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Rigid Pavement Planning and Road Lighting (Study Case on Merak–Cilegon Road, Banten Province, Indonesia)

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***Abstract*—Merak - Cilegon road is a national road that has many vehicles, ranging from light vehicles to heavy vehicles. Heavy vehicles that often cross the road are project vehicles used to transport goods and natural materials such as sand, stone to iron that will be sent out of the island. The existing pavement on the road using flexible pavement, while the burden received by the road is very large, so it needs to be planned using rigid pavement. Planning includes calculating road loading reactions and planning of rigid pavement thickness, and road complementary infrastructure (lighting) to reduce the danger to road users at night. Planning rigid pavement thickness (Rigid Pavement) using a type of concrete pavement without reinforcement with bars, bottom foundation using thin concrete K-125 with a thickness of 10 cm, cement concrete pavement using K-350 with a thickness of 22 cm. The lamps used are type B 150W SON with high- pressure sodium type, the number of lamps needed is 22 pieces, the height of the pole is 8 meters with the distance between the lamps as far as 47 meters. The total cost required for planning the rigid pavement thickness and planning for street lighting is Rp. 5,656,891,340, - (Five Billion Six Hundred Fifty-Six Million Eight Hundred Ninety Thirty-One Thousand Three Hundred Forty Rupiah).**

Keywords: rigid pavement, street lighting lights, vehicles

I. INTRODUCTION

The Merak - Cilegon toll road is a national road that links between the provincial capitals, the road is an area that has many vehicles, ranging from light vehicles to heavy vehicles. Heavy vehicles that often cross the road are project vehicles used to transport natural materials such as sand, stone to iron that will be sent out of the island. But besides that, the old pavement on the road using flexible pavement. Due to these conditions, the burden received by the road is very large and there must be a loading calculation that reacts on the road and then planned rigid pavement thickness, besides that the road complementary infrastructure that must exist is lighting, because it is dangerous for road users at night.

In this paper, planning calculations to find out how much rigid pavement thickness is needed so that the road can distribute vehicle loads properly and safely, then the Guidelines for Pd-T-14-2003 Bina Marga, as well as the number of lights needed for street lighting using SNI 391-2008.

II. METHODS

This research uses the quantitative method, by doing the library research, field observations, and traffic survey to get the value of daily traffic and average daily traffic, conducted on the Merak-Cilegon Road section of STA 3+500 – STA 4+500 as primary data., and soil bearing capacity from the secondary data, obtained from the Public Works Department.

III. RESULTS AND DISCUSSION

From the survey results, field observations and interviews, the following data were obtained:

TABLE 1. VEHICLE TRAFFIC DATA FOR YEAR 2019

No	Type of vehicle	Weight	Group	Average /day
1	Light Vehicle	2 T	2	1648
2	Light Bus	6 T	5a	130
3	Heavy Bus	8 T	5b	50
4	Light Truck 2 axle	6 T	6a	899
5	Medium Truck 2 axle	8 T	6b	1349
6	Heavy Truck 3 axle	20 T	7a	870
7	Trailer Truck	20 + 10 T	7b	134
8	Trailer Trcuk 2 axle	13 T	7c	184

Source : field survey

TABLE 2. *CALIFORNIA BEARING RATIO* (CBR) DATA

Point	KM/Sta	CBR %
1	3+500	4,58
2	4+000	4,33
3	4+500	3,64
4	5+000	3,64
5	5+500	3,44
6	6+000	10,45
CBR Average		5,01

Source: Public Works Department

TABLE 3. CALCULATION OF AXIS BASED ON TYPE AND LOAD

Group of vehicle	Axis Load Configuration (Ton)				Amount VEhivcle(pc)	Amount of Axis per vehicle	Amount of Axis (pc)	SASW		SADW		DADW	
	FW	RW	DFW	DRW				AL (pc)	AA(pc)	AL(pc)	AA (pc)	AL (pc)	AA (pc)
1	2				3	4	5=3x4	6	7	8	9	10	11
1	1	1	-	-	4584	-	-	-	-	-	-	-	-
2	1	1	-	-	1648	-	-	-	-	-	-	-	-
3	1	1	-	-	1367	-	-	-	-	-	-	-	-
4	1	1	-	-	137	-	-	-	-	-	-	-	-
5a	3	5	-	-	130	2	260	3	130	5	130	-	-
5b	3	5	-	-	50	2	100	3	50	5	50	-	-
6a	2	4	-	-	899	2	1798	2	899	-	-	-	-
								4	899	-	-	-	-
6b	5	8	-	-	1349	2	2698	5	1349	8	1349	-	-
7a	6	14	-	-	870	2	1740	6	870	-	-	14	870
								6	134	-	-	14	134
7b	6	14	5	5	134	4	536	5	134	-	-	-	-
								5	134	-	-	-	-
								6	184	-	-	14	184
7c	6	14	5	5	184	4	736	5	184	-	-	-	-
								5	184	-	-	-	-
Total							**7868**		**5151**		**1529**		**1188**

Note :

FW = Front Wheel
RW = Rear Wheel
DFW = Double Front Wheel
DR = Doble Rear Wheel
AL = Axle Load
AA = Amount of axle
SASW = Single Axle Single Wheel
SADW = Single Axle Double Wheel
DADW Doble Axle Double Wheel

A. Road data :

- Wide : 7 M (Non Median)
- Thickness : 220 mm (22 cm)
- Elevation : 2%
- Road performance : Rigid Pavement
- Concrete quality (fc') : K-350
- Dowel Bar : Ø32
- Long Bar : Ø22
- Across Bar : Ø22
- Tiebar : Ø16
- Sub Base Material : Stabilisation
- Reinforcing steel quality : BJTU 39 (f_y : = 3900 kg/cm^2) for continous concrete with reinforcement, and BJTU 24 (fy : 2400 kg/cm^2) for cocantenated concrete with reinforcement

From the results of the planning process above, the following data are obtained:
1. 220 mm plate thickness, dowel with a diameter of 32 mm, a length of 450 mm, and a distance of 300 mm, and tie Bar, screw thread diameter of 16 mm, length 69 cm and distance of 75 cm continuously.

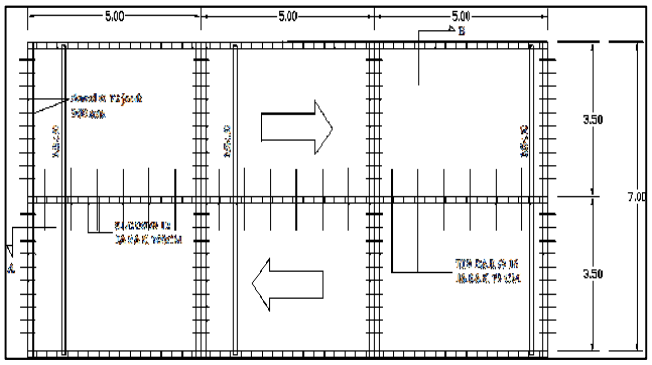

Fig.1. Floorplan dowel and tiebars

B. Planning for Lighting

In accordance with SNI 391- 2008, for the planning of road planning are,the height of the mast used is 8 meters, the distance between the poles as far as 47 meters, and the number of light points needed is 22 units.

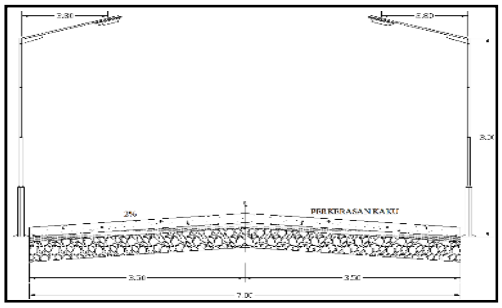

Fig.2. Lighting planning

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