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ANALYSIS OF ROAD IMPROVEMENT (OVERLAY) ON ROAD DAMAGE ON THE WEST SILVER DORANG FISH ROAD SECTION SURABAYA (STA0+000-STA0+470)

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Abstract - *Jalan Ikan Dorang Perak Barat Surabaya is categorized as a class I road, which is an arterial road with flexible pavement that is daily traversed by motorized vehicles including cargo vehicles with a width size not exceeding 2,500 mm, a length size not exceeding 18,000 mm and a permitted heaviest axis load of 11 tons, and there is a lot of road damage such as alligator cracks, local cracks, peeling, subsidence, longitudinal cracks, and holes. These conditions reduce the functional value of the road and require maintenance of the road to be very important. This research discusses the handling of road damage with the overlay method which is considered faster, and more efficient, and gets a more optimal result. This is because the method is widely used for planning the thickness of pavement in Indonesia. The results of this study are known on the road section, the traffic conditions are quite heavy, and the level of functional conditions is Heavy Damaged, so it is necessary to increase the road (overlay) as high as 4.5 cm with the type of pavement (AC-WC).*

Kata Kunci : Flexible pavment, overlay, crack, Road overlay, AC-WC (Asphalt Concrete - Wearing Course).

INTRODUCTION

The road network, as one of the transportation infrastructure that plays an important role in the transportation sector, especially for the continuity of the distribution of goods or services, has a crucial role in ensuring the smooth flow of traffic. In the context of high economic growth, traffic growth has also increased significantly, presenting a serious challenge if not matched by improvements in the quality of existing road facilities and infrastructure.

Addressing this issue requires the addition of adequate road infrastructure, good pavement planning, and ongoing road maintenance. The addition of road infrastructure facilities includes the construction of new roads, increasing the capacity of existing roads, and developing a well-integrated road system. In addition, good pavement planning is essential to ensure the strength and durability of roads against increasing traffic loads.

Ongoing road maintenance is also an important step in keeping roads safe and comfortable for road users. This includes routine repairs, surveillance of road defects, and timely corrective actions. With proper maintenance, roads can continue to provide good service to the motoring public.

Through the improvement of road facilities and infrastructure and good maintenance, it is expected that the road network can continue to meet the needs of community mobility and support sustainable economic growth. Good and stable road conditions will contribute positively to the smooth distribution of goods and services, and provide comfort and safety for road users.

The rapid growth of vehicles has a significant impact on traffic congestion, both in the city and outside the city. This requires an increase in the quality and quantity of road infrastructure to overcome these challenges. In an effort to support community mobility and all related activities, adequate facilities and infrastructure are needed.

Based on the road function classification, the Jalan Ikan Dorang Perak Barat section is categorized as a class I road. This road is included in the arterial road category that can be traversed by motorized vehicles, including cargo vehicles. For cargo vehicles, there is a width limit that cannot exceed 2,500 mm and a length limit that cannot exceed 18,000 mm. The heaviest axle load permitted on this road is 11 tons.

With the increasing number of vehicles and community activities, it is important for the government and related parties to ensure that existing road facilities and infrastructure are able to support these needs. In this case, improving road quality, including structural and surface improvements, as well as increasing road capacity is very important. In addition, increasing the quantity of road infrastructure can also involve building new roads or expanding existing roads to accommodate increasing traffic volumes.

With adequate road facilities and infrastructure, it is expected to improve the smooth flow of traffic, reduce congestion, and increase travel efficiency. In addition, good road conditions also provide safety and comfort for road users. Therefore, improving the quality and quantity of road infrastructure is an urgent need to support the development and growing transportation needs of the community.

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Surabaya City is also partly a satellite city in the field of industry and trade, so it is very important to maintain performance on the Ikan Dorang road section. To support the activities of the people and industry of Surabaya city. So far, the handling of road damage carried out on the Surabaya Ikan Dorang Road Section is only limited to maintenance, namely by functional repairs on damaged road surfaces. This handling is not considered appropriate enough because the repair efforts made cannot last long according to the age of the plan. Therefore, it is necessary to conduct a deeper study of the Surabaya Dorang Fish Road Section. This study aims to determine the functional condition and determine the appropriate repair of the Surabaya Ikan Dorang Road Section.

RESEARCH METHODS

Data collection in this study is by looking for information that is primary and secondary. The following are the data needed. This primary data is data obtained through observation of survey data in the field, as for the data needed is as follows:

1. Average daily traffic volume (LHR). The equipment used is a hand counter to record the number of vehicles passing both motorcycles, light vehicles and heavy vehicles. Data collection is carried out for 24 hours, with data recorded every 60 minutes, starting from 06.00 to 06.00.
2. Type of damage and dimensions of road damage. The equipment used is meter, paper, stationery, survey form, and camera as a documentation tool.

This secondary data is data obtained from the relevant agencies; in this case the relevant agency is the Public Works Office. The data needed are as follows:

1. Map of Jalan Ikan Dorang Perak Barat section
2. Existing pavement structure data.
3. Average daily traffic (LHR) data in previous years.

The data analysis carried out in this study is related to:

1. Average daily traffic data
2. Types of damage and dimensions of damage
3. Existing pavement structure layout
4. Existing ITP value
5. Functional condition level of the road
6. Planning the thickness of the additional layer of flexible pavement (ovelay)
7. Calculation of planned traffic volume
8. Calculation of initial equivalent traffic
9. Final equivalent traffic calculation
10. Calculation of center equivalent cross section
11. Subgrade bearing capacity analysis
12. Index analysis of pavement thickness plan
13. Calculation of required pavement Index
14. Calculation of additional layer thickness required

RESULTS AND DISCUSSIONS

Average Daily Traffic

From the survey results on the Ikan Dorang Perak Barat Surabaya road section, Average Daily Traffic (LHR) data is obtained which is shown in the following table.

Table 1. Average Daily Traffic

Hours	Average Daily Traffic				
	Jeep 2 ton	Bus 8 ton	Truck 2 as 13 ton	Truck 3 as 20 ton	Truck as 30 ton
06.00 -07.00	51	0	8	0	0
07.00 -08.00	65	0	5	0	0
08.00 -09.00	54	0	2	0	0
09.00 -10.00	42	0	3	0	0

10.00 -11.00	40	0	7	0	0
11.00 -12.00	53	0	0	0	12
12.00 -13.00	57	1	0	0	17
13.00 -14.00	50	0	0	0	16
14.00 -15.00	52	0	0	0	18
15.000 -16.00	53	0	0	0	5
16.00 -17.00	67	3	0	0	6
17.00 -18.00	79	0	0	0	3
18.00 -19.00	66	1	0	0	0
19.00 -20.00	62	0	0	0	11
20.00 -21.00	55	0	0	2	17
21.00 -22.00	36	0	1	5	18
22.00 -23.00	22	0	2	7	19
23.00 -24.00	12	0	3	9	18
00.00 -01.00	9	0	5	8	18
01.00 -02.00	8	0	3	9	17
02.00 -03.00	9	0	4	8	16
03.00 -04.00	20	0	3	4	19
04.00 -05.00	23	0	0	3	11
05.00 -06.00	49	0	0	0	7
TOTAL	**1034**	**5**	**46**	**55**	**248**

Types of Damage and Damage Dimensions

From the results of visual observations in the field, the types of damage and dimensions of damage are obtained which will be used to determine the level of functional conditions on the Jalan Ikan Dorang Surabaya section. From the survey results, data on the types of damage found in the field are holes / potholes, cracks / cracks, ambles / grade depressions and bleeding.

Existing ITP Value

The existing ITP value is the value that will be used to determine the ITP value needed in determining the thickness of the added pavement layer on the Road Section.

Existing ITP = a1 x D1 + a2 x D2 + a3 x D3

Existing ITP=0.4 x 6.5 + 0.14 x 20 +0.13 x 10

Existing ITP = 6.7

Determining the Road Functional Condition Level

In determining the functional condition of the road, some data is needed as a calculation of the Surface Distress Index (SDI), the data includes the type and dimensions of damage and the area of the road section which will be used to determine the percentage of the area of cracks in the road section. From the calculation of the functional condition of the road using the Surface Distress Index (SDI), it can be concluded that the functional condition of the Dorang Perak Barat Surabaya 0+000- 0+470 Fish section is Severely Damaged, because the final SDI value reaches 155. Then the addition of pavement surface layers will be carried out.

Planning of Additional Layer Thickness of Flexural Pavement (Overlay)

Technical data used in planning the thickness of the added layer of the Ikan Dorang Perak Barat Surabaya 0+000 -0+470 road section includes.

1. Road Length : 470 m
2. Pavement Width : 8 m
3. Plan Life : 10 Years
4. Traffic Growth Factor : 0.4%
5. Existing ITP : 6.7

Calculation of Plan Traffic Volume

From the Average Daily Traffic data, it can be known the Plan Traffic Volume at the age of 10 years, namely:

VLLR = LHR x (1+i)n
VLLR Sedan, Jeep 2Ton = 1139 x (1+0.04)10 = 1686 Vehicles
VLLR Bus 8 Ton = 633 x (1+0.04)10 = 937 Vehicles
VLLR Truck 2 axles 13 Ton = 277 x (1+0.04)10 = 410 Vehicles
VLLR Truck 3 axles 20 Tons = 55 x (1+0.04)10 = 81 Vehicles
VLLR Truck 3 axles 30 Ton = 21 x (1+0.04)10 = 31 Vehicles

Calculation of Starting Equivalent Traffic

The starting equivalent traffic (LEP), which is obtained from the equation:

LEP= Ex C x LH
LEP Sedan, Jeep 2 Ton = 0.0004 x 0.5 x 1139 = 0.23
LEP Bus 8 Ton = 0.1593 x 0.5 x 633 = 50.42
LEP Truck 2as13 Ton = 0.35 x 0.5 x 277 = 199.33
LEP Truck 3as20 Ton = 1.064 x 0.5 x 55 = 29.26
LEP Truck 3as30 Ton = 2.1579 x 0.5 x 21 = 22.66
Total LEP = 301,89

Final Equivalent Traffic Calculation

The amount of equivalent traffic when the road requires structural repairs is called the Final Equivalent Traffic (LEA), which is obtained from the equation:

LEA=E x C x VLLR
LEA Sedan, Jeep 2Ton = 0.0004 x 0.5 x 1686 = 0.34
LEA Bus 8Ton = 0.1593 x 0.5 x 937 = 74.63
LEA Truck2as 13Ton = 0.35 x 0.5 x 410 = 71.75
LEA Truck3as 20Ton = 1.064 x 0.5 x 81 = 29.26
LEATruck 3as30 Ton =2.1579 x 0.5 x 31 = 22.66
Total LEA = 198,64

Calculation of Center Equivalent Traffic

The center equivalent cross section is obtained by the equation:

$$. LET = \frac{LEP+LEA}{2}$$

$$. LET = \frac{301.89+198.64}{2} = \mathbf{250.27}$$

Calculation of Plan Equivalent Traffic

The amount of equivalent traffic that will cross the road during the service period, from the time it opens until the end of the plan life is called the Plan Equivalent Traffic, which is obtained from the equation :

$$. LER = LET\ x\ \frac{DR}{10}$$

$$. LER = LET\ x\ \frac{10}{10} = \mathbf{250.27}$$

Determining Subgrade Supportability

Determining the bearing capacity of the subgrade (DDT) by using the CBR examination. The DDT value is obtained from the conversion of the subgrade CBR value using the equation:

DDT = 1.6649 + 4.3592 x log (CBR)

DDT=1.6649 +4.3592x log (4.50)

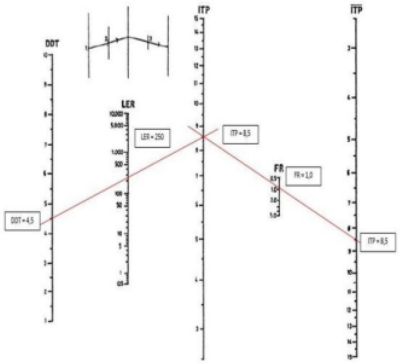
DDT=1.6649 +4.3592x 0.65

DDT=1.6649 +2.85

DDT= 4.51

Determining the Index of Pavement Thickness Plan

The value of the pavement thickness index is determined using a nomogram using data that has been calculated previously, namely: LER data, DDT values, Regional Factors.



Nomogram of ITP Values Plan = 8.5

Calculation of the Required Pavement Index

To determine the ITP value needed in planning the thickness of the additional layer of pavement (Overlay), the existing ITP value and the IT Planner value are needed, the following is the equation for determining the required Pavement Index:

ITP required = ITP Plan-ITP existing

ITP required = 8.5 - 6.7

Required ITP = 1.8

Calculation of the Required Thickness of Overlay

The material used for the increase in the thickness of the overlay on the WEST SURABAYA FISH ROAD (STA0+000-STA0+470) isAC-WC with a relative strength coefficient of 0.4. From the required ITP value, the required additional layer thickness can be determined through the following equation:

$$. DI = \frac{ITP\ yang\ dibutuhkan}{a1}$$

$$DI = \frac{1,8}{0,5} = \mathbf{4.5\ cm}$$

CONCLUSIONS

From the research and calculations carried out to analyze the increase in road damage on the Jalan Ikan Dorang Perak Barat Surabaya 0+000 -0+470 section, it can be concluded that:

1. Based on the results of the analysis and calculation in this study, it is known that the Average Daily Traffic on the section of Jalan Ikan Dorang Perak Barat Surabaya 0+000 - 0+470 is quite dense and is dominated by motorcycle vehicles and small car vehicles.
2. Based on the results of the analysis and calculation in this study, it is known that the level of functional conditions that exist on the section of Jalan Ikan Dorang Perak Barat Surabaya 0+000 - 0+470 is Severely Damaged because the SDI (Surface Distress Index) value reaches 155, so it is necessary to improve the road (Overlay) on the road section.
3. Based on the planning of improvements to road damage (Overlay) on the Jalan Ikan Dorang Perak Barat Surabaya section 0+000 - 0+470, it can be seen that the thickness of the added layer of pavement needed for planning improvements to road damage (Overlay) is as high as 4.5 cm with the type of pavement (AC-WC).

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