The Calculation of The Upper and Lower Components of Thre New Railway Road in Dead Lines Reacyivation in Babat-Jombang As a Cross Support

by Dadang Supriyatno

Submission date: 07-May-2020 09:50PM (UTC-0500)

Submission ID: 1319050860

File name: Dead_Lines_Reacyivation_in_Babat-Jombang_As_a_Cross_Support.pdf (799.76K)

Word count: 2771

Character count: 12804

International Journal of Civil Engineering and Technology (IJCIET)
Volume 10, Issue 04, April 2019, pp. 572-582. Article ID: IJCIET_10_04_059
Available online at http://www.iaeme.com/ijciet/issues.asp?JType=IJCIET&VType=10&IType=04
ISSN Print: 0976-6308 and ISSN Online: 0976-6316

© **IAEME** Publication **Scopus** Indexed

THE CALCULATION OF THE UPPER & LOWER COMPONENTS OF THE NEW RAILWAY ROAD IN DEAD LINES REACTIVATION IN BABAT-JOMBANG AS A CROSS SUPPORT

Dadang Supriyatno*
Faculty of Engineering Surabaya State of University, Indonesia, Kampus Ketintang Unesa, Jl. Ketintang Surabaya 60231, East Java Indonesia

Muhammad Ikhsan Setiawan
Program Studi Teknik Sipil, Universitas Narotama, Surabaya, Indonesia
*Corresponding author

ABSTRACT

Railways public transport play important roles in Indonesia in which it becomes one mode of national transportation system with bulk freight characteristics and it contains more advantages compared with other transport modes. The research aimed to know the rail class calculation on the reconstruct of line tripe-stubs based on the operation of the train and its load. Besides, this study also aimed to test the upper components to know the class of the railway by using UIC (Union International Railway) and PD 10 (Peraturan Dinas 10). Based on the result of the planning calculation the reconstruction of rail roads from Babat to Jombang, it was found that a new rail road which include rails type 50, concrete pads, ballast and sub ballast, and track from Babat to Jombang, later it can be passed by using a locomotive type CC 202 based on the calculation of the rail class by using Passing Tonage the result is UIC 6. Meanwhile, based on the Peraturan Dinas 10 possessed by PT. Kereta Api, and the locomotive's load axle and speed, the rail class on that line is planned to use II rail class.

Keywords: Mass transport, transport infrastructure, the rail network.

Cite this Article: Dadang Supriyatno and Muhammad Ikhsan Setiawan, The Calculation of the Upper & Lower Components of the New Railway Road in Dead Lines Reactivation in Babat-Jombang as a Cross Support, *International Journal of Civil Engineering and Technology*, 10(4), 2019, pp. 572-582.

http://www.iaeme.com/IJCIET/issues.asp?JType=IJCIET&VType=10&IType=04

1. INTRODUCTION

The success of development is strongly influenced by the role of transportation as an artery of political life, economic, social, cultural, and Defense-Security[1][2][3]. In this regard, railways as one mode of transportation in the national transportation system has bulk freight characteristics and some advantages[4][5].

The provincial Government of East Java in their planning on transportation infrastructure development[6], will apply the bulk transportation of rail-based by establishing or reviving a rail line integrated with network rail road turning to the rest of the territory within a radius of 100 kilometres west of Surabaya. As for the rail network planping rotation, it will soon be developed in a way to revive the rail line from Babat to Jombang City[7].

With a revived track from Babat-Jombang, it is expected that it will contribute particularly to a reduce congestion linkway South cross by Nothern cross and also to minimize congestion throughout the 100 km area from Surabaya that is the commuter rail line that runs from Surabaya-Mojokerto-Jombang-Babat-Gresik and Lamongan-return to Surabaya or vice versa. On the commuter line, it will serve the transport of passengers and goods passing through the corridor commuter rail operations[8].

2. METHOD

To obtain the data and information required in the activities of this research, the study employs methods as follows:

a. preparation phase: preliminary preparation stages is in the implementation of the study in the form of an inventory survey, data collection and other supporting and existing studies.

b. Data collection Stage: that is by obtaining the required data in the analysis of technical studies of rail road Babat-Jombang line reactivation.

c. The Analysis and planning stages of the development of the railway network of Babat-Jombang that will result in the Analysis and planning of the development of emplasemen and its infrastructure, as a follow-up to the development of railways in Babat-Jombang line.

3. RESULT AND DISCUSSION

3.1. Traffic Classification in the UIC

In the maintenance or enhancement of rail roads affected by the magnitude as follows:

- A daily passenger train Tonnage
- The tonnage of freight train and propulsion
- The pressure of the axle
- Speed

On cross Babat-Stubs, it will improve their capacity, the data decription is as follows:

The frequency of trains cross Babat-Jombang is estimated as follows:

Passenger train = 6 KA/day
Freight train = 12 KA/day
Commuter train = 8 KA/day
It is estimated (D) = 8 KA/day

__________+

Frequency = 46 KA/day

Stam formation is as follows:

The number of a series of passenger train each = 7 trains

The number of a series of freight train each = 12 trains

The number of a series of commuter train each = 8 trains

The number of one of the other train sets (D) = 6 train

The number of sets/day:

Passenger Train = 18 x 7 = 126 train

Freight train = 12 x 12 = 144 trains

Commuter Train = 8 x 8 = 64 trains

It is estimated (D) = 9 x 6 = 54 trains

_______________+

The number of arrangements = 388/train carriages/day

The weight of the Series:

Passenger Trains

126 x 35 Ton = 4410 Tons/day

64 x 35 Ton = 2240 Tons/day

54 x 35 Ton = 2200 Tons/day

______________+

Amount = 8540 Tons/day

Freight Train

144 x 35 Ton = 3300 Tons/day

Tonnase passengers and trains

= 8540 tons/day (Tp)

Tonnase barng and cars daily

= 3300 tons/day (Tb)

Tonnase Locomotives (T1)

locomotive used type C.C 202 = 108 Tons

Coefficient of load and Traffic Quality

KB = 1.15 (For a load axle s. d 20 tons)

S = 1.1 (For road rail passenger TRAIN with V max $\leq$ 200 km/hour)

K1 = 1.4

TE = Tp + (Kb x Tb) + (K1 x T1)

= 8540 + (5000 x 1.15) + (1.4 x 108)

= 8540 + 5796 + 151

= 14487 Tons/day

Passing Tonnage:

T = 360 x S x TE

= 360 x 1.1 x 14487

= 5.736.852 tonnes/year

Then, cross Babat-Jombang includes in III class (as PD 10) and entry requirement of the UIC 7

3.2. The Renewing of The Under Construction Building Implementation Method

With the renewal of construction including thick pads and a thick ballast larger than the old construction, It will be open space to new ballast and sub ballast place (layers of sand), given the high construction of the new rail road from the head rail (KR) to the sub ballast with the minimum ± 82.50 cm.

To give you an idea of the position of the old rail road R. 25 with the new position R. 50, the difference of rail road high construction update can be seen in figure 1 below:

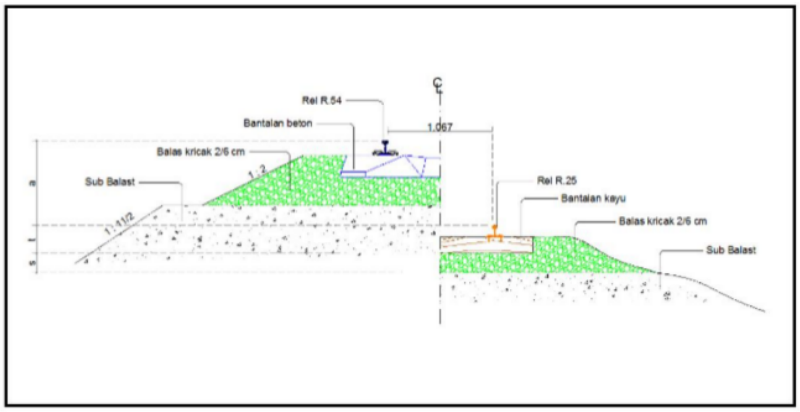

Figure 1 Height Difference of Existing Track and New Track Construction

3.3. The Calculation of Rail Road Construction Updates of Babat-Tuban

By analyzing the standard class of rail roads in the rules of the service (PD) 10, as described above, then the provisions are as follows:

The class path supporting cross Babat-Tuban planned class II

V maks = 100 km/hour

- d1 = 30 cm
- b = 140 cm
- c = 225 cm
- k1 = 240 cm – 270 cm (taken = 270 cm)
- d2 = 15 cm – 50 cm (taken = 15 cm)
- e = 22 cm
- k2 = 325 cm

It can be seen in the list of classification classes of railroad according rules of the service (PD) 10. To give an idea of the height of construction after the improvement of the upper and lower construction, it is shown as follows :

The Upper Construction:

Height R.50 rail = 15.00 cm (new)

Thick Pad = 0.50 cm
Thick concrete pads = 22.00 cm

The Lower Construction :

Thickness of ballast = 30.00 cm
the Sub-ballast = 15.00 cm
amount = 82,50 cm

The high of construction before any updates (existing track), is:

The Upper Construction:

Height R.50 rail = 9.30 cm (aus 7 mm)
Thickness of base plate a or b = 1.50 cm
Thickness Bearing wood = 12.00 cm

The Lower Construction :

Thickness of ballast = 20.00 cm (thick soil mix)
the Sub-ballast = 15.00 cm
amount = 57,80 cm.

The size of the Upper and Lower of the building

Calculation of the volume of a unit to new track:

Stone broke ballast

= (1.40 + 2.25) (0.22 + 0.30)-10/6x2x0, 22x0,23) + 20%

= 2,07 ≈ 2.10 m^3 (maximum)

the Sub-ballast

= [(2.70 + 3.25) (0.15 + 0.22)-(25x0, 22, 3)] + 20%

= 1.78 1.80 ≈ m^3 (minimum)

Calculation of tension in the upper and lower constructions of the rail roads.

Rail = 540 new Type R
P = 50.00 Kg/m '
a = 0.60 m
Wx = 270 cm^3

$$\delta = \frac{0{,}40}{1+Cx} + \frac{P}{a}$$

According to *verein* factor coefficient of speed of the plan is as follows

$$CX = \frac{V^2}{30.000}$$

Plans to speed 110 km/hour rail road class II according to, then,

$$Cx = \frac{V^2}{30.000}$$

$$\delta = \frac{0{,}40}{1+0{,}33} + \frac{50}{0.60} = \frac{0{,}40}{1{,}33} \text{ x } 83{,}33$$

$$= \frac{33{,}33}{1{,}33} = 25{,}06 \text{ Ton}$$

Thus, for the use of railway axle load of 18 tons of r. 50 new ones are able to focus on cross axle load of Babat-Jombang. So cross with Rails R 50 is reasonably safe.

Cross Babat-Jombang is expected to be traversed to all locomotives operating in Java island, including the type of CC 202, it will review the upper and lower construction components rail on the cross with the road rail renewal plan.

Where:

Axle loads operating = 18 tons (type of locomotive CC 202), as **figure 2** below

Axle distance = 1.6 m

Concrete bearing distance = 0.60 m

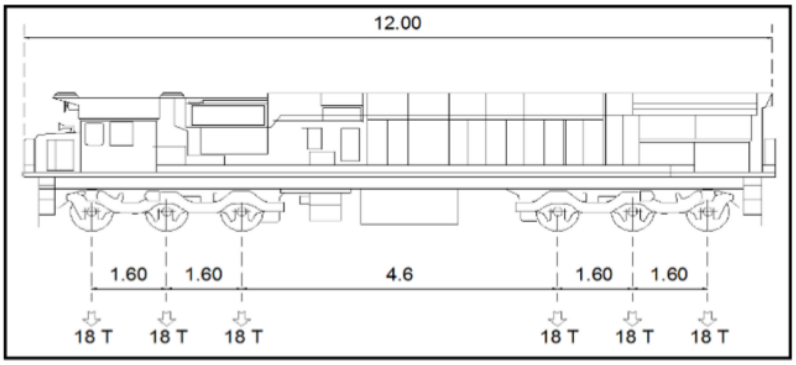

Figure 2 The Dimensions of Locomotive Type CC 202

Concrete pads size =

Top width : 20.00 cm

Bottom width : 23.00 cm

$\frac{V^2}{30.000}$Height : 22.00 cm

Speed coefficient = 1 +

So :

$$\frac{18+18}{2}\delta = \quad = 18 \text{ ton}$$

$$n = \frac{d}{a} = \frac{1,6}{0,6} = 2,67$$

$$\frac{\delta}{n} = \frac{18}{2,67} = 6,74 \text{ ton}$$

If the axle is a combination of two profitable speed 110 km/h, then the largest bearing pressure becomes:

$$D_{max} = 6,74\ (1 + \frac{10.000}{30.000})$$

$$= 6,74\ (1 + 0,33)$$

$$= 8,96 \text{ ton} \approx 8.960 \text{ kg}$$

Wide under concrete pads

= 22.00 x 200,00= 4.600 cm2

So the pressure of ballast under the bearing becomes:

$$\sigma b = \frac{9.346}{4600} = 2{,}05\ \text{kg/cm}^2 < \text{PD } 10 = 2{,}25\ \text{kg/cm}^2$$

For a thick ballast on concrete pad is 30 cm with a slope angle of 60 ° drilling as reflected in **figure 3** below, So the pressure of sub ballast become:

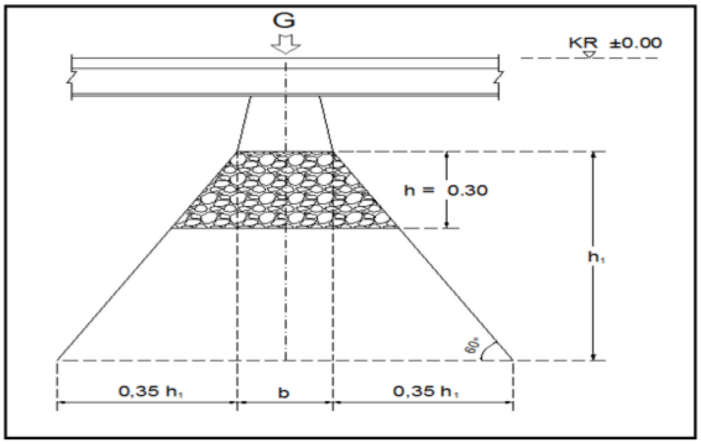

Figure 3 Spread the Burden of The Railway Lower Construction

$$\sigma\pi = \frac{b}{b+0{,}71} \text{ x } \sigma b$$

$$\sigma\pi = \frac{23}{23 + 0{,}7\,(30)} \text{ x } 1{,}95$$

$$= \frac{44{,}85}{44}$$

$$= 1.10\ \text{kg/cm}^2 = 10\ \text{PD} < 1.25\ \text{kg/cm}^2\ \textbf{(safe)}$$

When in cross posted with a thickness of 25 cm, then :

$$\sigma\pi = \frac{47{,}15}{40{,}50}$$

$$= 1.16\ \text{kg/cm}^2 = 10\ \text{PD} < 1.25\ \text{kg/cm}^2\ \textbf{(safe)}$$

For the thickness of ballast 20 cm:

$$\sigma\pi = \frac{44{,}85}{44}$$

$$= 1.27\ \text{kg/cm}^2 > \text{PD } 10 = 1.25\ \text{kg/cm}^2$$

(not quite safe)

By looking at the above calculation with a thickness of ballast which was just 25 cm the rail road, it can be assumption that is already safe enough, but when the planned for the thickness of the ballast under the pads of 20 cm, it is not secure.

With a loading axle placed at the line of Babat-Jombang becoming 18 tons, it was investigated whether the pressure of rail that occur from R.54 would not be exceeded.

If σ = 1600 kg/cm2, it was be investigated the pressure occuring for middle and end axle by using approach formula : *Verein and Dresien*.

3.3.1. For the middle axle.

$$\sigma a = \frac{12\ x\ m\ x\ n - 7\ (m+n) + 4}{16\ [\ 3\ x\ m\ x\ n - (\ m+n\ )]}\ \text{x}\ \frac{g\ x\ a}{Wx}$$

$$m = \frac{160}{60} = 2{,}67 \text{ x Wx} = 270 \text{ cm}^3$$

$$n = \frac{460}{60} = 7{,}67$$

$$K = 1 + \frac{V2}{30.000} = 1 + \frac{10.000}{30.000} =$$

$$g = \frac{G}{2} = \frac{18}{2} = 9000 \text{ kg}$$

$$\sigma a = \frac{12\ x\ 2{,}67\ x\ 7{,}67 - 7\ (\ 2{,}67 + 7{,}67\ ) + 4}{16\ [\ 3\ x\ 2{,}67\ x\ 7{,}67 - (2{,}67 + 7{,}67\ )\ ]}\ \text{x}\ 2000$$

$$= \frac{245{,}75 - 72{,}38 + 4}{16\ (61{,}44 - 10{,}34)}\ \text{x}\ 2000$$

$$= \frac{177{,}37}{817{,}6}\ \text{x}\ 2000$$

$$= 433{,}87 \text{ kg/cm}^2 < \bar{\sigma} = 1600 \text{ kg/cm}^2 \text{ (safe)}$$

3.3.2. The end axle

$$\sigma u = \frac{12\ x\ n - 7}{16\ (\ 3n - 1\ )}\ \text{x}\ \frac{g\ x\ a}{Wx}\ \text{kg/cm}^2$$

$$= \frac{(12\ x\ 7{,}67\ ) - 7}{16\ (\ 3\ x\ 7{,}67 - 1\ )}\ \text{x}\ \frac{9000\ x\ 60}{270}$$

$$= \frac{85{,}04}{352{,}16} \text{ x } 2000$$

$$= 482{,}96 \text{ kg/cm}^2 < \bar{\sigma} = 1600 \text{ kg/cm}^2 \text{ (safe)}$$

Conclusion

New rail R 50 put on the cross Babat-Jombang was eligible and worthy to be used on that cross.

3.4. The Determination of The Trace Line Direction of Babat-Jombang

The Determination of the trace line Direction of Babat-Jombang are divided based on some segments, such as:

3.4.1. Babat-Kedungpring Segment

For arbitration, the line for Babat-Kedungpring segment is shown in **figure 4** below

Figure 4 The segment of Babat-Kedungpring

3.4.2. Kedungpring-Ngimbang segment

For arbitration, the line for Kedungpring-Ngimbang segment is shown in **figure 5** below

Figure 5 The segment of Kedungpring-Ngimbang

3.4.3. Ngimbang-Ploso Segment

For arbitration, the line for Ngimbang-Ploso segment is shown in **figure 6** below

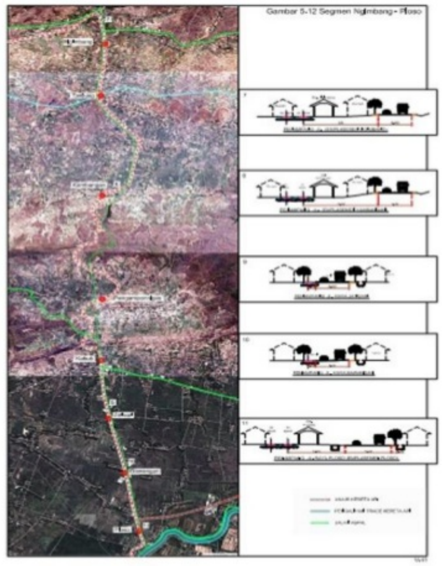

Figure 6 The segment of Ngimbang-Ploso

3.4.4. Ploso-Jombang Segment

For arbitration, the line for Ploso-Jombang segment is shown in figure 7 below

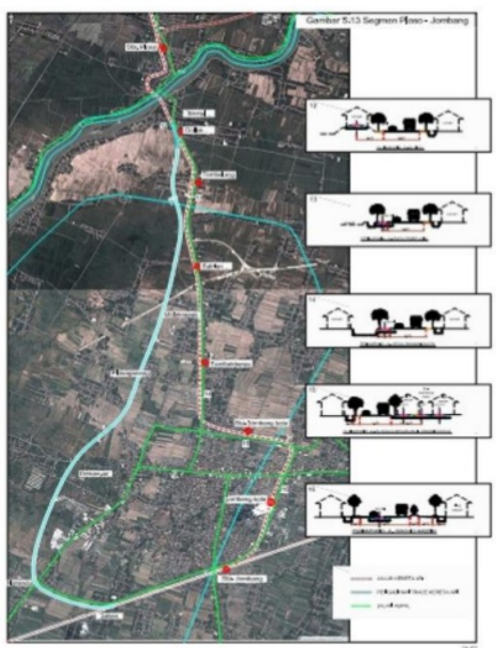

Figure 7 The segment of Ploso-Jombang

4. CONCLUSION

4.1. Based on the results and discussion, it can be concluded that:

a. The upper and lower construction was able to pass with an 18 Ton axle load in accordance with the calculation of the PD 10 or in accordance with the UIC Method passing tonnage. Based on the results of the calculation of tBabat-Jombang entered to UIC category 7.

b. It needs that the new rail road construction includes a type of rail, rail pads, rail fastening, ballast and sub ballast that would be crossed by the locomotive type CC 202 by using type of rails R 50

REFERENCES

[1] C. Esveld, "Modern Railway Track, 2nd Editon," *Delft Univ. Technol.*, 2001.

[2] S. A. P. Rosyidi, "Rekayasa Jalan Kereta Api." LP3M UMY, 2015.

[3] R. I. Presiden, "Peraturan Pemerintah Republik Indonesia Nomor 56 tahun 2009 tentang Penyelenggaraan Perkeretaapian." Jakarta, 2009.

[4] J. S. Mundrey, *Railway track engineering*. Tata McGraw-Hill Education, 2009.

[5] T. G. Crainic and G. Laporte, "Planning models for freight transportation," *Eur. J. Oper. Res.*, vol. 97, no. 3, pp. 409–438, 1997.

[6] R. Indonesia and M. P. R. Ketetapan, "Nomor," *MPR/2003 tentang Peninjauan Terhadap Mater. dan Status Huk. Ketetapan Majelis Permusyawaratan Rakyat Sementara dan Ketetapan Majelis Permusyawaratan Rakyat Tahun*, 1960.

[7] D. NUR CAHYO, "PERKEMBANGAN TRANSPORTASI KERETA API DI KABUPATEN LAMONGANTAHUN 1899–1932," *Avatara*, vol. 5, no. 1, 2016.

[8] N. B. Susanto and I. Muthohar, "Analisis Distribusi Beban Kereta Api Pada Konstruksi Timbunan Jalur Kereta Api." Yogyakarta: Universitas Gadjah Mada, 2015.

The Calculation of The Upper and Lower Components of Thre New Railway Road in Dead Lines Reacyivation in Babat-Jombang As a Cross Support

ORIGINALITY REPORT

14%	14%	4%	7%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	www.iaeme.com	Internet Source	7%
2	eprints.undip.ac.id	Internet Source	4%
3	iaeme.com	Internet Source	2%
4	repository.unib.ac.id	Internet Source	1%
5	Submitted to University of Greenwich	Student Paper	1%

Exclude quotes	On	Exclude matches	Off
Exclude bibliography	On		