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ANALYSIS OF DAMAGE CHARACTERISTICS OF URBAN ROAD ASPHALT PAVEMENTS USING THE BINA MARGA AND ASPHALT INSTITUTE MS-17 METHODS

(Study Case: Serang - Pandeglang Highway, Serang City - Banten)

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ABSTRACT

The Serang-Pandeglang Highway is a national road which has a width of 12 meters and is divided into 2 directions, most of the area being residential areas, educational institutions, offices and there are also factories and several construction projects which cause the road to experience damage due to excessive loads. The Bina Marga method and the Asphalt Institute MS-17 method are ways of assessing road conditions visually. The two methods are quite different in assessing road conditions, both from surveys and analysis to obtain road condition figures. The aim of this research is to analyze the damage characteristics of the Serang-Pandeglang highway using the Bina Marga method and the Asphalt Institute MS-17 method. The results of the survey and analysis of the primary data obtained showed that on the Jalan Raya Serang - Pandeglang section there were 7 types of damage, namely patches, loose granules, longitudinal cracks, crocodile skin cracks, sinking, holes and falling. The largest area of damage was a patch with an area of 116.16 m2 and the smallest was a sungkur with an area of 1.02 m2. The value obtained using the Bina Marga method produces a Priority Order (UP) value of 10.928 with the road handling program category, namely routine maintenance, and using the Asphalt Institute MS-17 method produces a Condition Value of 98.40 with the road handling program category, namely routine maintenance type.

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1. INTRODUCTION

The Serang-Pandeglang Highway is one of the national roads in the Serang - Banten City area. This road connects two regions, namely Pandeglang Regency and Serang Regency. The road is 12 meters

wide and divided into 2 directions, covering most of the area for residential areas, educational institutions and offices. However, there are also factories in the area, so the Serang-Pandeglang highway is often passed by heavily laden vehicles, which is partly due to several construction projects which have caused the road to be damaged due to excessive loads.[1] The need for handling measures such as surveys and analysis of road damage is very necessary to obtain data on field conditions, which later can be used as material for optimizing road damage recovery.[2] The method that will be used to obtain field data is the Bina Marga and Asphalt Institute MS-17 method.[7] This method is commonly used in Indonesia and other countries to produce road priority values and Pavement Condition Rating (PCR). Roads that have priority order values and condition values (PCR), the larger the number indicates the road is in optimal or good condition.[3] The aim of this research is to analyze the damage characteristics of urban road flexible pavement using the Bina Marga method [4] and the Asphalt Institute MS-17 method [5].

2. METHODS

2.1. Techniques and Data Collection

The Bina Marga method and the Asphalt Institute MS-17 method are ways of assessing road conditions visually. The two methods are quite different in assessing road conditions, both from surveys and analysis to obtain road condition figures. [14] The data collected and used are primary data, secondary data and literature.

Table 1 Requirements for Primary Data and Secondary Data

No	Data Type	Data Source
1	Road Location Map	PUPR Department
2	Road Geometric	PUPR Department
3	Type and Level of Road Damage	Field observation
4	Object Documentation	Field observation
5	LHR/Traffic Volume	Field observation

Source: Researcher Analysis

2.2. Data Analysis

Analyzing and discussing is carried out after some or all of the required data has been obtained. The data that has been obtained is then processed to obtain results according to the planning and assessment methods used. [15] When analyzing data, it is necessary to pay attention to the source and clarity of the data obtained so that research results can be appropriate and accountable.

2.3. Research Procedure

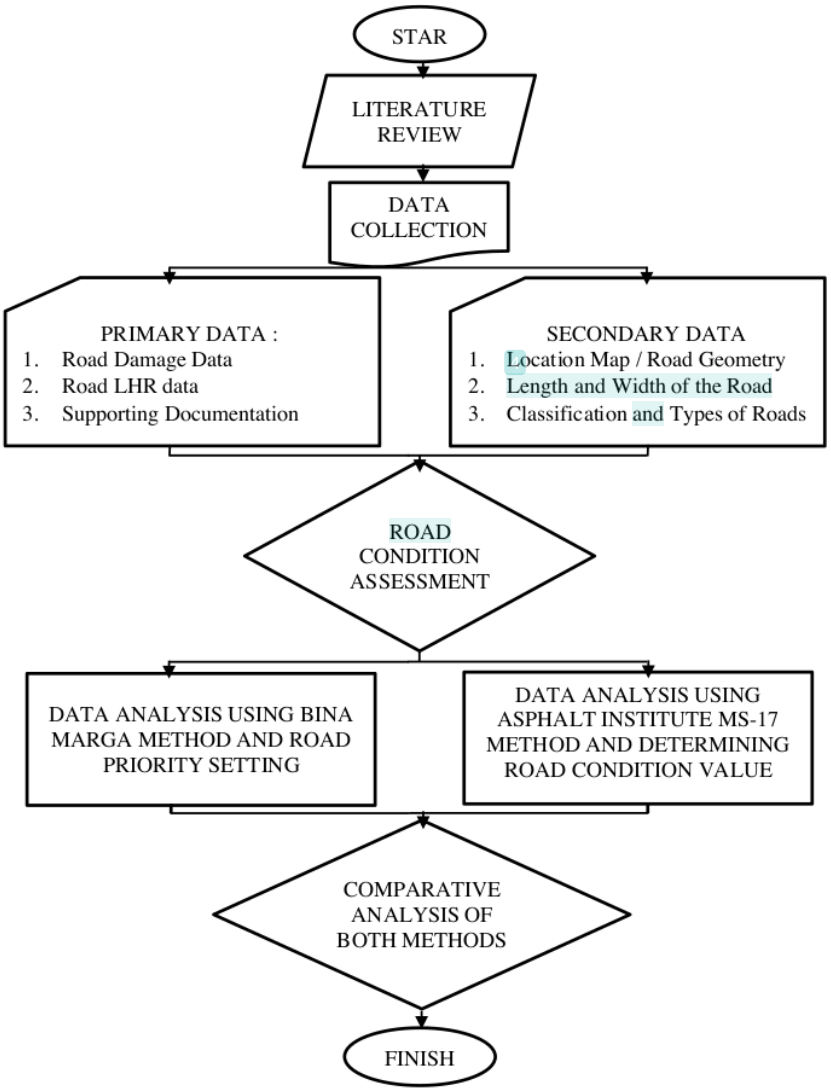

Figure 1 Research Flow Diagram
Source: Researcher Analysis

3. RESULTS AND DISCUSSION

3.1 Road Characteristics

The location of this research was carried out on the Serang-Pandeglang Highway section in Serang City. Based on PUPR Ministerial Decree No. 248/KTPS/M/2015 road authority is a National Road with road status as Primary Collector.

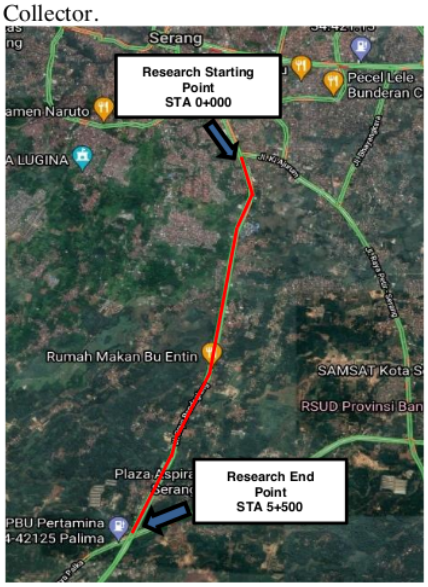

Figure 2 Research Location
Source: Google Earth, 2023

3.2 Research Results

In this research, using the Bina Marga method, the types of damage reviewed are cracks, grooves, patches and holes, and subsidence.[8] The roughness/unevenness of the surface (Roughness) was not carried out because the knowledge and tools were inadequate. Meanwhile, in the Asphalt Institute MS-17 method, the types of damage reviewed are cracks, grooves, curls, loose granules, sags, holes, excess asphalt and slippery aggregate.[10]

Based on the results of the road assessment, it was found that 7 types of road damage had occurred, so the Serang-Pandeglang Highway had the following types of damage, from the largest to the smallest, namely:

a. Patching, with an area of 116.16 m2
b. Alligator Crack, with an area of 65.45 m2
c. Raveling, with an area of 39.00 m2
d. Longitudinal Crack, with an area of 13.37 m2
e. Sink, with an area of 3.17 m2
f. Hole, with an area of 1.35 m2
g. Shoving, with an area of 1.02 m2

3.3 Data Analysis

a. Analysis of Average Daily Traffic Data (LHR)

In this Bina Marga (BM) method, all traffic flow values are converted into passenger car units (pcu) using passenger car equivalents (emp) which are derived empirically for vehicle types.[12] The results of the observations made are as follows:

Table 2 Vehicle Emp Value

Type Vehicle	Emp Value	Volume Traffic	Traffic Volume (smp)
Light Vehicles	1 smp	2106	2106
Medium Vehicle	1,3 smp	73	94,9

Type Vehicle	Emp Value	Volume Traffic	Traffic Volume (smp)
Heavy Vehicle	1,3 smp	17	22,1
Motorcycle	0,5 smp	2194	1097
Total		**4390**	**3320**

Source: Researcher Analysis

b. Data Analysis using the Bina Marga Method

An example of a visual observation assessment using the Bina Marga method carried out on segment 49 of Jalan Raya Serang-Pandeglang is as follows:

Based on the assessment in Table 3.3, an assessment is carried out on each type of damage and dimension of damage which will have its own value. As an illustration of the assessment according to Table 3.3, namely the type of crocodile crack damage will have a value of 5, then the crack width of the crocodile crack if the width is more than 2 mm will get a value of 3 and the percentage of damage area to segment area if <10% will get a value of 1, so that if added up the value is 9 with an average damage value of 3. If all types of damage have been assessed in each segment then the total damage value for each segment is obtained and will be converted into a condition value according to the total damage value as in Table 5.4 in segment 49 to get a value total 7.00 then you will get a condition value of 3 from the conversion of numbers 7 – 9.

Condition Assesment	
Number	Mark
26 – 29	9
22 – 25	8
19 – 21	7
16 – 18	6
13 – 15	5
10 – 12	4
7 – 9	3
4 – 6	2
0 – 3	1
Cracked	
Type	Number
a. Ther Isn't Any	1
b. Longitudinal	2
c. Transverse	3
d. Random	4
e. Aligator	5
Wide	
a. Ther Isn't Any	0
b. <1 mm	1
c. 1 – 2 mm	2
d. >2 mm	3
Amount of Damage	
Area	Number
a. 0	0
b. <10%	1
c. 10 – 30%	2
d. >30%	3

Figure 3 Example of Bina Marga Assessment Method
Source: Researcher's analysis

Table 3 Road Condition Assessment Method for Bina Marga Segment 49 (Stationing 4+800 to 4+900)

STA		4 ± 800 s/d 4 ± 900		
Damage Type	**Influence Factors**	**Size**	**Damage Figures**	**Average Damage Rate**
Cracked	Crocodile Crack	-	5	3,00
	Wide	>2 mm	3	
	Area	<10 %	1	
	Longitudinal Crack	-	2	2,00
	Wide	>2 mm	3	
	Area	<10%	1	
Channel	Depth			
Patches and Holes	Area	<10%	0	0
Surface Roughness				
Sink	Depth	2 – 5 / 100m	2	2
Total Damage Value				**7,00**

Source: Researcher's analysis

From the road condition assessment calculations, the average road condition value is the total condition value divided by the number of segments, so we get $\frac{59}{55} = 1{,}072$.

The assessment of the priority order of road handling regarding the condition of damage on the Serang – Pandeglang road is calculated using the formula:

Priority Order = 17 – (LHR Class + Road Condition Value)

So :

Order of Priority = 17 – (5 + 1.072)

= 10.928

The calculation results above show that the Serang – Pandeglang highway received a priority order value of 10.928. Based on Government Regulation no. 34 of 2006 concerning Roads for a priority order > 7 is a class A priority order, where roads in this priority order are included in the routine maintenance type road handling program.

c. Data Analysis using the Asphalt Institute MS-17 Method

Example of visual observation assessment using the Asphalt Institute MS-17 method:

Assessment using this method is generally more subjective because it depends on the assessing personnel. Where damage that is less serious in its consequences for the pavement is given a value of 0 – 5 and damage that is more serious in nature which directly affects the strength of the pavement is given a value of 5 – 10.

Table 4 Asphalt Institute MS-17 Segment 49 Road Condition Assessment Method (Stationing 4+800 to 4+900)

STA	4 ± 800 s/d 4 ± 900	
Damage	**Value Range**	**Value**
Transverse crack	0 – 5	
Longitudinal crack	0 – 5	5
Cracked crocodile skin	0 – 10	8
Shrinkage cracks	0 – 5	
Channel	0 – 10	
Curly	0 – 5	
Ravelling	0 – 5	
Shoving	0 – 10	
Pothole	0 – 10	7
Excess Asphalt	0 – 10	
Smooth Aggregate	0 – 5	
Poor drainage	0 – 10	
Quality Driving Comfort	0 – 10	

STA Damage	4 ± 800 s/d 4 ± 900 Value Range	Value
(0 is very good and 10 is very bad)		
Total damage value (X)	20	
Condition value (100 - Total damage value)	**80**	

Source: Researcher's analysis

From the road condition assessment calculation, the average road condition value is the total condition value divided by the number of segments, so we get $\frac{5,412}{55} = 98,40$

Interpretation of condition values for road handling on the Serang – Pandeglang road can be shown in the maintenance type indicator.[13] The calculation results show that the Serang - Pandeglang highway has a condition value of 98.40, where roads with this value are included in the routine maintenance type road handling program.

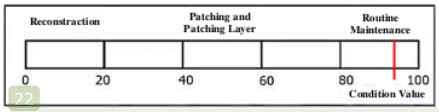

Figure 4 Condition Value as an Indicator of Maintenance Type
Source: Researcher's analysis

3.4 Discussion

a. Damage to the Serang-Pandeglang Highway

Damage to the Serang – Pandeglang highway, based on a road assessment survey, found 7 types of damage out of 13 types of damage in 2 (two) road damage assessment methods. The highest damage area was the patch damage type which had a total area of 116.16 m2 and the lowest was the fall damage type of 1.02 m2. In the community development method, the largest type of damage is a patch of 116.16 m2 and the smallest type of damage is a hole of 1.35 m2. In the Asphalt Institute MS-17 method, the largest type of damage is loose granules of 39.00 m2 and the smallest type of damage is falling of 1.02 m2.

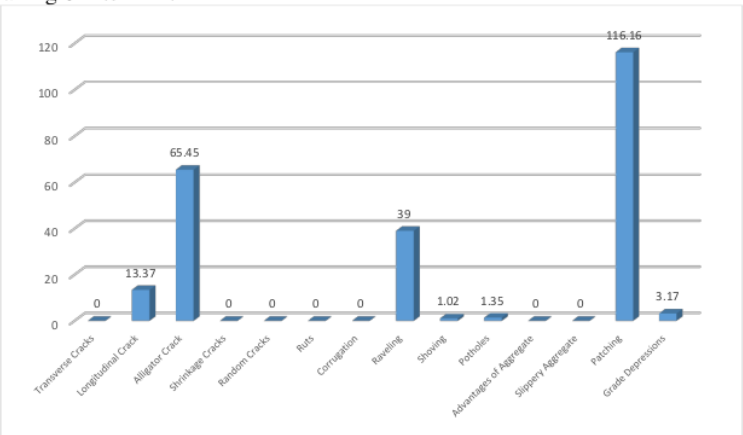

Figure 5 Diagram of the extent of damage in both methods
Source: Researcher's analysis

b. Comparison of Data Analysis Results of the Bina Marga Method and the Asphalt Institute MS-17 Method

1. Highway Development Method
   a) In the Bina Marga method, there are 6 types of damage that occur on the Jalan Raya Serang - Pandeglang section, namely, crocodile skin cracks, longitudinal cracks, loose grains, patches, holes and collapse.
   b) The assessment of road conditions is obtained based on the provisions of the requirements that have been formulated in the method, so that the value obtained is in accordance with the assessment method used.
   c) The data used is data on the length, width and extent of each type of damage reviewed as well as daily traffic volume data.
   d) Data analysis procedures using the Bina Marga method, namely: -
   e) From the data obtained, the road condition value and LHR class value can be determined.
      1) Determining the priority order using the formula:
         Priority Order = 17- (LHR Class+Road Condition Value).
      2) Determining the type of maintenance for damage based on priority order.
   f) The results of the analysis of the Serang-Pandeglang highway obtained a priority order of 10,928 (priority order > 7) which is included in priority order A where this road needs a routine maintenance program.

2. Asphalt Institute Method MS-17
   a) In the Asphalt Institute MS-17 method, there are 5 types of damage that occur on the Jalan Raya Serang - Pandeglang section, namely, crocodile skin cracks, longitudinal cracks, loose granules, holes, and falls.
   b) The assessment of road conditions is based on the researcher's subjectivity, so that the value obtained is only based on the assessor's suitability for the existing damage.
   c) The data used is data on the length, width and area of each type of damage being reviewed.
   d) Data analysis procedures using the Asphalt Institute MS-17 method, namely:
      1) From the data obtained, the value of the road condition can be determined.
      2) Determining the type of maintenance for damage based on condition value interpretation indicators.
   e) The results of the analysis of the Serang-Pandeglang highway showed a maintenance indicator value of 98.40, which was included in the routine maintenance program.

c. Disadvantages and Advantages of the Bina Marga Method and the Asphalt Institute MS-17 Method

1. In the Bina Merga method, there are 12 types of damage that can be reviewed, consisting of longitudinal cracks, transverse cracks, random cracks, alligator cracks, grooves, patches and holes, fatty, roughnes, grain release, disintegration, and sinking. Meanwhile, in the Asphalt Institute MS-17 method, there are only 11 types of damage that can be reviewed, including transverse cracks, longitudinal cracks, crocodile skin cracks, shrinkage cracks, grooves, curls, loose granules, sags, holes, excess asphalt, and slippery aggregate.
2. There are several assessments that are not mutually exclusive between the two methods, namely the Bina Marga method does not contain any types of shrinkage, curling and sagging crack damage. Meanwhile, in the Asphalt Institute MS-17 method, there are no types of patch damage, fatty, roughness, disintegration and collapse.
3. The assessment parameters in the Bina Marga method are more measurable compared to the Asphalt Institute MS-17 method, where the Asphalt Institute MS-17 method only relies on the subjective nature of the assessor. However, in the Bina Marga method, if there is damage that is

quite severe but does not meet the criteria, the value obtained is below the value of the Asphalt Institute MS-17 method.

4. The Bina Marga method uses an Average Daily Traffic survey as an assessment support that makes it easier to carry out road handling sequences.

4. CONCLUSION

4.1 Conclusion

1) The analysis carried out using the Bina Marga and Asphalt Institute MS-17 method on the Serang-Pandeglang highway section contained 7 types of damage, namely patches, loose granules, longitudinal cracks, crocodile skin cracks, collapse, holes and sinkholes with the largest damage area being 116 .16 m2 type of patch damage and the smallest area is 1.02 m2 type of fall damage.
2) The Priority Order Value in the Bina Marga method is 10.928, priority scale with the road handling program, namely routine maintenance type (pothole patching, asphalt resurfacing, etc.) and the Condition Value in the Asphlat Institut MS-17 method is 98.40 with the handling program The road is a type of routine maintenance (pothole patching, asphalt resurfacing, etc.).
3) Comparison between the two methods shows that the Bina Marga method and the Asphalt Institute MS-17 method have differences, namely:
   a) There are 6 types of damage that occur in the Bina Marga method, namely longitudinal cracks, crocodile skin cracks, holes, loose grains, patches and collapse. Meanwhile, there are 5 types of damage that occur in the Asphalt Institut MS-17 method, namely longitudinal cracks, crocodile skin cracks, loose granules, falls and holes.
   b) The largest damage area in the Bina Marga method was patch damage of 116.16 m2 and in the Asphalt Institute MS-17 method the largest type of damage was loose granules of 39.00 m2.
4) The road condition assessment procedures using the Bina Marga method are more extensive and measurable compared to the Asphalt Institute MS-17 method.

4.2 Suggestion

1) In conducting visual surveys, more accurate methods and tools are still needed, such as NAASRA (National Association of Australian State Road Authorities), namely a method that measures the roughness of asphalt roads, one of the tools used is PARVIDNET (Positioning Accurate Roughness With Video and Net Inventory), and can also use the ROMDAS (Road Measurement Data Acquistion System) measuring instrument, which is a system for collecting unevenness data from the response type Bump Integrator unevenness measuring instrument, etc. which can be taken into consideration in determining road condition values.
2) The analysis observed in this final project focuses more on road pavement, so it is necessary to support a more complex maintenance program, further studies are still needed such as analysis of road drainage systems, sidewalks, road shoulders, and other supporting conditions that need to be researched further.
3) It is hoped that the relevant agencies can carry out maintenance as well as possible so that it does not cause further damage.

REFERENCES

[1] Sulfah A, & Pristianita RT. (2020). *ANALISIS PENANGANAN KERUSAKAN JALAN AJIBARANG-CILONGOK DENGAN METODE ASPHALT INSTITUTE ANALYSIS OF DAMAGE HANDLING ON THE AJIBARANG-CILONGOK ROAD USING THE ASPHALT INSTITUTE METHOD*. *1*(2), 49–54. http://jurnalnasional.ump.ac.id?index.php/civeng

[2] Hendra JO, Haris TV, & Rahmat H. (2022). Analisis Kerusakan Perkerasan Jalan menurut Bina Marga dan Alternatif Penanganannya. *Analisis Kerusakan Perkerasan Jalan menurut Bina Marga dan Alternatif Penanganannya*.

[3] Gilang, R., Prasetyanto, & Dwi. (2015). Perbandingan Nilai Kondisi Permukaan Perkerasan Jalan Lentur Dengan Menggunakan Metode Asphalt Institute Dan Metode PCI. Dalam *Jurnal Online Institut Teknologi Nasional Januari*.

[4] Siagin, B., Riani, D., & Salonten, D. (2021). *ANALISIS KERUSAKAN JALAN MENGGUNAKAN METODE BINA MARGA PADA JALAN RAJAWALI KOTA PALANGKA RAYA* (Vol. 4, Nomor 1).

[5] Waas, R. H., Ch Kastanya, F. J., & Sahusilawane, M. (2022). *Analisa Kerusakan Jalan Dengan Perbandingan Metode Asplaht Institute Dan Metode Dirgolaksono dan Mochtar (1990), (Studi Kasus Ruas Jalan Trans Seram Desa Haruru-Desa Sion, Kecamatan Amahai Kabupaten Maluku Tengah)*. *8*, 0–1.

[6] Sulistyo T, & Huda M. (2019). *ANALISA KERUSAKAN JALAN DENGAN METODE LHR BINA MARGA (STUDI KASUS RUAS JALAN AMD PROJAKAL KARIANGAU, KOTA BALIKPAPAN)*.

[7] Herbin F, Betaubun, & Jeni Paresa. (2019). ANALISA KERUSAKAN JALAN MENGGUNAKAN METODE PCIDAN ASPHALT INSTITUTE MS–17. *ANALISA KERUSAKAN JALAN MENGGUNAKAN METODE PCIDAN ASPHALT INSTITUTE MS–17*.

[8] Handoyo, H. A. (2016). ANALISIS KERUSAKAN JALAN PERKOTAAN MENGGUNAKAN METODE BINA MARGA. *ANALISIS KERUSAKAN JALAN PERKOTAAN MENGGUNAKAN METODE BINA MARGA*.

[9] Haris R, Syarwan, & Gusrizal. (2018). *EVALUASI TINGKAT KERUSAKAN PERMUKAAN JALAN BERDASARKAN METODE BINA MARGA*.

[10] Harahap, Y. S. (2019). ANALISA TINGKAT KERUSAKAN JALAN SEBAGAI DASAR PENENTUAN PERBAIKAN (JALAN LINTAS SUMATRA) KOTA TEBING TINGGI. *ANALISA TINGKAT KERUSAKAN JALAN SEBAGAI DASAR PENENTUAN PERBAIKAN (JALAN LINTAS SUMATRA) KOTA TEBING TINGGI*.

[11] Firman, M., Wicaksono, B., & Mahardi, P. (2018). *Analisis Nilai Kondisi Perkerasan Jalan Secara Visual Dengan Metode Bina Marga dan Pavement Condition Index Studi Kasus: Jalan Mastrip (SBY 10+100-10+700)*.

[12] Junior, E. W., Leba, L. W. H., Santi, S., & Seran, L. M. F. (2023). *Analisis Kerusakan Jalan menggunakan Metode Asphalt Institute Studi Kasus: Jl. Claret Sta 0-Sta 800*. *1*(1). https://doi.org/10.59810/localengineering

[13] Nashruddin ZA, & Buana C. (2021). Analisis Penilaian Kerusakan Jalan dan Perbaikan Perkerasan pada Jalan Raya Roomo, Kecamatan Manyar, Kabupaten Gresik. *Analisis Penilaian Kerusakan Jalan dan Perbaikan Perkerasan pada Jalan Raya Roomo, Kecamatan Manyar, Kabupaten Gresik*.

[14] Daryoto, Widodo S, & Mayuni S. (2014). STUDI KONDISI KERUSAKAN JALAN PADA LAPIS PERMUKAAN DENGAN MENGGUNAKAN METODE BINA MARGA (STUDI KASUS RUAS JALAN HARAPAN JAYA) KOTA PONTIANAK. *STUDI KONDISI KERUSAKAN JALAN PADA LAPIS PERMUKAAN DENGAN MENGGUNAKAN METODE BINA MARGA (STUDI KASUS RUAS JALAN HARAPAN JAYA) KOTA PONTIANAK*.

[15] Yuliandra, E., Abrar, A., Abdillah, N., Studi, P., Sipil, T., Tinggi, S., Dumai, T., Utama, J., Bukit, K., & Ii, B. (2022). Analisis Kerusakan Jalan Menggunakan Metode Bina Marga dan Metode Pavement Condition Index (PCI) (Studi Kasus : Jalan Sudirman dan Jalan Soekarno-

Hatta Kota Dumai). Dalam *Nuryasin Abdillah 3 JURNAL SLUMP TeS* (Vol. 1, Nomor 1).R. I. Kusuma, E. Mina, and A. F. Irhamna, "Stabilisasi Tanah Lempung Menggunakan Fly Ash Terhadap Nilai Cbr," *Fondasi J. Tek. Sipil*, vol. 2, no. 2, 2013, doi: 10.36055/jft.v2i2.1731.

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