Effect of Brake Liner Wear and Surface finish on Braking time

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Abstract Brakes are one of the most important safety appliances. In this study**,** asbestos-free brake pads were studied for wear and surface finish. High quality brake liner has enabled to lead investment in new production techniques and design technology. Safety has created higher demands on strict requirements for new braking pad composition. An attempt is made through this project to incorporate braking time. In this study the brake pads are tested for wear and effect of surface finish

***Index Terms*— Unpretentious, Quenching agents, Brake pads. fail-to-safe, impeccable, pragmatic** *(key words)*

I. Introduction

A common understanding about brakes is that brakes squeeze against a drum or disc, and the friction of brake pad squeezes action and hence slows the motion. It should be highly unpretentious to wear and must have outstanding thermal conductivity, so as to get consistent performance. It is obvious that efficient design of braking systems is to reduce accidents. The brakes regulates the speed by converting kinetic energy to heat and this heat is then degenerate to environment. The brake disc withstands a large number of braking operations and is sensitive to pressure applied by pads, surface hardness of pads, temperature generated on pads, surface roughness, moisture and oil absorption capacity & load on liner. The brake linings having a longer life period and potential can reduce "brake fade" problem. In this study, the brake lining are of asbestos-free material. The abrasives proportion used in brake friction material depends upon surface hardness and stickiness and other quenching agents. The lining must be capable of persisting high temperatures without excessive wear, subsequently the lining is the heart of the braking system which transforms the vehicle's kinetic energy into heat.

Brake linings are manufactured of a moderately soft but tough and temperature-resistant material with a high factor of dynamic friction naturally mounted to a solid metal support using high-heat adhesives or rivets. The complete assembly together with lining and support is then frequently called a brake pad or brake shoe. These pads are of two categories commercial and racing. The friction coefficient "μ" for commercial brake pads is usually in the low range. The friction coefficient "μ" for racing pads is high range with excellent high-temperature behavior. The friction and wear behaviors are not inborn characteristics of friction materials, these parameters may be influenced by many factors such as braking and surrounding conditions. It is believed that the investigations on the friction and wear behaviors of brake's friction materials must be valuable for controlling friction, reducing wear, developing new fine friction materials, and improving braking consistency

II. Motor Brake

Brake motors provide the means of decelerating or ending the driven equipment effectively and ensuring safety in a short time period. The brakes are single liner type, fixed on the non-drive end of the motor. They are spring pragmatic electrically released units, which provide fail-to-safe operating features, such that on distraction, or failure of the power supply, the brake will engage and arrest the load. The common frames used in industrial application with

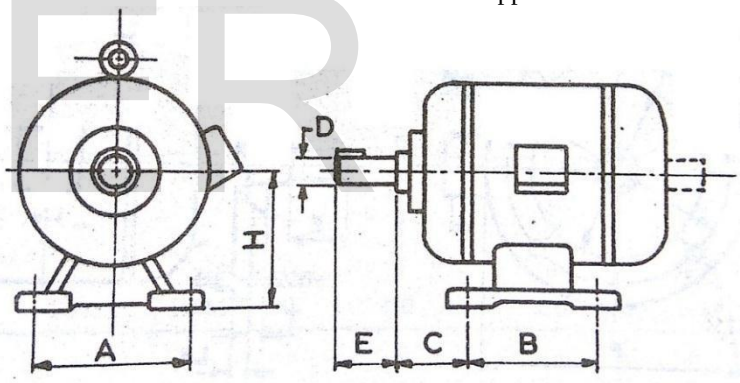


Fig 1 Foot Mounted Motors [12]

Frame No	H	A	B	C	D	E
71	71	112	90	45	14j6	30
80	80	125	100	50	19j6	40
90	90	140	100	56	24j6	50
100	100	160	140	63	28j6	60
112	112	190	140	70	28j6	60

Table 1 Frame Details [12]

III. Modes Of Operation

Braking is done on various modes. These are dependent on the application and braking necessities so that the selected brake should meet the application requirements.

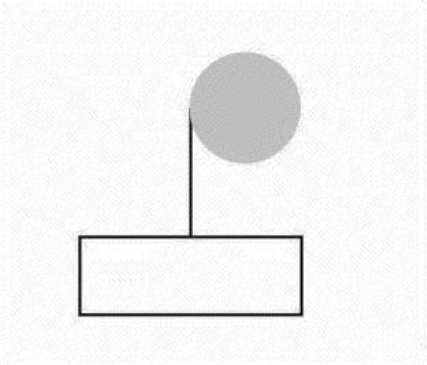


Fig 2 Holding [1]

Holding:

A. This approach is where the brake is used to grip the fixed load as shown in Fig 2.

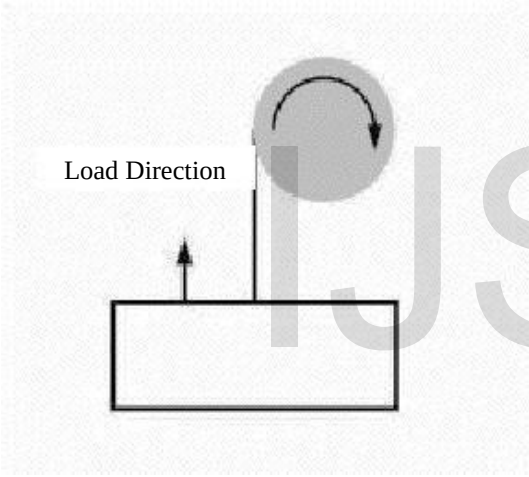


Fig 3 Load assisted braking [1]

Load assisted braking:

B. This braking mode is where the load is supporting the braking action as shown in Fig 3.

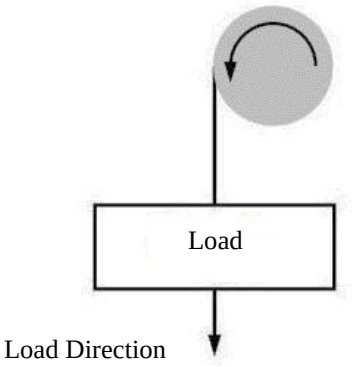


Fig 4 Over hauling braking [1]

Over hauling braking:

C. This braking mode is where the load is acting in contradiction of the braking action as shown in Fig 4.

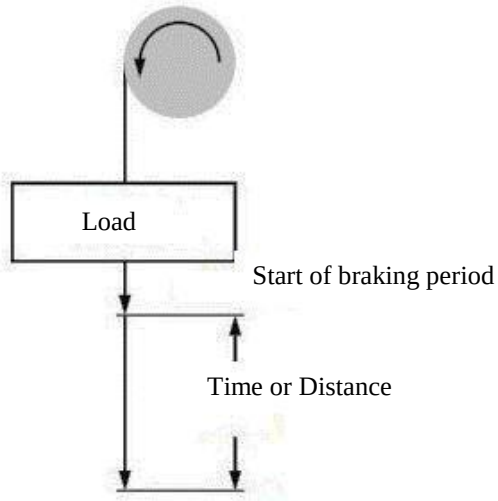


Fig 5 Soft stop braking

[1] Soft stop braking:

D. This braking mode is where the braking action is gradual over a permitted time period or distance as shown in Fig 5.

IV. Methodology

The brake liners were tested on a setup, for Surface finish, wear and temperature treatment on liner and surface hardness, temperature generated on liner surface.

Surface finish:

The brake liner performance was checked for various surface finish and pressure applied by the liner to friction disc. The 30 µ finish was done on lathe turning operation and 20 & 10µ were obtained from diamond surface grinding. The test results were noted and plotted for study purpose. Friction pads are especially used in such brake systems in order to absorb the kinetic energy of a machine. Friction is greatly affected by surface finish. Therefore, research is conducted on generating the surface with minimum roughness.

Wear:

The brake pads were tested for wear by subsequently braking with iterations. This hardness can be determined by the Shore D Hardness tester. The wear can be calculated by dial gauge as shown in fig 8.

The pneumatic pressure is supplied by compressor, which is measured by pressure controller on compressor and setup. This pressure can be brought in working condition by On/Off Knob. The brake liner disc is mounted on brake disc holder. Motor drives the Driven pulley and this transmits power to Braking Disc. The brake is applied on braking disc and the stopping time is recorded. Brake liner was tested on following setup:

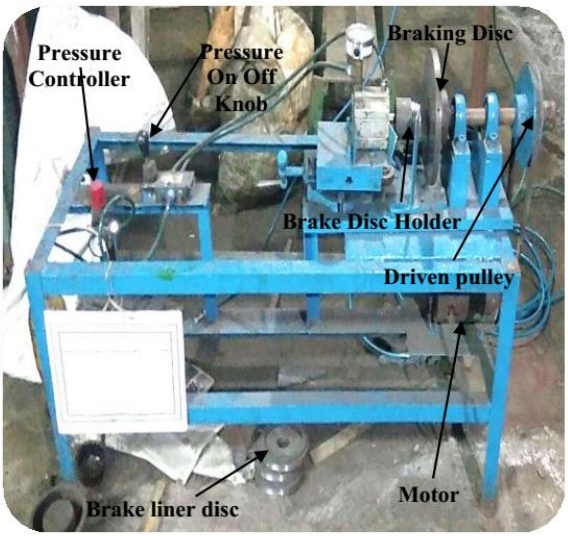


Fig 6 Set up for Brake Liner testing [10]

Fig 7 Brake Liner Disc [10]

Fig 8 Brake Liner surface check [10]

V. Material Constituents:

The major constituents of materials are Rubber, Wool, Metal fines, Various Resins, Slag and quenching agents. Among these material Resin & Slag are the most important constituents which determine properties of brake material. In present study two different material where created by adding percentage of Resin and Slag named as M2 & M3, where M1 is the present material used in company. Due to copyright of

reference industry actual configuration is not disclosed in current work, but can be found out by contacting reference no 10.

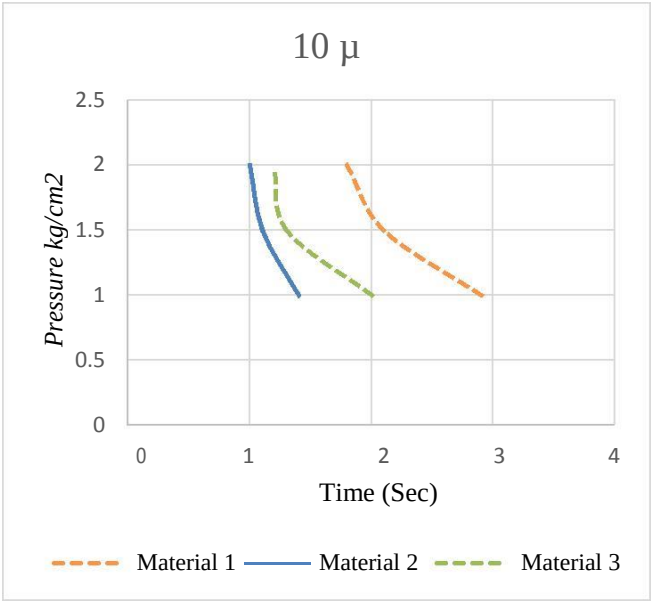
VI. Test results:

The three varieties of material were tested with specific rpm, pressure, surface roughness and time required to stop was noted for 71 frame size. All the observations are formulated in a table. The table and graphs are as follows:

Surface Roughness µ	Pressure Kg/cm^2	Time (Sec)		
		M1	M2	M3
10	1	2.9	1.4	2
10	1.5	2.1	1.1	1.3
10	2	1.8	1	1.2
15	1	2.7	1.8	2.1
15	1.5	2.2	1.2	1.5
15	2	1.9	1.1	1.3
30	1	3	2.5	2.8
30	1.5	2.3	1.8	2
30	2	1.9	1.5	1.8

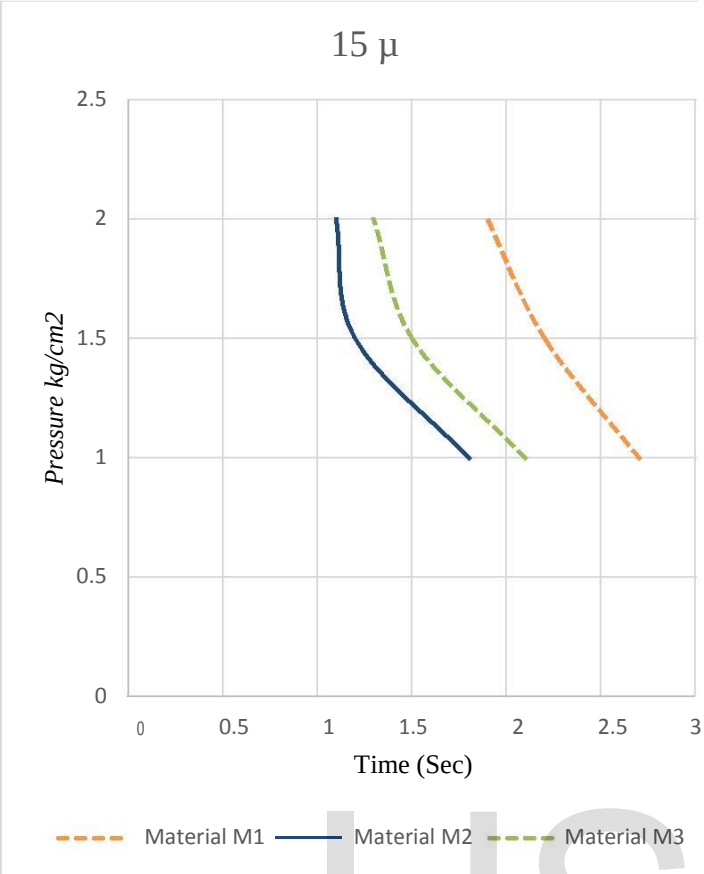
Table 2 Observation Table.

Graph 1: Time vs. Pressure at 10 µ for 3 material



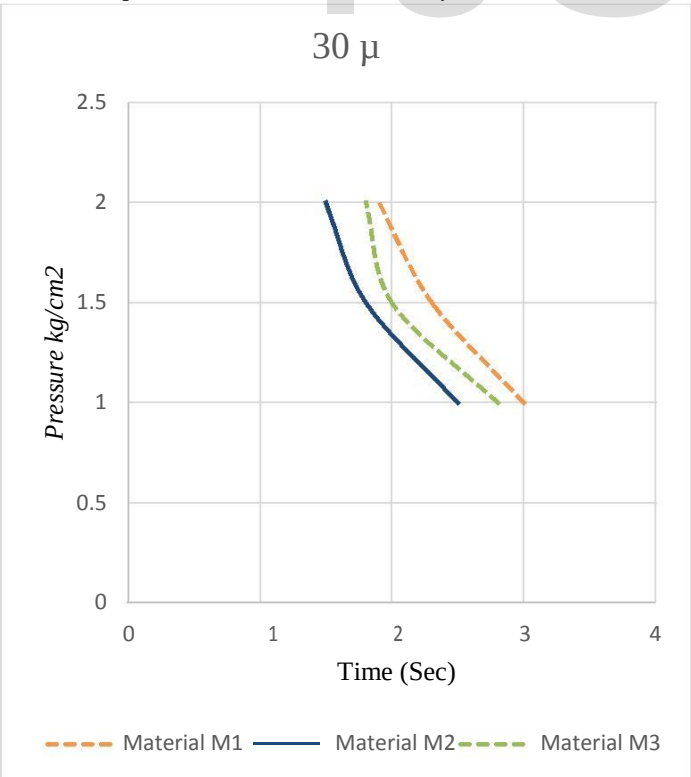
This graph shows that material M1 stopping time is greater than M2 & M3. The material M2 is effective material.

Graph 2: Time vs. Pressure at 20 µ for 3 material



This graph shows that material M1 stopping time is greater than M2 & M3. The material M2 is great material.

Graph 3: Time vs. Pressure at 30 µ for 3 material.

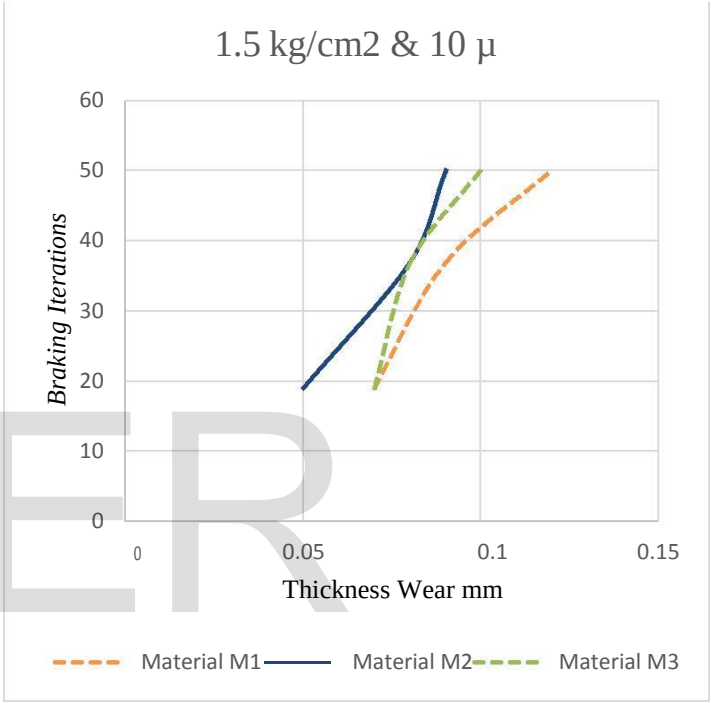


This graph shows that material M1 and M3 stopping time is greater than M2.

Surface Roughness µ	Pressure Kg/cm^2	Braking Iterations	Thickness Wear mm		
			M1	M2	M3
10	1.5	19	0.07	0.05	0.07
10	1.5	37	0.09	0.08	0.08
10	1.5	50	0.12	0.09	0.1

Table 3 Observation Table.

Graph 4: Thickness wear mm vs. Braking Iterations at 10 µ for 3 material



This graph shows that material M2 wear is lower but after 50 iterations M2 increases wear resistance. The material M3 & M1 wear resistance decreases.

VII. Conclusion:

From this study it was observed that

1. Material M2 is the impeccable material at all surface finish for 71 frame size. The material efficiency can be stated as M2 > M3 > M1.
2. The results showed good performance due to which the vendor gave approval to M2 material. This study shows proportion of Resin is inversely proportional stopping time with same hardness.
3. The stopping time is more effective when the Slag is mixed with Resin.

Future Scope: The material can be further improved and checked for heavy application such as EOT and marine works. The material used are most durable compared to the available brake material in the market which can be further developed by improving the quenching agent and temperature treatment.

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