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

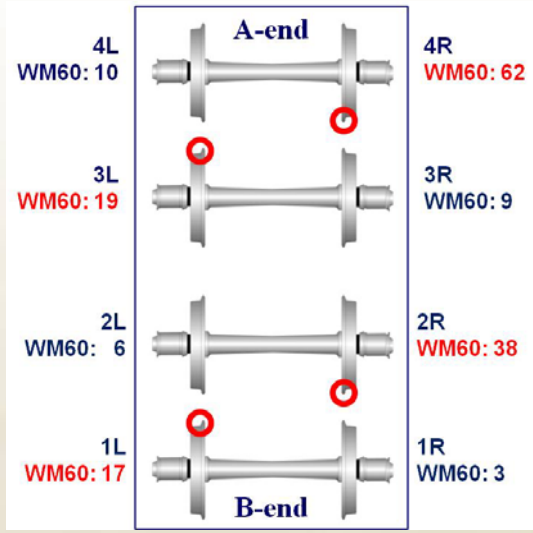
Major Tasks in 2010:

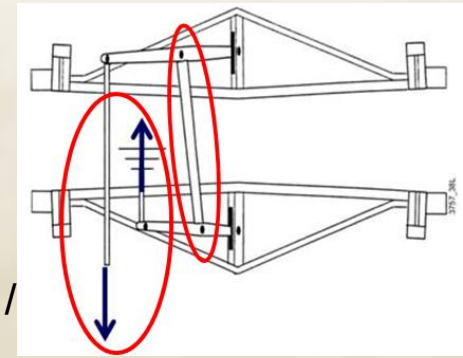
- Improved truck brake rigging
  - Static and dynamic brake shoe force testing of improved designs
  - Evaluate four candidate remote operated handbrake systems
  - Monitor electronically controlled pneumatic (ECP) brake system performance and reliability

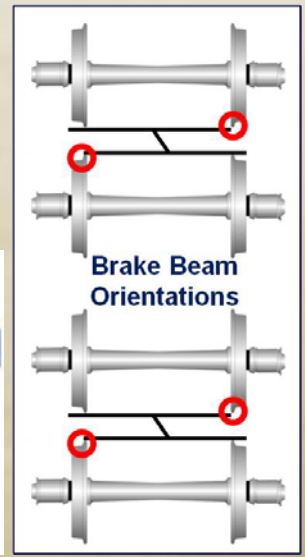
Improved Brake System Performance

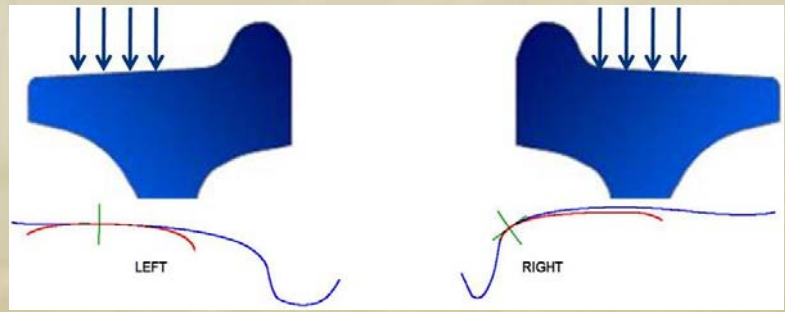
Asymmetric wheel wear (SRI 2A):

- 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**

Rigging Designs

2. **Modified unit beams**
   - **Small tab welded to bottom of beam end extension**
     - **Minimize reaction moment in side frame**
   - **Design concept**

Rigging Designs

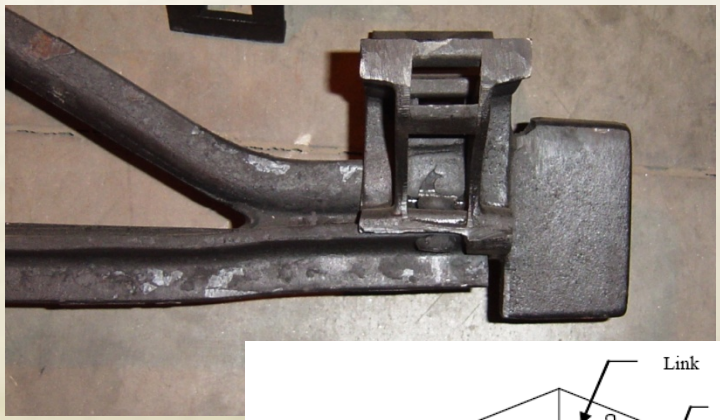
3. **Longer unit guide bracket and beam end extension**

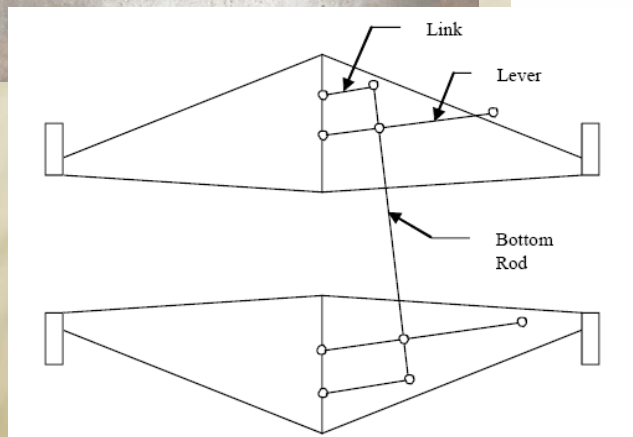
- **Longer end extension reacts in line with brake force — also limits beam droop and taper shoe wear**
- **Design concept**

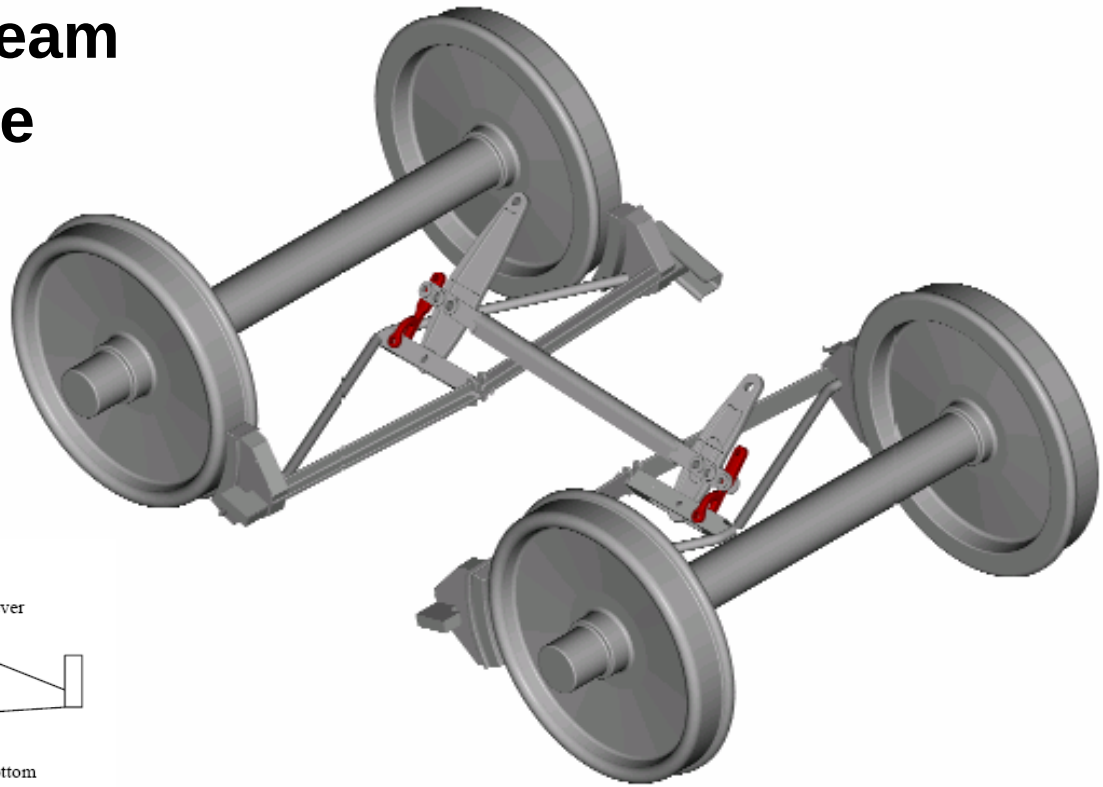
Rigging Designs

4. **Unit beams with link brake system**
   4-bar linkage:

- **Restricts beam pitch & lateral motion**
- **Reacts moments on beam**
- **Commercially available**



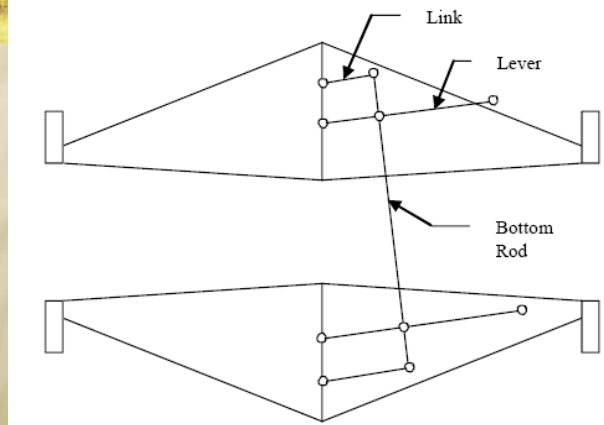


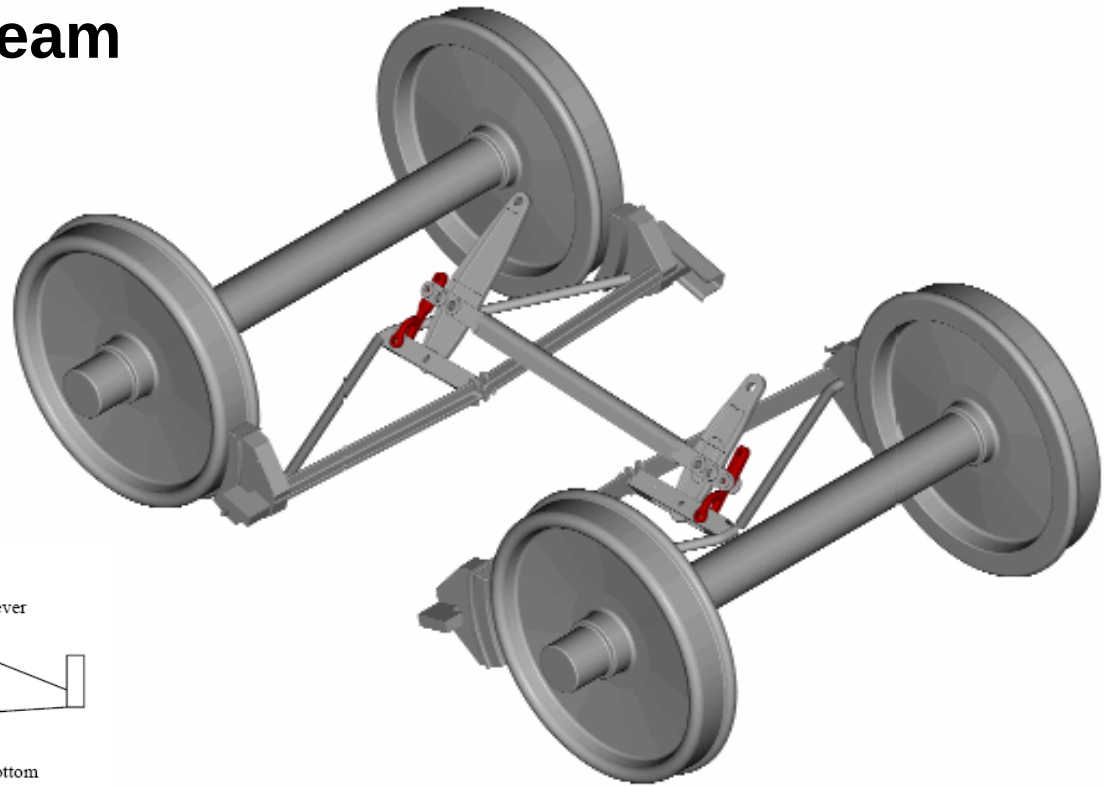


Rigging Designs

5. **Modified unit beams with link brake system**
   4-bar linkage:

- **Restricts beam pitch and lateral motion**
- **Reacts moments on beam**
- **Design concept**

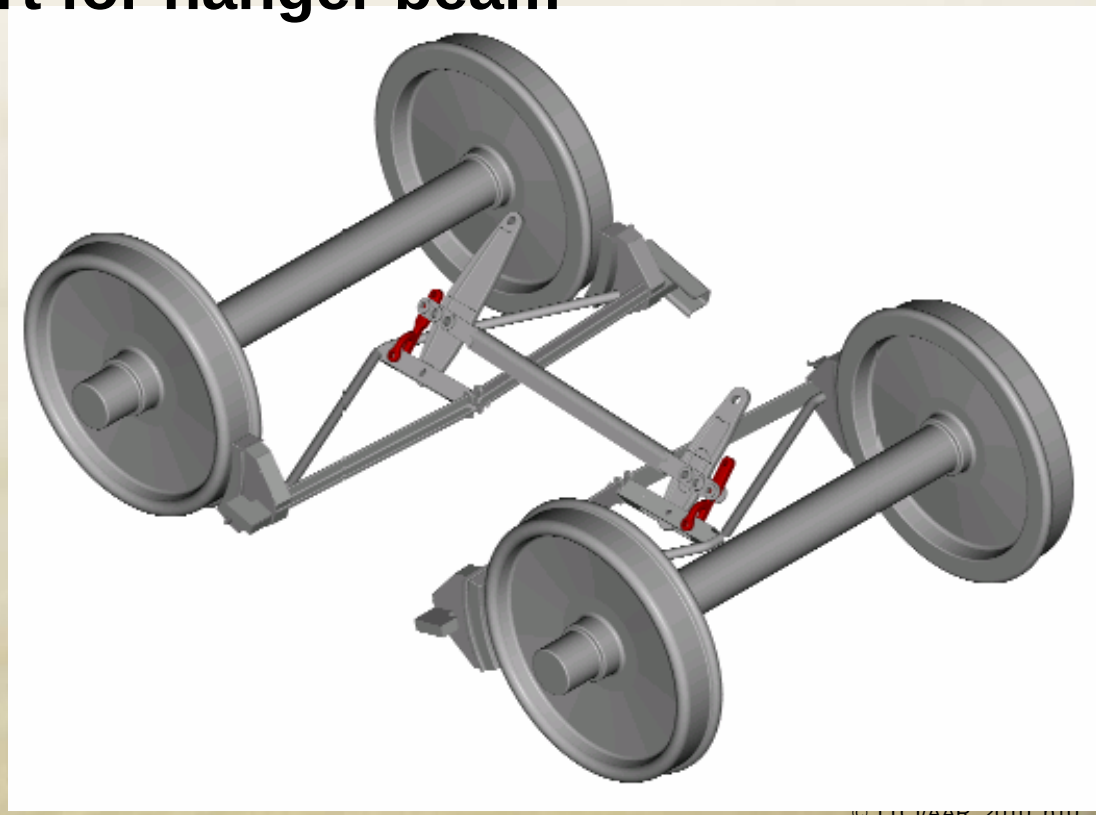




Rigging Designs

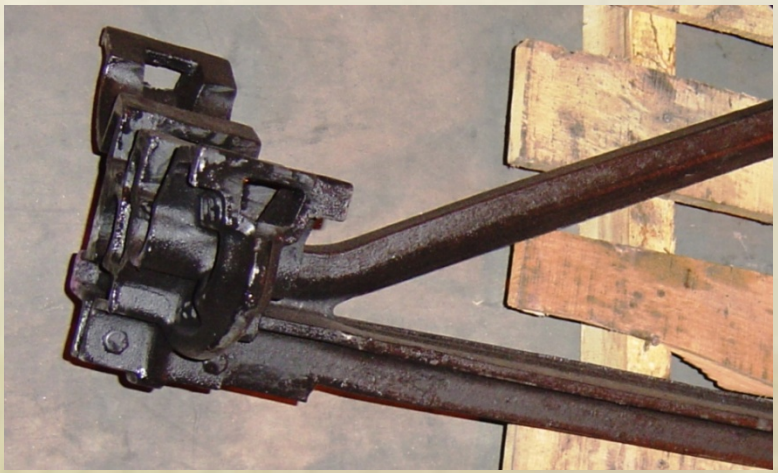
6. **Swing hanger beams with link brake system**
   4-bar linkage:

- **Restricts beam pitch and lateral motion**
- **Reacts moments on beam**
- **Acts as a safety support for hanger beam**
- **Design concept**



Rigging Designs

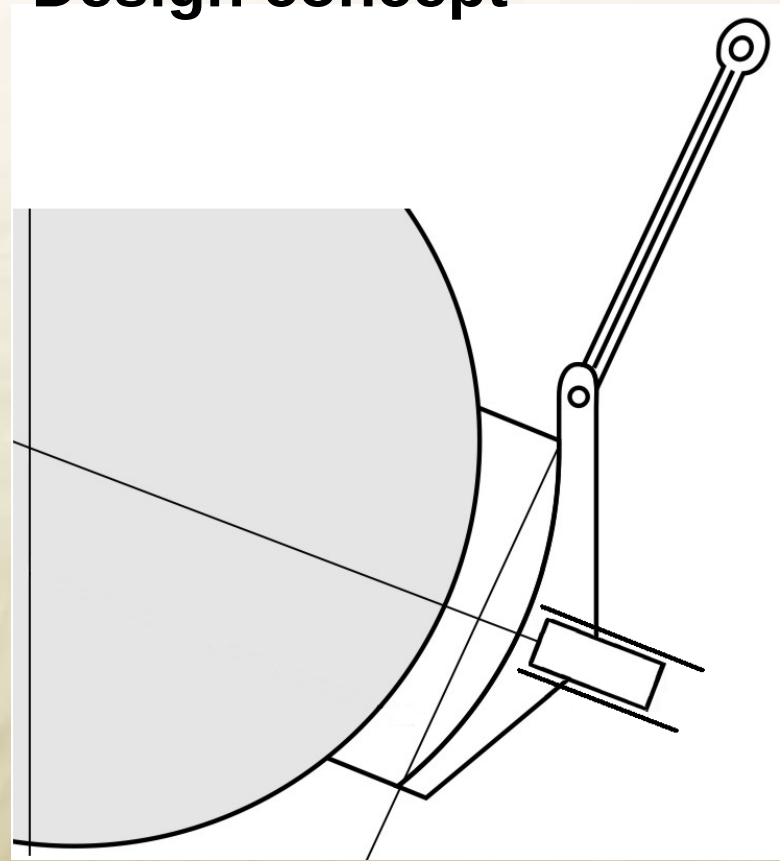
7. **Swing hanger beams**
   - **Supported from swing link to eliminate sliding friction**
   - **No beam end extension**
   - **Commercially available**

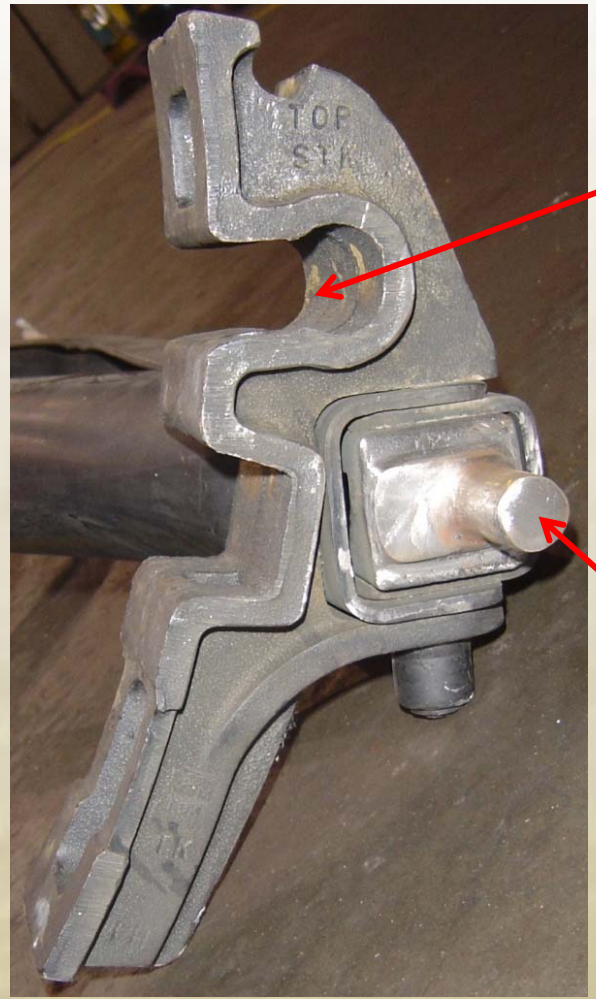


Rigging Designs

8. **Swing hanger beams with extension nubs**

- **End extension restricts lateral motion and acts as safety support device**
- **Design concept**

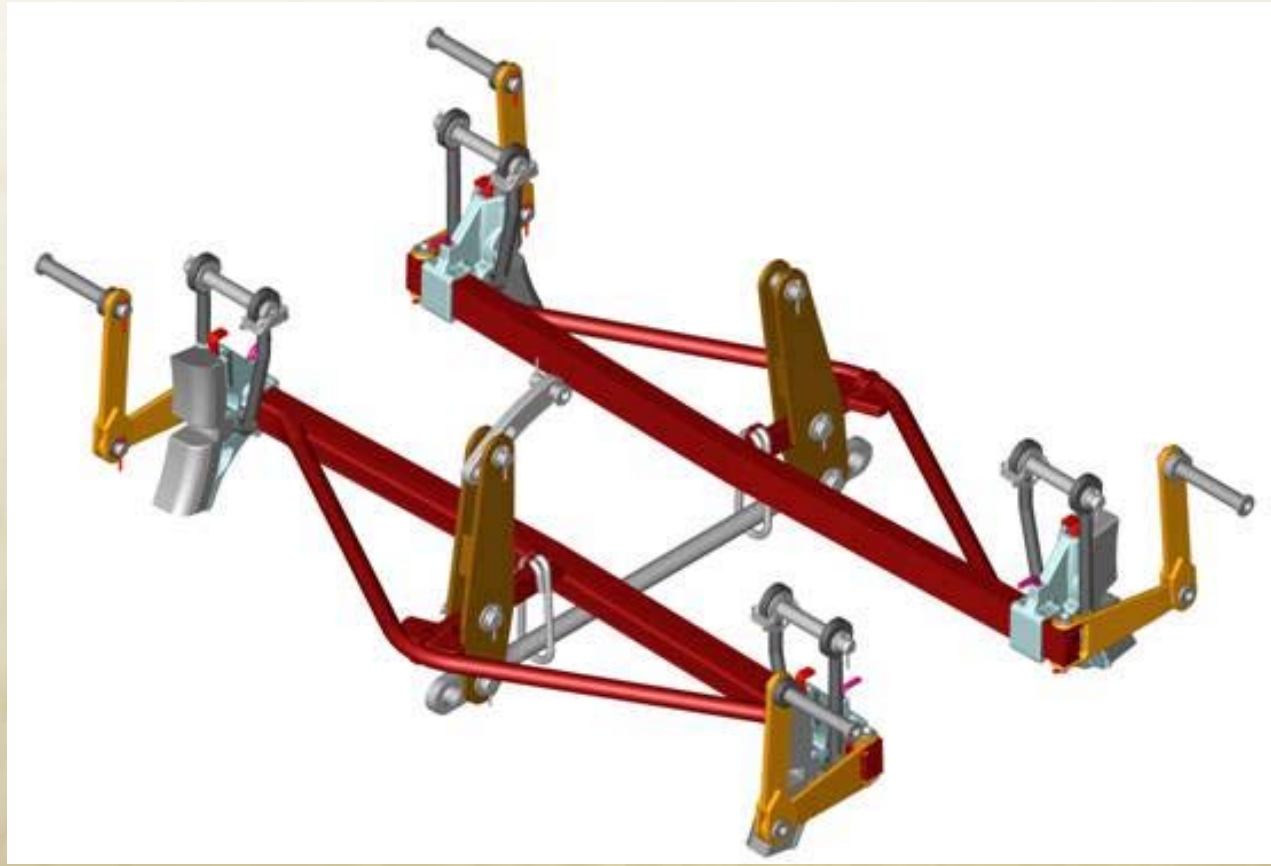




Rigging Designs

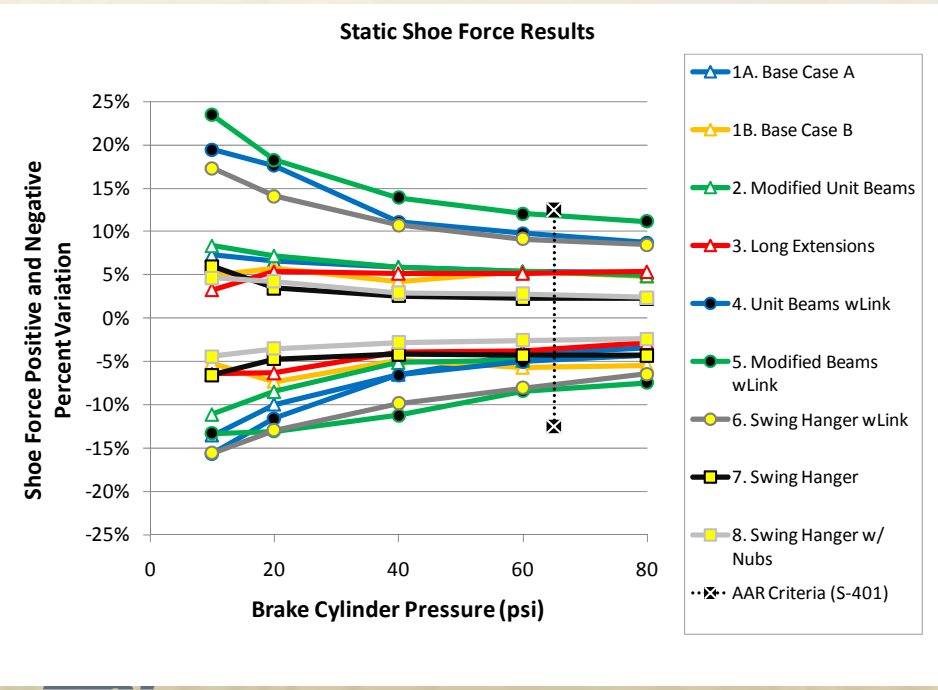
9. **Swing hanger beams with guides**

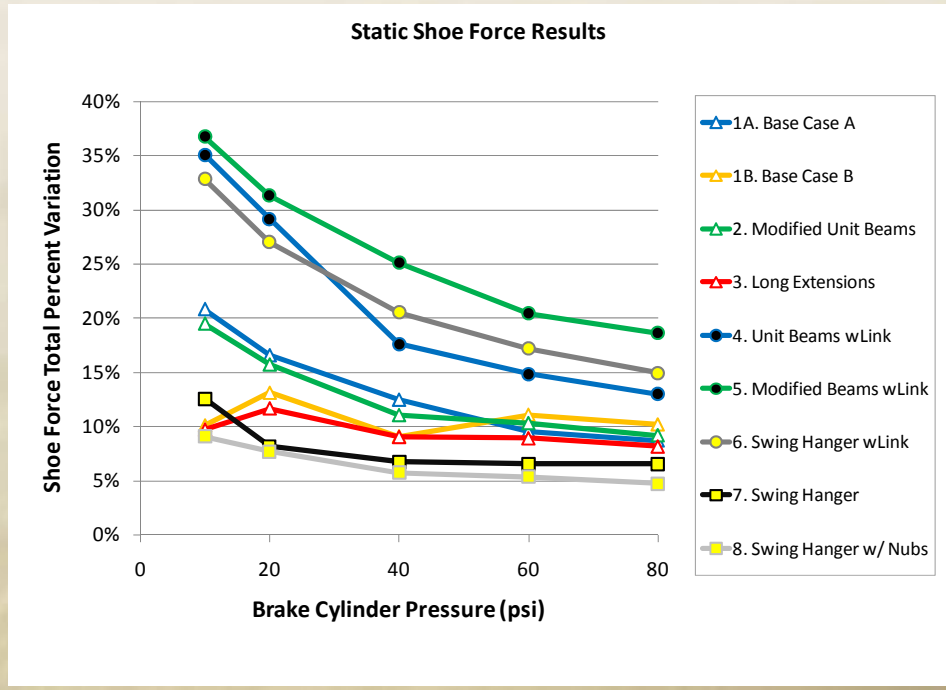
- **Designed to prevent wear or chatter as it engages**
- **Not available for testing by TTCI until September**
- **Design concept (US Patent 7,527,131 BI)**



SRI 5A: Improved Brake System Performance

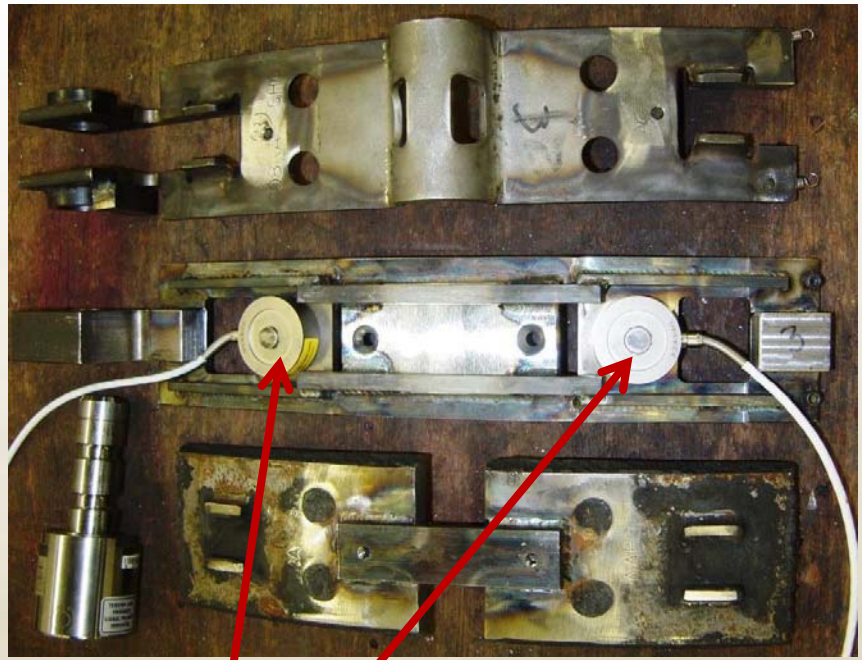
- **Preliminary static shoe force test results**
  - Evaluation based even distribution of shoe forces
  - Swing hangers (#7, #8) performed very well
  - Unit beams (#1A&B, #2, #3) performed reasonably well (new condition)
  - Link systems (#4, #5, #6) and were over-constrained in this test with bent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

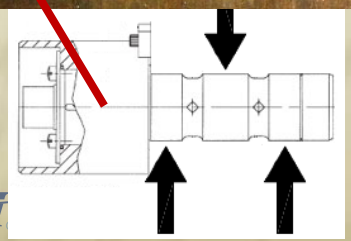




SRI 5A: Improved Brake System Performance

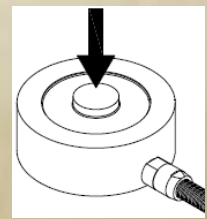
- Dynamic curving tests with instrumented brake shoes – Fall 2010





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