Improved Brake Systems
AAR SRI Project

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Improved Brake System Performance

Objective:
♦ Improve brake system performance by investigating the root causes of poor performance
♦ Demonstrate potential solutions

End Product(s):
♦ Improved braking, improved brake shoe life, improved wheel life

Major Tasks in 2010:
♦ Improved truck brake rigging
  • Static and dynamic brake shoe force testing of improved designs
♦ Evaluate four candidate remote operated handbrake systems
♦ Monitor electronically controlled pneumatic (ECP) brake system performance and reliability
Asymmetric wheel wear (SRI 2A):

- Identified on 134 coal cars in fleet of Mitsui Rail Capital
- Associated with:
  - Truck & car body brake rigging asymmetries
  - Asymmetric tread wear due to asymmetric location of the shoe on the tread & shoe contact
  - Increase in brake forces?
  - Seems to be endemic to NA fleet
- Results in:
  - Reduced wheel life
  - Possible increased track / rail forces / stresses
  - Associated high conicity wheels
- Suggested remedies:
  - Symmetric brake rigging
  - Altered shoe shape
- Tournay to make extended presentation by telecon to next BSC meeting
**Improved Brake System Performance**

**Progress:** Improved Truck Brake Rigging

- Demonstrate designs that provide improved distribution of brake shoe forces
- TAG sourced for ideas and feedback
- Nine rigging designs for evaluation
- Tests include:
  - Static shoe force tests – conducted June 2010 (8 systems tested)
  - Dynamic shoe force tests – fall 2010
    - Instrumented brake shoes
    - Standard 3-piece truck and M-976 truck
    - Brakes applied/released in moving car
      - Apply brakes in tangent prior to curve, release brakes in tangent following curve
      - Apply brakes in body of curve, release brakes in tangent following curve
      - Apply brakes in tangent prior to curve, release brakes in body of curve
Rigging Designs

1. Base case: normal unit beams
   • Sliding contact between beam and side frame
   • Performance will be used to quantify any improvements in the other designs
   • Commercially available
2. Modified unit beams
   • Small tab welded to bottom of beam end extension
     ▲ Minimize reaction moment in side frame
   • Design concept
3. Longer unit guide bracket and beam end extension
   - Longer end extension reacts in line with brake force — also limits beam droop and taper shoe wear
   - Design concept
4. Unit beams with link brake system

4-bar linkage:
- Restricts beam pitch & lateral motion
- Reacts moments on beam
- Commercially available
5. Modified unit beams with link brake system

4-bar linkage:
- Restricts beam pitch and lateral motion
- Reacts moments on beam
- Design concept
6. Swing hanger beams with link brake system

4-bar linkage:
- Restricts beam pitch and lateral motion
- Reacts moments on beam
- Acts as a safety support for hanger beam
- Design concept
7. Swing hanger beams

- Supported from swing link to eliminate sliding friction
- No beam end extension
- Commercially available
8. Swing hanger beams with extension nubs
   • End extension restricts lateral motion and acts as safety support device
   • Design concept

Swing link fits here
Small end extension

Swing link fits here

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9. Swing hanger beams with guides
   - Designed to prevent wear or chatter as it engages
   - Not available for testing by TTCI until September
   - Design concept (US Patent 7,527,131 B1)
SRI 5A: Improved Brake System Performance

♦ Preliminary static shoe force test results

- Evaluation based even distribution of shoe forces
- Swing hangers (#7, #8) performed very well
- Unit beams (#1A&B, #2, #3) performed reasonably well (new condition)
- Link systems (#4, #5, #6) and were over-constrained in this test with bent truck levers – have had much better results in past with straight levers
SRI 5A: Improved Brake System Performance

♦ Dynamic curving tests with instrumented brake shoes – Fall 2010

- Instrumented clevis pin
  - 12,500 lbs capacity
  - Friction retarding force

- Mini Load Cell x 2
  - 10,000 lbs capacity
  - Normal force
  - Top/Bottom force distribution
SRI 5A: Improved Brake System Performance

♦ Path Forward

- Improved truck brake rigging
  - Conduct static testing on system #9 when it becomes available
  - Calibrate instrumented brake shoes
  - Conduct dynamic testing, fall 2010
- Continue evaluation of four candidate remote operated handbrake systems at FAST
- Continue to monitor ECP brake system performance and reliability