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Review Paper on Brake Shoe Failure

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Abstract: ***Brake shoe is the component which is mainly used in braking system. Indian railway braking system is one of the complex and high maintenance processes system. Mainly due to the less quality material of the brake shoe used in railway it comes under high maintenance zone due to which brake shoe get fired usually. As the brake shoe catch fire the material of the brake shoe melt and stick with the wheels of the train and changes the inner dimension of the wheel which leads to damage of wheel and increase the chances of accident.***

In this paper we are going to do analysis on brake shoe by some software which will help to find stress analysis and thermal analysis and finally suggest some solution in relation to the material of the brake shoe.

Keyword: component, maintenance, stick, inner dimension, accident

I. INTRODUCTION

Brake shoe plays an important role in the braking system .Currently the brake shoe used in Indian railway is "L Type UIC 270". The maximum durability of this material is one month and some in single journey it may be replaced. So while study on the material we got to know that resins plays an important role in the composition of the material of the brake shoe. However the resin material use now a day is phenolic resin.

So in this project we are studying on different resin material properties to overcome the problem of durability, sustainability of brake shoe with the help of some analysis software.

Fig1:-Brake shoe on ICF Bogies

II. DEFECT ON BRAKE SHOE

A. Cracks on wheel of the ICF bogie due to improper adjustment of brake shoe in the braking system

B. Brake shoe melt and layer get stick on the wheel due to high temperature between the brake shoe and the wheel.

C. Material composition, load, heating, stress generation due to improper braking system.

III. CONDITION OF BRAKE SHOE AND WHEEL

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Fig 2: CONDITION OF BRAKE SHOE

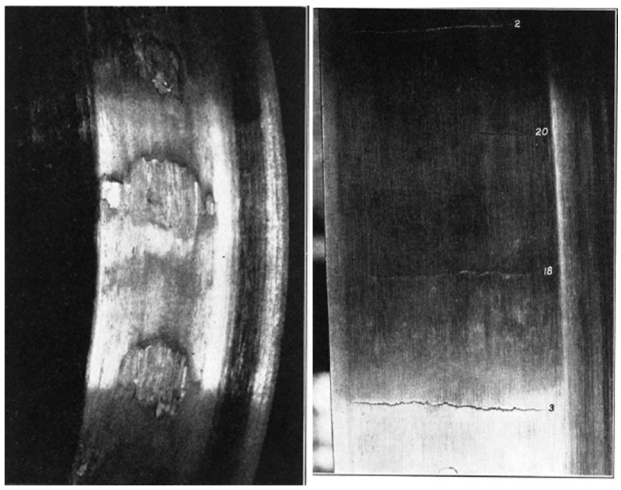
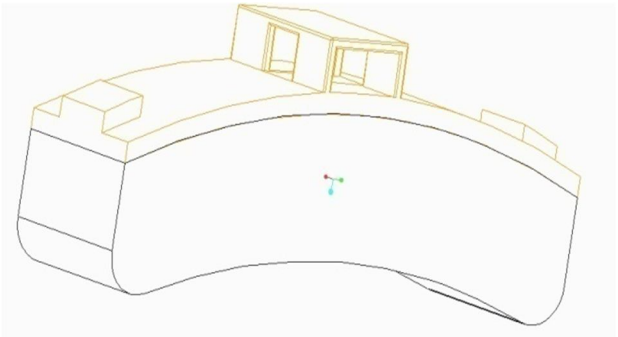


Fig 3: DEFECTIVE OF WHEEL



WIREFRAME MODEL OF BRAKE SHOE

IV. THEROTICAL CALCULATION

A. Force of Brake Shoe

$$Ft = Rn \times \mu$$

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1) Ft = Tangential braking force
2) Rn=Normal force pressing the brake block on the wheel
3) μ= Coefficient of friction =0.4 ,(reference Design book)

B. Coefficient Of Friction

$$\mu = \frac{Ft}{Rn}$$

Another formula if angle of contact is more than 60˚

$$\mu' = \frac{4\mu \sin\theta}{2\theta + \sin 2\theta}$$

Angle of contact is 100^0,
Therefore, equivalent coefficient of friction,

$$\mu' = \frac{4.00 \times 0.41 \sin 50}{1.782 + \sin 100}$$

Where, $2\theta = \frac{\pi}{180} \times 100 = 1.782$

$$\mu' = 0.4556$$

C. Calculation Of Tangential Force

Taking moments about the fulcrum O^1, we have

$$P \times l = Rn^1 \times x + Ft^1 \times a$$

$$P \times 455 = Rn^1 \times 210 + Ft^1 \times (178 - 48)$$

Substituting $Rn^1 = \frac{Ft^1}{\mu}$

$$P \times 455 = 578.41\ Ft$$

$$Ft^1 = \frac{P \times 455}{578.41}$$

$$Ft^1 = 0.755 \times P$$

Taking moments about the fulcrum O^2, we have

$$P \times 455 + Ft^2 \times (178 - 48) = Rn^2 \times 210$$

Substituting $Rn^2 = \frac{Ft^2}{\mu}$

$$Ft^2 = \frac{P \times 455}{319.45}$$

$$Ft^2 = 1.459 \times P$$

'P' applied at end of the lever is 3697 N
Tangential force, on the right hand side

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$$Ft^1 = 2685.51\ N$$

Tangential force, on the left hand side

$$Ft^2 = 5665\ N$$

Ft² is maximum so we will design the shoe with Tangential force, Ft²

D. Calculation Of Normal Force

Normal force, on the right hand side

$$Rn^1 = \frac{2783.23}{0.451}$$

$$Rn^1 = 6266\ N$$

Normal force on the left hand side of the shoe

$$Rn^2 = \frac{5913}{0.451}$$

$$Rn^2 = 12290\ N$$

Rn² is maximum so we will design the shoe with Normal force.

E. Width Of Brake Shoe

Let,
b= width of the brake shoes in mm.
We know that projected bearing area for one shoe
Ab= b(2r$\sin\theta$)

Ab= b(2×1.7512$\sin 50$)

Ab= 268.00 b

Rn² is maximum so we will design the shoe with normal force ,

$$Pb = \frac{Rn^2}{Ab}$$

$$0.3 = \frac{12290}{268.00b}$$

B= 84.12 MM

F. Involvement Of Software

1) Cero, Pro-E software.
2) ANSYS.

V. LIFE OF BRAKE SHOE

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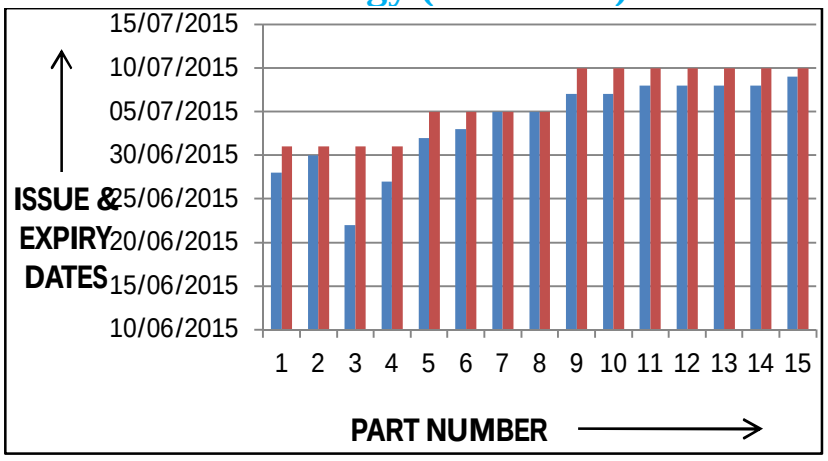
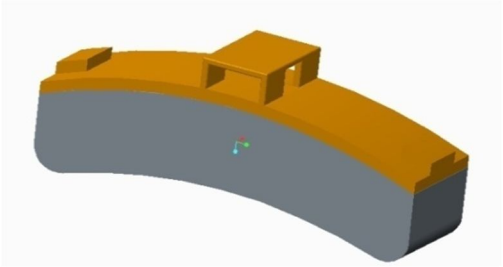


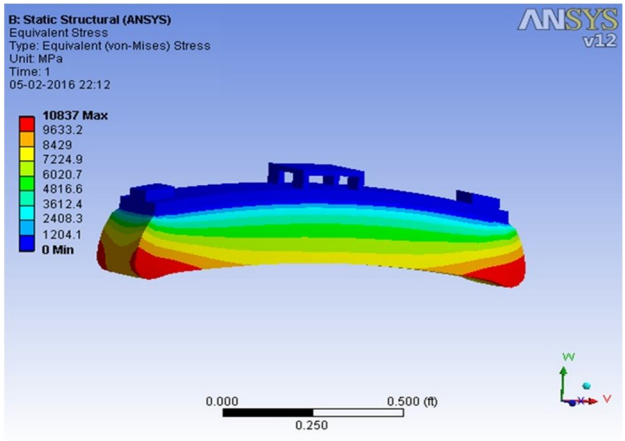
SOLID MODEL DIAGRAM OF BRAKE SHOE



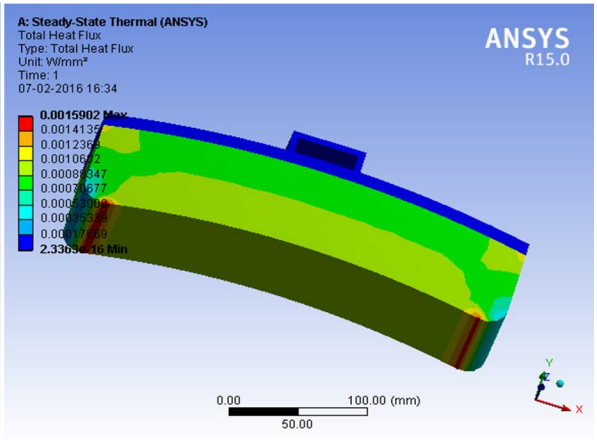
VI. MODEL ANALYSIS

8.1 ANALYSIS OF EXISTING MATERIAL (PHENOLIC):

EQUIVALENT STRESS: PHENOLIC MATERIAL



TOTAL HEAT FLUX: PHENOLIC MATERIAL



VII. CONCLUSION

After studying different resin properties and various software analysis we come to conclusion that there are too many resin better than phenolic resin such as epoxy, silicon, thermoplastic polyamide, cyanide ester, alkyl benzene.

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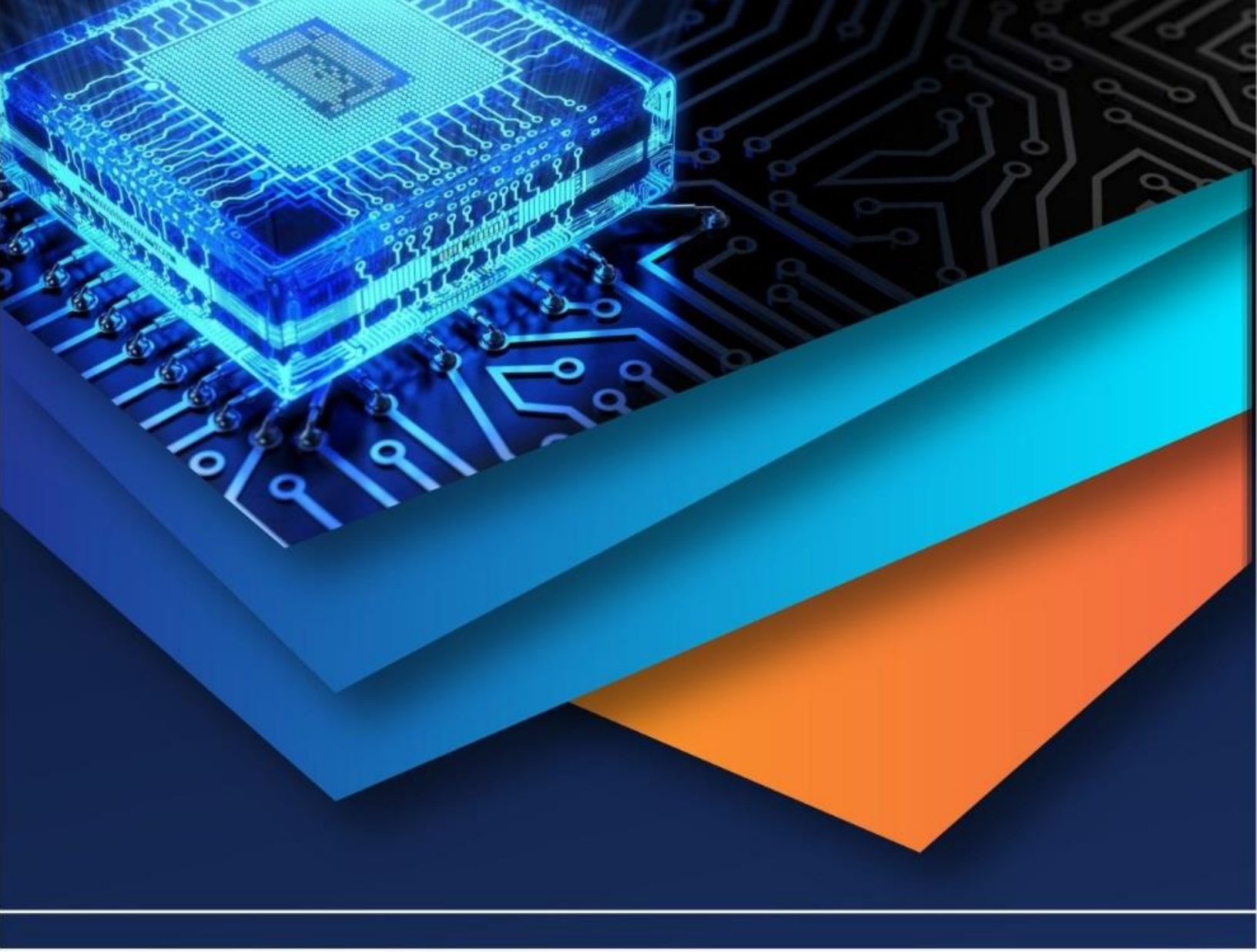

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