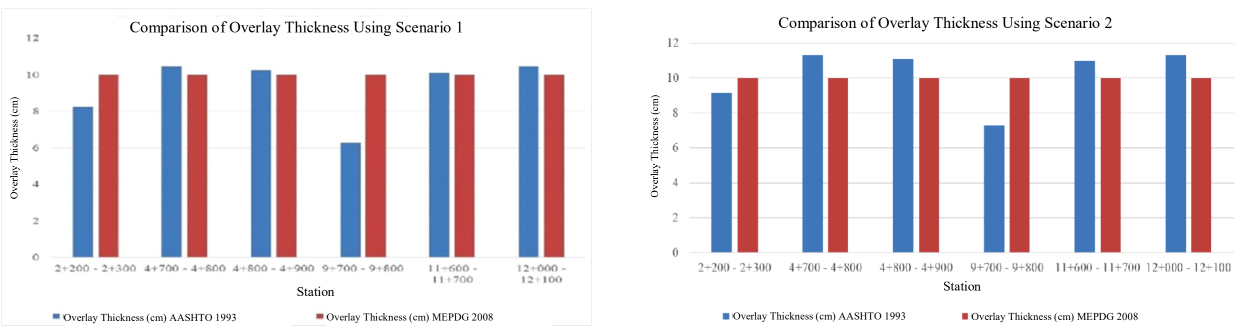

Figure 3 dan 4. Comparison of overlay thickness for scenario 1 and scenario 2

Diterima 3 November 2021, Direvisi 27 November 2021, Diterima untuk dipublikasikan 7 Desember 2021

Based on the results of the analysis using the AASHTO 1993 and MEPDG 2008 methods that have been conducted, the final results of the overlay thickness are not much different. The overlay thickness results using the AASHTO 1993 method have varying overlay values, with the maximum thickness produced in scenario 1 being 10 cm and scenario 2 being 11 cm, while the overlay thickness using the MEPDG method is 10cm for both scenarios. From these results, it can be concluded that the overlay thickness analyzed using the MEPDG 2008 method is more economical than the overlay thickness using the AASHTO 1993 method, with a note that the local calibration factor from Oregon is assumed to represent the pavement conditions in Indonesia.

However, because further studies have not been developed on the MEPDG method, the calculation still uses many initial assumptions and uses local calibration factors from the United States, so that the resulting overlay design does not represent the real conditions in the field and in this study the overlay thickness was selected using the AASHTO 1993 method.

5. Conclusions and Recommendations

5.1 Conclusions

Based on the data analysis that has been conducted, the following conclusions are drawn:

1. From the analysis conducted using the AASHTO 1993 and MEPDG 2008 methods, the more economical overlay thickness is the one using the MEPDG 2008 method, which is 10 cm for both the CESAL 1 scenario and the CESAL 2 scenario. MEPDG method is considered more economical with the assumption that the calibration factor of the state of Oregon can represent pavement conditions in Indonesia.
2. The overlay thickness produced by the two methods used is influenced by different factors. The overlay thickness analyzed using the AASHTO 1993 method is influenced by deflection, while the overlay thickness analyzed using the MEPDG 2008 method is influenced by stress and strain that occurs in the surface course to the subgrade and by local calibration factors from the state of Oregon.
3. The local calibration factor from the state of Oregon is assumed to represent the pavement conditions in Indonesia, this is indicated by the resulting overlay thickness being not much different from the overlay thickness from the analysis using the AASHTO 1993 method, but it is advisable to conduct further studies on the calibration factor so that the MEPDG 2008 method can be applied in Indonesia and become a more innovative method.
4. The overlay thickness analysis method that can be applied at this time is AASHTO 1993 because the local calibration factor used in the MEPDG 2008 method is still a calibration factor from the states in America, so the resulting value is not very representative of real conditions in Indonesia.

5.2 Recommendations

Based on the results of this study, it is recommended that:

1. It is better to do the deflection test again using the FWD tool, because the deflection data obtained at this time is the deflection data for 2018.
2. It is recommended that for further studies, the repetitive load value used in the MEPDG 2008 method uses a traffic load spectrum.
3. It is recommended to conduct further studies on the MEPDG Method so that it can become a new guide that is more innovative and can be applied to road pavement conditions in Indonesia. One of the important parameters to be studied is the local calibration factor, so that Indonesia has a calibration factor that is in accordance with the pavement conditions in Indonesia.
4. It is also recommended to conduct further studies on the MEPDG program, namely AASHTOWARE, so that the analysis can be more efficient, because the analysis conducted this time only focuses on empirical and mechanistic-empirical equations.

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