



# RIP & SHARE SAFETY HANDOUT

## Guide for Maintenance Superintendents

### PRESS BRAKES FOR SAFETY!

What happened?

A truck driver was operating a haul truck and lost control of the vehicle. The truck eventually plowed through a berm and over a highwall fatally injuring the driver. The brakes were determined to be inadequate to stop the truck, and were found to be the primary contributing factor in the fatality. The brake standard found in 30 CFR 56.14101 outlines the minimum requirements that operators must follow to ensure compliance with U.S. Mine Safety and Health Administration regulations.

The operator was cited for a violation of the brake standard shown above, and the citation that was issued read as follows:

“The right rear brakes were not functionally proper. Incorrectly-sized brake linings had been installed, evidenced by the lining size being mismatched with the brake drum diameter. The brake linings still showed some of their original mill markings which indicate the right rear brake assembly had not been maintained properly. The old brake assembly was reinstated in lieu of being replaced even though the drum had numerous heat cracks and showed excessive wear of three-sixteenths of an inch beyond the manufacturer’s recommended limit. The activators, plungers, rollers, wedges and cylinders were found to have considerable wear and had not been replaced when earlier repairs were made.”

Mechanics, drivers, supervisors...in short anyone with responsibility for equipment safety must ensure that brakes *ALWAYS* work properly. To begin:

- Make sure to follow the standards’ requirements found in 30 CFR 56.14100 (mobile equipment examinations, corrections and records) and 56.14101 (brakes);
- When machining a drum, stay within the manufacturer’s recommended tolerances;
- When repairing brakes, use original equipment manufacturer’s (OEM) replacements;
- Always repair brakes in pairs, not just one side;
- If brake pipes are replaced, always make sure that the same diameter pipe is used;
- On hydraulic brake repairs, if a leaking wheel cylinder is repaired, replace the seals on the opposite side as well, since they are probably in a similar condition. The same applies when replacing diaphragms on air brake chambers;
- The hold-down and return springs should always be replaced when shoes are removed;
- Don’t fit new brake shoes to oversized (worn or mismatched) drums. This was a contributing cause in the accident described above.

by Peter Ward

Director, Safety & Health, Hanson North America

Let’s take a fresh look at brakes. Ask anyone what the primary braking system does and they will say, “Slow the vehicle down.” Actually, that is a secondary function. The **primary function of a braking system is to turn energy into heat.** Period. Once this fact is placed first and foremost in the minds of maintenance staff, component replacement decisions become easier to prioritize.

Often, mechanics and operators will say that brake repairs do not restore efficiency to original standards. In many cases they are right and the reasons are easily understood and remedied once identified. Now more than ever, use original equipment manufacturer (OEM) replacements or insist on written confirmation that the equipment meets or exceeds OEM specifications when repairing brakes.

We are all aware that brake linings and pads are no longer available with asbestos compounds. What is less well known is that the older asbestos-based compounds incorporated a quantity of lead to break in the friction surfaces. The adding of lead is no longer permitted either. The more expensive

(usually OEM) replacement linings include compounds that replicate the action of lead. Cheaper brands do not, and the absences of these compounds create hot-spots (Martenside Formations). If these formations are not machined out they can grow and will eventually crack a drum. So, on this point, do a cost/value analysis. In the final analysis, the cost of new drums and OEM linings may in fact be far less than the apparent cost of the less expensive and technically inferior linings and “will fit” drums.

**When replacing linings**, check the run-out of the drum/disc. The maximum run-out before machining is required is 0.005”. Greater run-outs cause a pulsing sensation due to varying friction material contact. This results in a greater localized heat build-up and reduced braking efficiency. After several machinings, the drum will have a greater radius than the shoes. This will cause a reduced contact area and a consequential reduction in braking efficiency that is seldom noticed in regular service, but often critical in emergency braking situations.

#### NATIONAL STONE, SAND & GRAVEL ASSOCIATION



Natural building blocks for quality of life



**The thinner the drum, the less its heat absorption capacity.** Remember, the drum has two functions. One is to provide a friction surface; the other is to dissipate the heat the friction creates. Since we often keep our machines 10 years or more, it is essential that we keep a record in the maintenance books showing the number of times a drum is machined. When machining a drum, stay within the manufacturer's recommended tolerances. Reduced drum or disc material exponentially reduces heat dissipation capacity and structural integrity.

**Always repair brakes in pairs.** Never do just one side. Different lining materials have different coefficients of friction and also perform differently at varying speeds and temperatures. Asymmetrical braking is seldom noticeable until an emergency situation arises (as you will find out, if you perform annual tests to ensure that you are in compliance with the U.S. Mine Safety and Health Administration's [MSHA] brake standard). This is mostly true with park brakes, but, in several cases, has occurred with the service brakes. Two years later, fail rate was under three percent, still justifying the checks.

**If brake pipes are replaced, always ensure that the same diameter pipe is used.** If the pipe is metal, check that the ends are deburred and that the pipe is clear of loose material.

**On hydraulic brake repairs,** if a leaking wheel cylinder is repaired, **replace the seals on the opposite side as well,** they are probably in a similar condition. The same logic applies when replacing diaphragms on air brake chambers.

**Other important and often overlooked items** on brake repairs are the **hold-down and return springs.** These springs should always be replaced when shoes are removed. We recently investigated a serious accident. At the accident scene, it was noticed that the return springs were missing on one side and only connected to the top shoe on the other side. The machine had recently had new shoes installed. No record of an order for new springs has been located. The loops on the remaining spring had stretched over the years. The implications are obvious.

A contributory cause of a mine fatality at a South Carolina quarry was identified as "mismatched radii of brake shoes and drums." Put another way, new shoes were fitted to oversized (either worn or machined) drums. In the case under review, the throttle of a haul truck became stuck in the fully opened position. The operator's first reaction was to stand on the brakes. Due to the reduced friction area, the

brakes did not hold and the truck plowed through a berm and went over a high wall.

Many companies **conduct semi-annual brake testing,** a very good proactive maintenance test. Examine and compare the braking distances of like machines. Remember that the stopping distances allowed under MSHA standards are minimum requirements. If you require all or nearly all of the allowable stopping distance, there is invariably a significant problem. This holds true for older machines as well as newer designed equipment much of which will require less than 25 percent of the allowable distance.

When you see a brake lining invoice come over your desk with no hold-down or return springs, ask why (then order and fit!). Also, look for a machining order and ask for the run-out. (Remember: > 0.005" requires machining or replacement.) Tell your shop personnel about the South Carolina accident to add impact to the message.

Remember, there are several people in South Carolina who wish that this advice had been received and followed; they include a shop foreman, a quarry superintendent and the family of the deceased. Part of an Unwarrantable Failure Citation issued in this fatality cites the MSHA metal/nonmetal brake standard, and reads as follows:

*"The right rear brakes were not functionally proper. (sic). Incorrectly sized brake linings had been installed, evidenced by the lining size being mismatched with the brake drum diameter. The brake linings still showed some of their original mill markings which indicate the right rear brake assembly was not maintained properly. The old brake assembly was reinstated in lieu of being replaced even though the drum had numerous open heat cracks and showed excessive wear of 3/16 inches beyond the manufacturer's recommended limit. The activators, plungers, rollers, wedges and cylinders were found to have considerable wear and had not been replaced when earlier repairs were made."* ■

*This product was developed as part of the MSHA Alliance Program. It does not necessarily reflect the official views of MSHA. Use of the alliance Program logos is reserved for MSHA and its active Alliance partners. The MSHA Alliance Program is designed to promote miner safety and health through voluntary partnerships, which provide training and education, outreach, technical assistance and a national dialog on mine safety and health. For more information, contact MSHA, [www.msha.gov/alliance/alliances.htm](http://www.msha.gov/alliance/alliances.htm).*