Failure Analysis
Failure Analysis

- Inspecting components to determine the cause for failure
- Object is not repaired until the cause for failure has been determined
Fade, poor stopping, and brake lockup are problems that could be caused by air system malfunctions, wrong friction or bad brake maintenance.

A drum that’s heat checked can cause fade and poor performance during a panic stop.

Ways to prevent heat checking:
1. Replace all hardware at the time of reline.
2. Use the friction material recommended for the application.
3. Make all adjustments equal: what you do to one wheel, do to all other wheels.
4. Make sure drum is in good condition.
Uneven Wear - Brake Shoe

**Problem**
Always check where the lining is worn before you take it off the axle.

End wear indicates a drum with bell mouth condition or worn bushings.

Indicates bent spider.

**Solution**
Check drum diameter for bell mouth condition and turn drums or replace. Replace cam bushings at every reline.

If shoe ends or lining must be ground to allow shoes to fit, or for the drum to go on, you may have a bent spider or the wrong shoes.
Broken webs on relined shoes

Common overload failure mode on garbage trucks
Broken webs on shoe

Shock load failure caused by repeated extreme brake applications.
MISSING LINING ON CAM SIDE OF SHOE

Shock load failure caused by repeated extreme brake applications. Seen on severe duty applications.
Could not get drum over brakes.

Aftermarket material not to OEM specs.
Lining chunking

Caused by abuse and overheating. Look for signs of heat on other components.
Rust Jacking

- Formation of an oxide layer developed and growing on the brake shoe table.
- Oxide layer is created by a corrosive action.
- Formation of the ferrous oxide layer causes brake block to be pushed away from brake shoe table.
Causes of Rust Jacking

- Geographic region of operation
- Container chassis trailers
  - Parked at sea ports
- Change in de-icing compounds
  - Magnesium Chloride
  - Calcium Chloride
  - Sodium Chloride (Salt)
- Time and brake usage
  - Oxidation process takes time to develop
  - Block life correlates to operational duty cycle
How to Detect Lining Block Rust Jacking

• Visual inspection with wheels on
  – Look for radial cracks in the edge of block.

• Visual inspection with wheels off
  – Look for cracks across block face.

• Listen for brake noise
Grooved Brake Lining Wear -

Abrasive materials inside of drum such as small stones
Tapered Brake Lining Wear

Not Worn

Worn

BENT SPIDER OR WORN CAM BUSHINGS
Tapered Lining Wear

- Drum may be bell mouthed
  - Inspect drum inner diameter
- Worn cam rollers
- Worn anchor pins
- Broken or weak hold down springs
Cracked lining

Rust Jacking
CRACKED LINING

This is called: De-lamination.

Manufacture defect
Cracked lining

Block not tightly fastened – loose rivets
Out of round drums may look the same in appearance but are usually caused by improper fit-up to wheel hub or heat distortion.
Heat checked brake drum
HEAT CHECKED DRUMS

- Second stage of heat spot formation. Spot continues to grow in size
- **Caused By:**
  - Constant heating and cooling and brakes
    - Brake imbalance
    - Dragging brakes
    - Driver abuse
    - Not need to replace most of the time
Cracked drum

Final result of hot spot formation is drum failure.
CRACKED DRUM

Final result of hot spot formation is failure of the drum

Caused By:
• Dropped drum
• Improper shoe contact
• Fatigue due to heating

Corrections
• Replace brake drum
• Check brake balance and operation
Grooves in brake drum

Abrasive material between drum and lining.
Performance Analysis - Camshaft

Lack of lube
Performance Analysis - Spider Assembly

Chamber bracket bolts were loose.
Performance Analysis - Bracket Assembly

Chamber bracket bolts were loose.
Performance Analysis - Spring Brake Chamber

Broken stud.
Performance Analysis – Bracket Assembly

Bracket failure at chamber end with external support.
Performance Analysis – Bracket Assembly

Bent bracket above the gusset.
Brake shoe overhanging

Excessive end play.
Performance Analysis – Return Spring
Wheel lock up due to a broken hold down spring.

Broken shoe retainer clip
Performance Analysis – Tone Ring

Shoe clip broke and caused damage to ABS tone ring