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Maintenance Management In Handling The Problem of Rail Damage Affecting Railway Travel Safety (Wonokromo-Sidoarjo Route)

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ABSTRACT: Regarding the number of trains that have accidents, one of them is due to damaged rails among 4 other causes, so that it has an impact on the delay and safety of the train journey itself. The purpose of this study is as an input related to the maintenance management system, especially in terms of handling problems of damage to railway infrastructure, in this case rail lines that require maintenance, especially regarding human resources who handle them, so that appropriate solutions can be obtained in short-term or long-term solutions for the comfort and safety of train travel. This study uses a mix method, and when identification is carried out, problems are found on the railway, namely the number of damages where after analysis, the results are a number of maintenance equipment that is still lacking, as well as the number of logistics or spare parts. And after being evaluated, it was found that some damage to the components of the Wonokromo – Sidoarjo cross rail road was caused by the cross load received by the cross of 11,543,796 tons/year, so that when it is associated with PM 60 of 2012 concerning Technical Requirements for Railway Lines, the Wonokromo-Sidoarjo cross should no longer be included in road class III but class II, so that maintenance management is needed in the maintenance of railway infrastructure which should be further improved, especially in terms of fulfilling certified human resources.

Keywords: maintenance management, human resources, railway infrastructure, rail lines

INTRODUCTION

According to Morlok (1985), transportation is one of the activities to move or transport something from one place to another. While transportation itself is the movement of goods or passengers from one place to another, where products are moved to the place where they are needed and in general transportation is an activity of moving something (goods and/or people) from one place to another, either with or without means, (Bowersox, 1981). For this reason, a good transportation system is needed to provide comfortable, safe but fast services for transportation passengers.

Transportation is not only in the form of vehicles on the highway such as buses and public transportation, but trains are also one of the means of transportation in the form of vehicles, which can move on rails, either by using their own drive or pulled by using other railway facilities (Karim et al., 2023).

The train itself is a mode of land transportation that serves intercity and even inter-provincial travel. When compared to other modes of transportation, trains have the advantage

of having a larger carrying capacity, but with a shorter travel time. In some areas there are local trains that only serve travel within the city or between several surrounding cities. Trains are mass transportation that is in great demand by the public so that they can reach their destinations quickly. So that PT. Indonesian Railways must provide optimal service and safety to the community in order to realize good mass transportation. For example, the train must arrive on time at the destination station according to the time stated on the passenger ticket. Trains have their own tracks, namely in the form of rail lines (Luqman & Wibisono, 2023).

The rail line in Indonesia currently stretches along the 6.32 million meters in 2020. The R 54 type railway is the most widely used in the country, namely 4.6 million meters. The least used type of rail is R 25, which is 110.2 meters (Rizaty, 2020). The railway structure itself is a construction consisting of several components such as subgrade, Subballast, Ballast and railways. Line Rails are a part of the railway system, which is very important to support the smooth operation of the railway. The technical standards for rail lines have been regulated in PM 60 of 2012. In addition to technical standards, the rail line must also be maintained so that it can continue to function as it should (Kemmala & Aris, 2023).

Railway infrastructure maintenance in PM. 32 of 2011, is an activity carried out to maintain the reliability of railway infrastructure so that it is operational. Included in infrastructure maintenance management are periodic maintenance and repairs to restore function. In periodic care management, it is divided into 3 parts, namely daily care, monthly care, and annual care. Meanwhile, in improvement management to restore function, it includes corrective improvement which is divided into classification A (severe), classification B (moderate), classification C (light) (Romadhani, Putra, Burhani, Setiawan, & Amir, 2024).

As happened on the Wonokromo-Sidoarjo crossing, which is aRailthat connects between Wonokromo StationandSidoarjo Stationat Daop VIII Surabaya. Based on data from the Railway Engineering Center class 1 of the Eastern Java Region, the length of the Wonokromo – Sidoarjo crossing is 17,629 km, of which there are 4 active stations and 1 inactive station, namely from Won okromo Station, Waru Station, Gedangan Station, Buduran Station, and Sidoarjo Station (ERSAN, 2019). This line is passed by local trains, commuter lines and express trains (long distance), and freight trains, Some of the trains that pass on the Wonokromo Station to Sidoarjo Station line are Mutiara Timur Train to Banyuwangi, Jayabaya Train from Malang to Jakarta via Surabaya Gubeng Station, Ranggajati Train to Jember, Sri Tanjung Train to Banyuwangi, Penataran Train to Malang, Surabaya Porong Komuter Train to Surabaya-Porong (pp), Freight Train (BBM) from Surabaya-Malang (pp), and Logawa Train to Jember. There is a special train stop that is reserved only forDelta Express Train(Komuter Train) (Hakim, 2024). In addition, if you take the train from Wonokromo to Sidoarjo, we can also see the view of the highway crossing which has heavy traffic from the west side of the railway, starting from Wonokromo Station to the Buduran Bus Stop. This line is connected and connects with the Surabaya Kota - Wonokromo Railway Line, Kertosono - Wonokromo Railway Line, Sidoarjo - Bangil Railway Line and Sidoarjo - Tarik Railway Line (Azis, 2018).

Wonokromo Station based on PM 33 of 2011 is a small class passenger station, located at kilometer 7+881 which is located in Jagir Village, Wonokromo District, Surabaya City. Included in the Operation Area 8 Surabaya. Meanwhile, Sidoarjo Station is included in the class of small stations which is also a station located in Lemahputro Village, Sidoarjo District, Sidoarjo Regency. Previously, Sidoarjo station, which has the name Sidhoarjo Station, is located in Operation Area 8 Surabaya at kilometer 25 + 510 (Hadi, 2023).

The Wonokromo – Sidoarjo crossing with a distance of 17,629 kilometers is still using single track. The characteristics of the Wonokromo-Sidoarjo rail line have a size of R42 issued

in 1961/1962 with concrete bearings (except on steel bridges that use wooden bearings) and bearing anchors DE Spring Clip (Safar et al., 2024). The Speed Limit (Taspat) ranges from 60-70 kilometers per hour, depending on the season, rail conditions, foundation soil and region. Based on the comparison of the arrangement of the train series between the Betmakola Fuel Train and the Bima Train with the CC-206 locomotive type, it was found that the Betmakola Freight Train with the CC-206 locomotive has an operational weight (Wlok) of 90 tons and has the largest maximum load, namely on a boiler car weighing 40 tons so that development is needed double track (Harry Yulianto, Yahya, & SE, 2018).

Meanwhile, on the Wonokromo – Sidoarjo crossing, there are still many problems that exist in the components of the rail road that can endanger trains when crossing the crossing (Hidayati & Febriharati, 2016). For example, regarding the number of trains that have accidents, one of them is due to damaged tracks among 4 other causes, such as incident in 2023 there was a Pandalungan Train plummeting at the embankment of Tanggulangin-Sidoarjo Station on Sunday (14/1/2023) at 07.57 WIB which resulted in the train line temporarily impassable (Kompas, id, 2024) In order for can minimize accidents due to a fall in the train, which has an impact on the delay and safety of the train journey itself, so a solution is needed in handling it. Damage to the bearing, then the missing anchor, Rail Defect, Mud Pumping which is one of the most common problems encountered on the Wonokromo – Sidoarjo crossing. Damaged bearings and incomplete anchors on each bearing or missing anchor have a great effect on the safety of train travel. If the bearing breaks and the anchor is lost while the train is running at maximum speed, it can cause a drop in the crossing (PRABOWO, 2023).

To be able to minimize damage to the Wonokromo – Sidoarjo crossing and to support the development of double track management is needed in the rail road maintenance system in accordance with the provisions, so that double track that are built can be maintained in quality and according to predetermined standards.

The urgency of this research stems from the critical role that railway infrastructure plays in ensuring safe and efficient transportation, particularly on high-demand routes like the Wonokromo-Sidoarjo line. Persistent rail damage and maintenance issues pose significant risks to operational safety, resulting in accidents, delays, and decreased public trust. Addressing these challenges is essential to enhance railway reliability, minimize risks, and support the growing demand for secure and efficient mass transportation systems.

While existing studies focus on general railway maintenance practices, there is a lack of detailed investigations into the specific challenges associated with rail infrastructure in Indonesia, particularly concerning the management of heavily trafficked routes like Wonokromo-Sidoarjo. Limited research has been conducted on the application of comprehensive maintenance management systems that account for localized challenges, such as outdated components, insufficient resources, and the impact of excessive loads. This gap underscores the need for tailored approaches to railway maintenance in the region.

The novelty of this study lies in its focus on developing a maintenance management framework that integrates technical analysis with resource allocation strategies to address rail damage issues. By assessing factors such as bearing quality, anchor stability, and drainage systems, the research provides a unique perspective on how infrastructure deficiencies can be mitigated. The study also introduces solutions based on compliance with updated railway standards, offering a practical approach to improving the safety and reliability of railway operations.

The objective of this research is to analyze the causes of rail damage on the Wonokromo-Sidoarjo line and propose effective maintenance management strategies to ensure compliance

with national railway standards. The findings aim to benefit railway operators by providing actionable recommendations for improving infrastructure durability and operational safety. Additionally, the study offers insights for policymakers to strengthen regulatory frameworks and allocate resources effectively. Ultimately, the research contributes to the development of safer, more efficient railway systems that align with the needs of modern transportation demands.

Therefore it needs to be done"MAINTENANCE MANAGEMENT IN HANDLING THE PROBLEM OF RAIL DAMAGE THAT AFFECTS THE SAFETY OF RAILWAY TRAVEL", In order to minimize accidents due to a fall in the train which has an impact on the delay and safety of the train journey itself.

RESEARCH METHODOLOGY

The research design employed is a case study approach, deemed the most suitable method for the investigation phase of research as it emphasizes surveys and historical processes to provide causal explanations. The quality criteria of this design encompass several key aspects: construct validity ensures accurate operational definitions for the concepts under study, utilizing multi-source evidence and allowing key informants to review draft case study reports; internal validity establishes cause-and-effect relationships by considering specific conditions that influence others, distinguishing them from pseudo-relationships; external validity defines the domain in which study findings can be generalized; and reliability ensures that data collection procedures yield consistent results across different timeframes. Additionally, a comparative research design is incorporated, adhering to three essential criteria for establishing cause-and-effect relationships: the cause must precede the effect over time, the variables must vary, and there must be no alternative explanations for the observed relationship. This comprehensive framework ensures the robustness and credibility of the research findings.

Figure 1 Research Design

RESULT AND DISCUSSION

Indicators of rail line damage problems that affect the safety of train travel on the Wonokromo-Sidoarjo crossing

On the rail road on the Wonokromo – Sidoarjo crossing, there are disturbances such as missing anchors, *rail defects*, and broken bearings. These disturbances, if left unchecked, will result in train travel traffic that passes on the Wonokromo – Sidoarjo crossing. In the results of the DMJR (Rail Road Material Data) survey carried out, several damage to the rail road along the Wonokromo – Sidoarjo crossing was found, as follows:

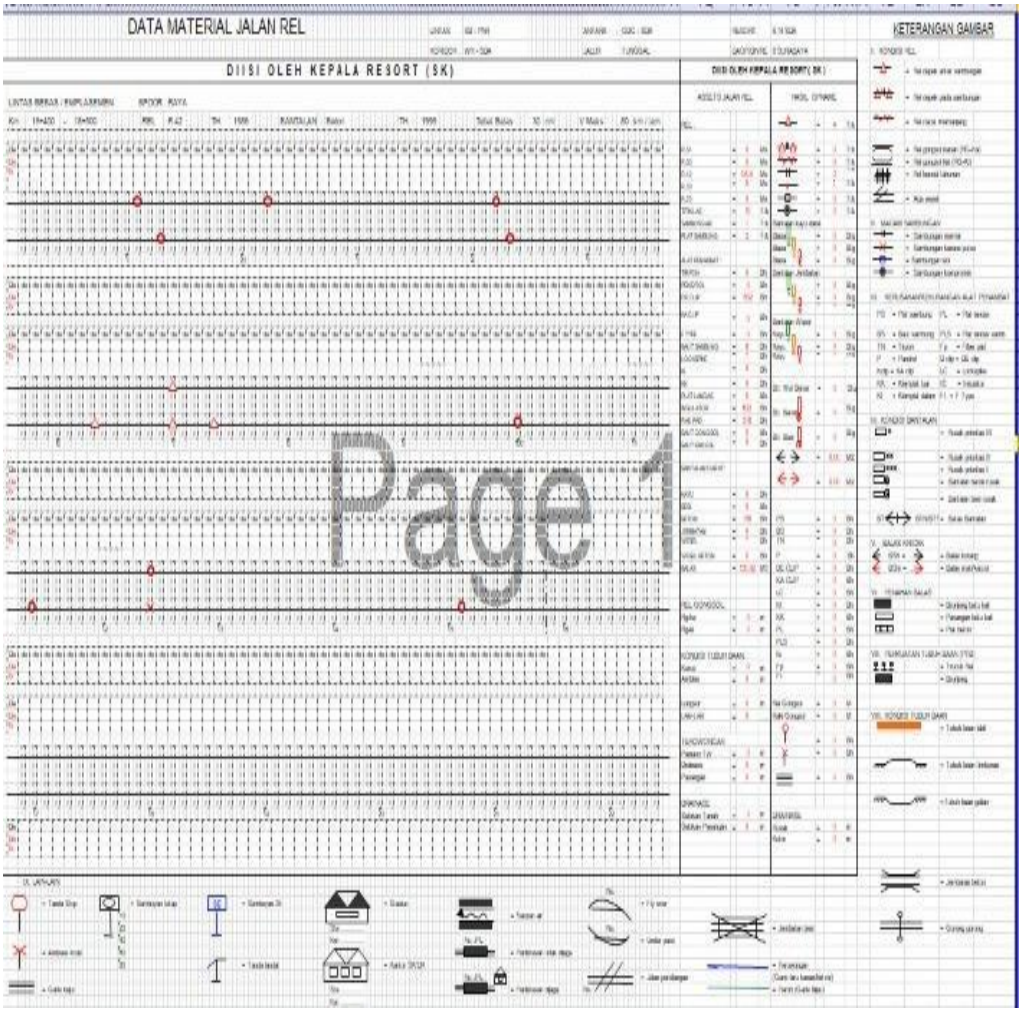

Figure 1 DMJR Sheet (Rail Road Material Data)
Source : Sidoarjo Road and Bridge Resort, 2023

The discovery of damage to the rail road includes:

1. Broken Bearings

From the results of the survey conducted during the field research, there was damage to the bearing at KM 21 + 657. And according to PM 32 of 2011 concerning Standards and Procedures for Railway Infrastructure Maintenance, it is stated that bearings that experience cracks are categorized into the C (light) classification which means that they are still classified as safe because they do not interfere with train travel and the distance between the average bearings on the Wonokromo - Sidoarjo crossing which was found at that time was 45 cm to 58 cm long. Seen in **Picture** 4,2

Figure 2 Broken Bearing
Source : Personal doc of field survey results, 2023

After analyzing the damage to this bearing, it turns out that it is influenced by material factors, namely the existence of less reaction conditions, and geometric factors (such as unstable soil quality) also have an effect. But if the damage has been included in the A (heavy) classification, then the bearing must be replaced immediately because it will interfere and endanger the train journey that will pass through the line.

The solution is to maintain the bearing function according to the design that has been set. The scope for performing maintenance on rail bearings is:

a. Checking the condition of the bearing;
b. Checking the distance between the bearings;
c. Replacing damaged bearings.

To perform bearing maintenance, the following minimum tools are required:

a. Scratch;
b. Dustpan;
c. Palu;
d. Pen puller;
e. Crowbar.

Standards in carrying out bearing maintenance in accordance with Ministerial Regulation Number 32 of 2011 must be carried out twice, namely, monthly maintenance and annual maintenance

The distance between the bearings and other bearings is 60 cm and the number of bearings per 100 meters is 166 – 167 bearings. To find out the number of bearings on the Wonokromo – Sidoarjo crossing using the following formula:

Formula 1 Bearing Formula

$$\sum Bantalan = \frac{panjang\ track}{0{,}6}$$

Information:

a. 0.6 is the distance between the bearings (meters)
b. The length of the track is the length of the Wonokromo – Sidoarjo crossing

So the calculation results:

$$\sum Bantalan = \frac{17.629}{0,6} = 29.382\ bantalan$$

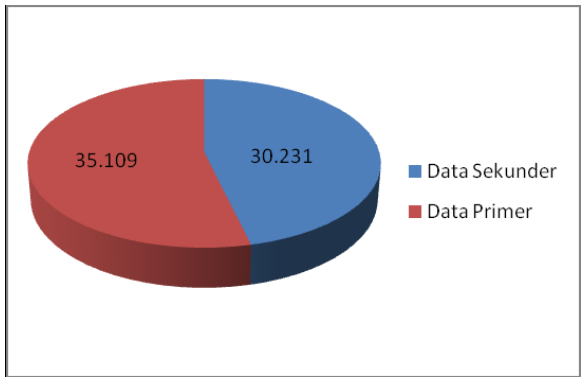

Figure 3 Comparison of the number of bearings

Table 1 Existing Bearing Data

Wonokromo - Sidoarjo Cross Bearing Data	
Street Plot	**Number of Bearings**
Wonkromo - Waru	8.149
Waru - Gedangan	9.865
Gedangan - Buduran	9.258
Buduran - Sidoarjo	7.837
Sum	35.109

So if we look at the calculation above which is in accordance with the standard, the results of 29,382 bearings along the Wonokromo to Sidoarjo crossing are obtained, but in the results of the Rail Road Material Data (DMJR) carried out there are 35,109 bearings. So if you look for the cause of the number of bearings more than the standard number:
1) due to the inappropriate distance between the pads, which is 60 cm,
2) Because the attached anchor is not tight or loose.

Therefore, why on the Wonokromo – Sidoarjo crossing, especially after the Gedangan station at kilometers 18 + 100 – 18 + 200, the number of bearings at the kilometer amounts to 189 bearings which should be the number of bearings per meter, which should be 166 – 167 bearings. Because the distance between the bearings is not in accordance with the standard and also at the kilometer there are many anchors that are shaky or not tight which causes the bearings to shift every time the train passes.

So the solution that can be done is to rearrange the bearings with a standard distance of 60 cm and tighten the anchors on each bearing so that the distance and number of bearings every 100 meters are maintained and in accordance with the standards that have been set.
So that to solve these problems is done by:

a. Conduct periodic checks on shaky anchors and tighten anchors or replace anchors;
b. Measure each distance between the bearings in accordance with the standard of 60 cm, replace the damaged bearing immediately;
c. Ensure sufficient supply of bearings.

2. Rail Defect

Figure 4 *Rail Defect*

Source : Doc

On the Wonokromo – Sidoarjo crossing, the type of rail type R.42 is used, on the crossing there are *defective rails* or worn rails. *Rail defects occur due to friction between the wheels of the train that is too fast, causing a depression in the rail body. In addition, due to the existence of this rail defect*, there is discomfort felt by passengers when the train passes on the track, namely a slight jolt.

According to PM 32 of 2011 concerning Standards and Procedures for Railway Infrastructure Maintenance, rail road maintenance activities include:

a. Periodic maintenance consisting of:

1) Daily maintenance.

2) Monthly maintenance.

3) Annual maintenance.

b. Fix to restore functionality.

According to Ministerial Regulation No. 24 of 2015 concerning Railway Safety Standards on *rail defects* or rail wear has tolerances measured on the vertical axis (a) and in the direction of 450 from the vertical axis (e), rail wear for each type of rail is as follows

Table 4 Rail Wear

RAIL TYPE	e Maximum (mm)	a Maximum (mm)
R.25	10	10
R.33	12	10
R.42	13	10
R.50	15	12
R.54	15	12
R.60	15	12

Source: Ministerial Regulation No. 24 of 2015 concerning Railway Safety Standards

On the Wonokromo – Sidoarjo crossing using the R.42 rail type and all *rail defects* can still be tolerated.

Solving the problem of *rail defects*, namely:

a. Visually check and measure the wear of the rails.

b. Perform welding if the wear has exceeded the tolerance limit.

3. Missing Anchor

Figure 5 Missing Anchor
Source: Doc

A very dangerous disturbance to the rail road is if the anchor is lost three times in a row. And causing the width of the rail to change and result in when the train runs at maximum speed, there will be a drop.

On the Wonokromo – Sidoarjo crossing, there are still many missing or incomplete anchors, it is caused by the clamp nails that are cushioned in a loose state so that if the train passes at maximum speed there will be vibrations that result in the anchor coming off.

In the survey that has been carried out to find out the actual number of anchors with those in the field, the following anchor calculation formula is used:

$$\sum Penambat = \sum Bantalan\ x\ 4$$

Information:
1. The number 4 is the number of anchors for each bearing;
2. The number of bearings is the total bearing used on the Wonokromo Sidoarjo crossing.

So the calculation is as follows:

$\sum Penambat =$ 29.382 x 4
= 117,528 pieces

From the results of the calculation, 117,528 anchors were obtained according to the standard, but the results of the calculation were different from the results obtained from the survey, which was 117,517 pieces. And at the time of the DMJR survey, there were also 4,547 poor anchors. So it means that the anchor on the Wonokromo – Sidoarjo cross rail line still does not meet the standards.

The solution is by:
a. Visual checking;
b. Check the strength of the swaying anchor and tighten it for the rigid anchor type, and replace the elastic anchor

So that the need for maintenance actions on the anchor, the goal is to be able to maintain the function of the anchor in accordance with the design that has been set.

The scope for mooring treatment includes**:**
a. Inspection of the completeness of the anchor.
b. Clamping strength check.

c. Replacement on missing anchors.
Tools used to perform anchor maintenance include:
a. Steel hammer
b. Penpuller
4. Mud Pumping

Figure 6 *Mud Pumping*
Source : Doc

Mud pumping (stuck) is caused by a poor functioning of the drainage system which results in the flow of water when it rains cannot decompose properly, so that water settles under the bearing. If this happens and continues to be left unchecked, it will cause the bearing to not function perfectly. With that, drainage maintenance is carried out to keep the flow of water from interfering with train operations. The scope of drainage treatment includes:
a. Check the slope of drainage;
b. Check the condition of drainage flow;
c. Checking the condition of drainage buildings;
d Repair of drainage channels.

Figure 7. Drainage
Source: Doc

In the picture above, it can be seen that the drainage system is still very poor, when it rains, the area will experience flooding that almost covers the rail road on the right side.

The tools used to carry out drainage maintenance, the minimum are as follows:

a. Serokan
b. Dustpan
c. Water pass

Drainage problems can be solved in the following ways:

a. Reactivation of drainage that is no longer functioning;
b. Cleaning sewers clogged with garbage or grass growing around the drainage;
c. Rehabilitation of drainage channels.

5. Reply

Underreply is one of the rail road disturbances caused by the absence of a stopper reply that functions to hold back the backlash so that it does not scatter when receiving vibrations when the train passes. On the Wonokromo-Sidoarjo crossing, there is still a rail road disruption, namely a low volume of feedback. This is clearly seen in the picture of the condition of the rail road in the following picture:

Figure 8 Volume Reply Less

Source: Doc

If viewed from the appropriate standards are as follows:

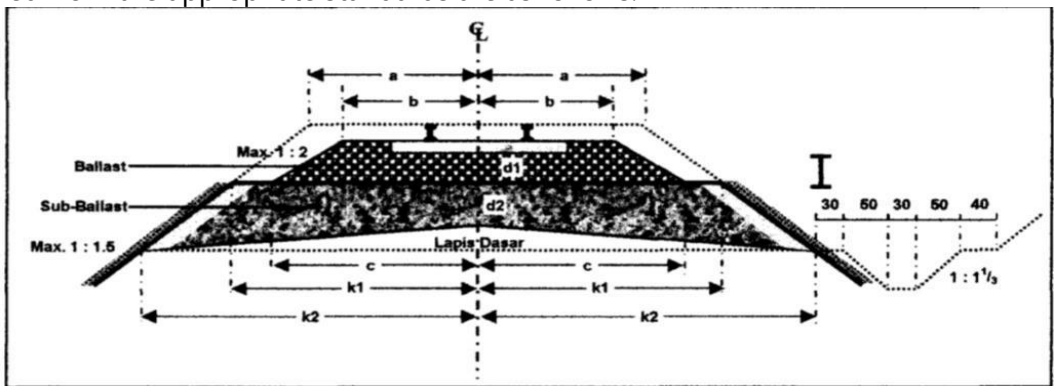

Figure 9 Cross-section of the railway on the straight section

Source: PM No. 60 of 2012 concerning Technical Requirements for Railway Lines

Table 5. Cross-section of the railway road

KELAS JALAN	V Maks (km/jam)	d1 (cm)	b (cm)	c (cm)	k1 (cm)	d2 (cm)	e (cm)	k2 (cm)
I	120	30	150	235	265	15 – 50	25	375
II	110	30	150	235	265	15 – 50	25	375
III	100	30	140	225	240	15 – 50	22	325
IV	90	25	140	215	240	15 – 35	20	300
V	80	25	135	210	240	15 – 35	20	300

Source : PM 60 of 2012 concerning Technical Requirements for Railway Lines

Impact of Maintenance That Does Not Refer to Rail Road Construction Standards

One of the factors that cause damage to rail roads is *tonnage* or cross loads. The cross-load of a rail road depends on the class of the cross-rail road. If the construction requirements of the road class cannot be met due to the improper maintenance process, the quality of the rail road will decline and will no longer be in accordance with the cross load.

Based on PM 60 of 2012 concerning Technical Requirements for Railway Lines, rail road classes are divided based on the width of the rail road, namely the width of the rail road is 1067 mm and the width of the rail road is 1435 mm, and for the Wonokromo – Sidoarjo crossing there is a rail road width of 1067 mm. The following is the calculation of *the passing tonnage* on the Wonokromo – Sidoarjo crossing:

1. Passing Tonnage is a formula used to calculate the load received at a rail crossing.
2. Passing tonnage calculation factor,
   a. The number of trains passing on the crossing;
   b. Stamformation/number of train series passing through the crossing;
   c. The type of locomotive used (not all locomotives have the same weight).

Table 6. Width of 1067 Rail Road

Kelas Jalan	Daya Angkut Lintas (ton/tahun)	V maks (km/jam)	P maks gandar (ton)	Tipe Rel	Jenis Bantalan / Jarak antar sumbu bantalan (cm)	Jenis Penambat	Tebal Balas Atas (cm)	Lebar Bahu Balas (cm)
I	$> 20.10^6$	120	18	R.60/R.54	Beton / 60	Elastis Ganda	30	60
II	$10.10^6 – 20.10^6$	110	18	R.54/R.50	Beton/Kayu / 60	Elastis Ganda	30	50
III	$5.10^6 – 10.10^6$	100	18	R.54/R.50/R.42	Beton/Kayu/Baja / 60	Elastis Ganda	30	40
IV	$2,5.10^6 – 5.10^6$	90	18	R.54/R.50/R.42	Beton/Kayu/Baja / 60	Elastis Ganda/ Tunggal	25	40
V	$< 2.5.10^6$	80	18	R.42	Kayu/Baja / 60	Elastis Tunggal	25	35

Source: Ministerial Regulation No. 60 of 2012 concerning Technical Requirements for Railway Lines

Above is a table for determining the road class with a rail road width of 1067 mm.

1. *Passing Tonnage* calculation is*:*
   a. Train Frequency Across Wonokromo – Sidoarjo:

1) Passenger train = 34 trains/day
2) Freight train = 10 trains/day
3) commuter train = 16 trains/day
Number = 60 trains/day

b. Stamformation of the Wonokromo – Sidoarjo Cross-Line Railway:
1) Total 1 passenger train network = 9 trains
2) Number of 1 freight train = 12 cars
3) Total 1 commuter train = 6 trains

c. Weight of Facilities:
1) Cart weight = 35 tons
2) Car weight = 44 tons
3) Commuter train weight = 35
4) Locomotive weight = 84 tons d. Number of networks/day:

d Number of networks/day:
1) Passenger train = 34 x 9 = 309 trains
2) Freight train = 10 x 12 = 120 carriages
3) Commuter train = 16 x 6 = 96 trains
Total = 525 trains/day

e. Network Weight:
1) Passenger train = 309 x 35 = 10,815 tons
Commuter train = 96 x 35 = 3,360 tons
Amount = 14,175 tons
2) Freight train = 120 x 44 = 5,280 tons
Passenger tonnage (Tp): 14,175 tons
Tonnase of goods (Tb) : 5,280 tons

f Tonnase locomotive (T1):
CC 201 = 84 tons
Total locomotive tonnage = (34 + 10 + 16) x 84 = 5,040 tons

Passing Tonnage Calculation Formula:

$$T = 360 \times S \times TE$$

Information:
T = Cross Load
S = 1.1 (for passenger train crossings with a maximum speed of 110 km/h)

TE Formula = Load Coefficient and Cross Quality

$$TE = Tp + (Kb \times Tb) + (K1 \times T1)$$

Information:
KTp = Weight of Passenger Train Network (tons/day)
Kb = Load Coefficient (1.5 for axle load < 18 tons)
Tb = Weight of Freight Train Series (tons/day)
K1 = Cross Quality Coefficient (1,4)
T1 = Locomotive Weight

The calculation of the Wonokromo – Sidoarjo Cross Load is obtained as follows**:**

Tp = 14,175 tons/day
Tb = 5,280 tons/day
Kb = 1.5
K1 = 1.4
T1 = 5,040 tons/day
S1 = 1.1

So:
TE = Tp + (Kb x Tb) + (K1 x T1)
= 14.175 + (1.5 x 5.280) + (1.4 x 5.040)
= 14.175 + 7.920 + 7.056
= 29,151 tons/day
So T = 360 x S x TE
= 360 x 1,1 x 29,151
= 11,543,796 tons/year

So that from the calculation above, a passing tonnage of 11,543,796 tons/year was obtained, which means that the Wonokromo – Sidoarjo crossing is still included in the III road class, but in the results of the interview survey, it turns out that the Wonokromo – Sidoarjo Road and Bridge Resort has entered the II road class, so if this is not adjusted immediately, the damage to the rail road components along the Wonokromo - Sidoarjo route will remain and increasingly the impact will be affect the safety of train travel.

When associated with PM 60 of 2012 concerning Technical Requirements for Railway Lines, the observation results show the suitability of technical construction as follows:

Table 7 Rail Type Conformity

Rail Type		**Conformity**	
Standard	**Observation Results**	**Appropriate**	**Not Suitable**
R.54	R.42		√
R.50	R.42		√

Table 8 Bearing Suitability

Bearing Type		**Conformity**	
Standard	**Observation Results**	**Appropriate**	**Not Suitable**
Concrete (60 cm)	Concrete (60 cm)	√	
Wood (60 cm)	Wood (60 cm)	√	

Table 9 Speed Suitability

Maximum Speed (km/h)		**Conformity**	
Standard	**Observation Results**	**Appropriate**	**Not Suitable**
110	80		√

Table 10 Axle Load Suitability

Maximum Axle Load (tons		Conformity	
Standard	**Observation Results**	**Appropriate**	**Not Suitable**
18	18	√	

Table 11 Peg Conformity

Types of Anchors		Conformity	
Standard	**Observation Results**	**Appropriate**	**Not Suitable**
Double Elastic	Double Elastic	√	

Table 12 Carrying Capacity Suitability

Cross Carrying Capacity (tons/year)		Conformity	
Standard	**Observation Results**	**Appropriate**	**Not Suitable**
5.106 – 10.10^6	11.543.796		√

As a result, there are several tables that are declared non-compliant, namely the rail type suitability table, the speed suitability table, and the carrying capacity suitability table. For the rail type conformity table that does not conform, the change of rail type from the R.42 rail type should be changed to the R.54/R.50 rail type, while the speed conformity table also has discrepancies, it is all due to the Wonokromo-Sidoarjo cross-rail road class should be included in the road class two, not road class three.

The solution can actually be adjusted by replacing rail road components that are in accordance with road class two, such as the R.42 rail type is replaced with the R.54 rail type and the crossing carrying capacity is adjusted to the crossing carrying capacity, which is 10,106 – 20.10^6 tons/year, then the maximum speed of the train will be 110 km/h.

This discrepancy is caused by several things, such as delays in replacing damaged or missing rail components caused by several things, including a shortage of spare parts, a shortage of maintenance personnel and a shortage of equipment for repairs.

For example, the impact caused if the maintenance of the rail road is not in accordance with the standard of maintenance of the railway road construction then it will result in:

a. There is a lot of damage to the bearings such as broken bearings and the distance between the bearings is not in accordance with the standard of 60 cm;
b. Many of the anchors in the pads are missing and loose;
c. There is damage to the rails such as *defective* rails or worn rails;
d. Poor *drainage* system.

Good Maintenance Management in Handling Damage Problems Wonokromo-Sidoarjo Cross Rail Line

From some of the problems above, it is necessary to fulfill the requirements of good maintenance management in the technical handling of the railway line on the Wonokromo - Sidoarjo route which requires support from several things, including:

a. Human Resources

Human resources are one of the important sectors in the maintenance of railway infrastructure. Without good human resources, the maintenance of railway infrastructure will not run optimally. On the Wonokromo – Sidoarjo crossing, there are two resorts that carry out railway infrastructure maintenance, namely roads Rail. Resort 8.11 Surabaya Gubeng has 13 employees in charge of maintenance while resort 8.14 Sidoarjo has 12 maintenance employees. So there are 25 people in total and 16 people who have been certified, while for those who have not been certified there are 9 people. This causes the rail road maintenance process on the Wonokromo – Sidoarjo crossing to not be optimal because there are still maintenance officers who have not been certified. So it is necessary to provide training and certification to every employee who has not been certified in rail road maintenance.

b. Maintenance equipment in accordance with the provisions of PM 32 of 2011 concerning Standards and Procedures for Railway Infrastructure Maintenance;
c. Adequate logistic support for all rail components so that there are no more damaged bearings, loose anchors, less backlash, because they can be replaced immediately.

CONCLUSION

Based on the description above, it can be concluded that the indicator of the problem of rail line damage that affects the safety of train travel on the Wonokromo-Sidoarjo crossing is caused by the cross load received by the cross of 11,543,796 tons/year, this figure is not in accordance with the existing rail road class on the Wonokromo-Sidoarjo cross if based on PM 60 of 2012 should no longer be road class III, but there is an increase to the road class II. The problems of damage to the rail line were identified as follows: 1) the bearing broke at KM 21 + 657 along 45cm - 58cm (still relatively light), 2) the number of bearings exceeded the existing standard by 35,109 which should have amounted to 29,382 3) at the kilometer there were many anchors that were shaking or not tight which resulted in the bearing shifting every time the train passed.4) there was a rail defect or natural wear due to friction between the wheels of the train that is too fast so that it causes a depression in the rail body, 5) Mud pumping occurs due to the reduced function of the counter layer as a bottom soil filter. 6) Many anchors are missing (incomplete) caused by the clamps that are in the bearing in a loose state so that if the train passes At maximum speed, there will be vibrations that result in the anchors coming loose and the number of anchors not in accordance with the existing standards which should be 117,528, of which there are only 117,517 and there are still 4,547 anchors that are not good, so it can be said that it is still not in accordance with the existing standards. 7) There are still some places where the volume of reply is not in accordance with existing standards, due to the absence of a stopper reply that functions to hold the response so that it does not scatter when receiving vibrations when the train passes.

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