



Vision

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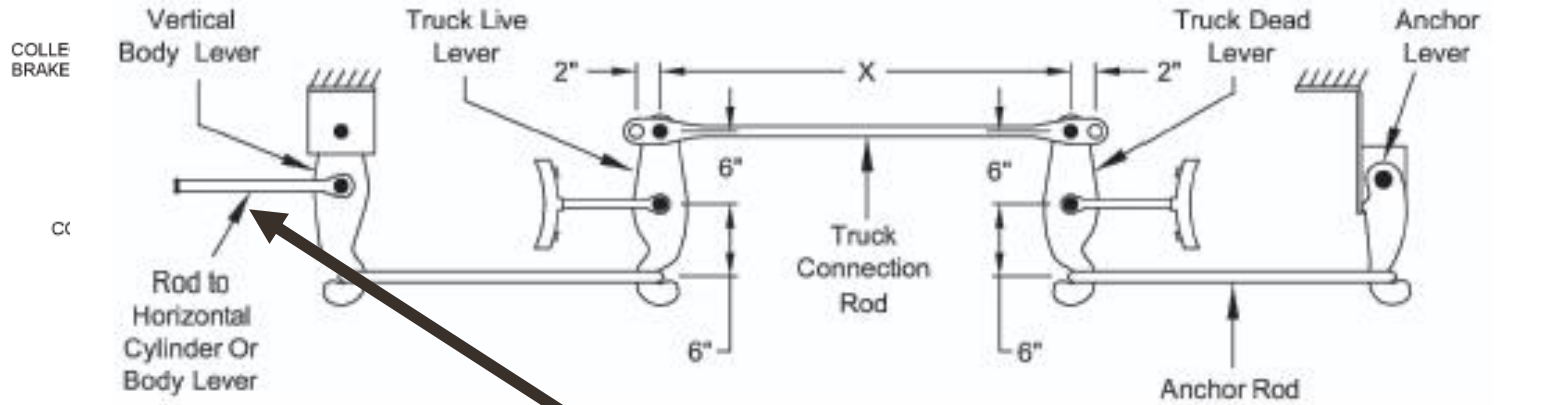
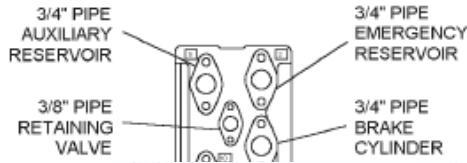
Brake System Performance Reliability Improved Brake Systems

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October 6, 2015

Brake Systems



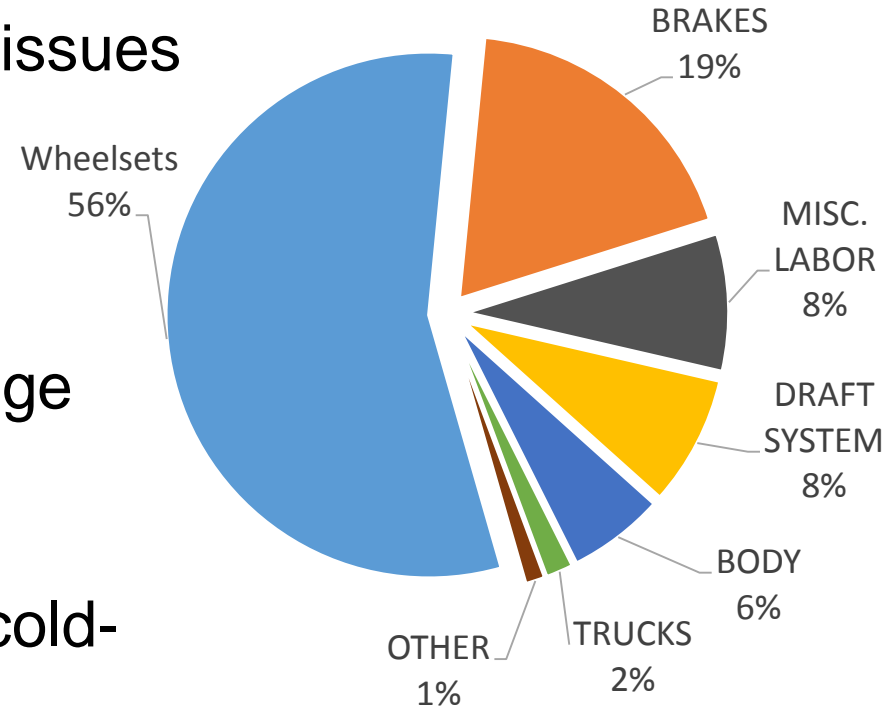
BRAKE CYL



Improved Brake Systems

◆ Problem Definition:

- Braking system performance issues
 - ▲ Wheelset removals
 - High impact
 - Flange thin
 - Asymmetrical wheel flange wear
- Brake beam fatigue
- Operational reliability due to cold-weather brake performance
- Reduce train delays
 - ▲ Air hose separation



Maximize Life Wheels / Effectiveness of Brakes

- ◆ Challenges addressed by SRI 5A
 - Longer Charging Times
 - Delayed trains
 - Cold wheel cars



End products: Reduced undesired emergencies (UDE),
reduced repair times

Current Work

Specific Topic	Status
Root Cause of Cold Wheel Cars	Cars are being monitored
Prevention of Air Hose Separations	Tests were completed
Cold Weather	Tests are being conducted at TTC
Off-Air Time Limits	Testing underway





Wheel Temperature Detector Background

- ◆ Wheel temperature detectors are used system-wide
- ◆ Used to detect stuck brakes or under-performing brakes
- ◆ Provide in-situ brake system feedback
- ◆ Based on this feedback, what can we learn?



Cold Wheel Cars

- ◆ **Inspecting identified cold wheel cars:**
 - Of the 12 cars inspected
 - ▲ 9 cars were repaired
 - ▲ 12 cars have passed detectors since repair
 - 6 of 9 car have no cold wheel indications
 - 1 car had 1 cold wheel indication
 - 2 cars had multiple indications
- ◆ **Cars will continue to be monitored.**



Lots of Bubbles

◆ Cold Wheel Cars Leading Reasons

- Torn packing cups
- Bad truck mounted cylinders
- Bad flange connections

Torn
Packing
Cup



Air Hose Separation Background

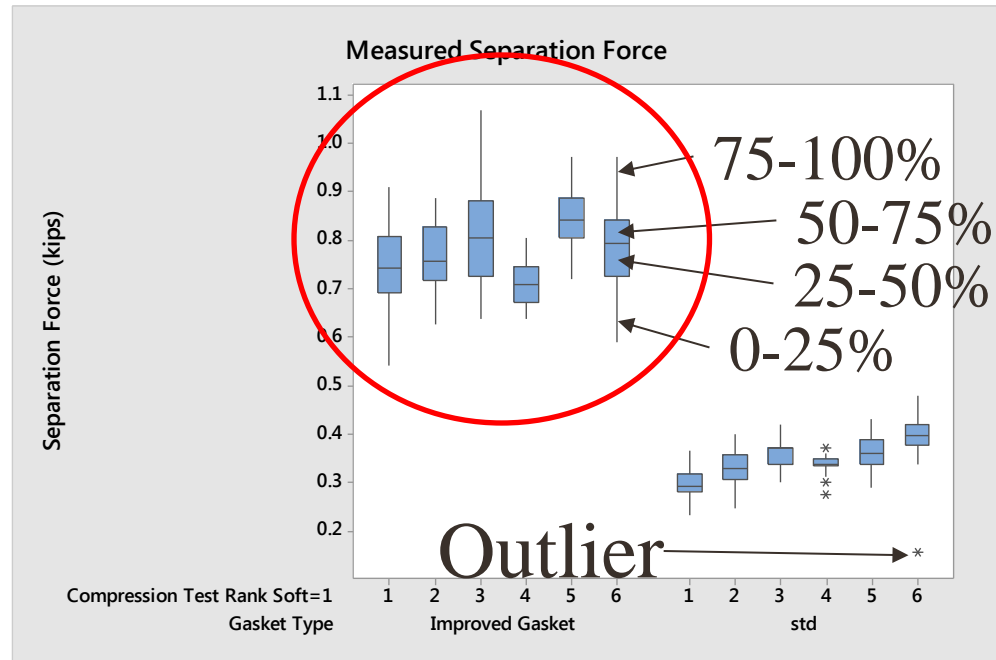
- ◆ End hose life is limited to 8 years (AAR Rule 5 A.2).
- ◆ Wear can cause early removal or can affect field performance.
- ◆ Undesired separations can cause line of road train delays.
- ◆ How do gaskets affect performance?



Air Hose Separations

◆ Gasket testing conducted

- Improved gaskets equal higher separation force.
- Correlations between gasket stiffness and separations forces were not clear.



◆ Initial Terminal Criteria

- Leakage = Pressure loss over a given time period
- Must be less than 5 psi/min
 - ▲ Pressure drop in 1 min → 2 psi
 - ▲ Pressure drop in 1 min → 6 psi
- Gradient = Head end pressure — end of train pressure
 - ▲ Must be less than 15 psi
 - ▲ $\Delta = 90 \text{ psi} - 87 \text{ psi}$ $\Delta = 3 \text{ psi}$
 - ▲ $\Delta = 90 \text{ psi} - 74 \text{ psi}$ $\Delta = 16 \text{ psi}$
- Individual segments qualify but if combined will not qualify



◆ Small Terminals

- Common practice to prequalify cars
- Multiple segment testing



- Individual segments qualify but if combined will not qualify

- ◆ **Train delays especially prevalent with cold weather**
 - Can we predict these failures?
 - Can you predict where the leaks are?



Photo courtesy of Rich Reiff

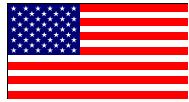

◆ Brake Lab Repairs

- Repairs for single car test rack
- Rack repairs for induced leaking
 - ▲ Use chokes to simulate cold weather leakage



◆ Off-Air Definition

- Means the car or cars were not connected to a continuous source of compressed air of at least a pressure of 60 psi

Category	FRA 	Transport Canada 
Test Name	Class 2	Number 1A
Cars to test	No Class I or off air for 4+ hrs	Number 1 info or off air for 24+ hrs, no Number 1A
Test	Leakage, continuity, set/release	SBU reduction reading, Set release

◆ Initial Testing Complete



Summary and Next Steps

Specific Topic	Findings	Next Step
Root Cause of Cold Wheel Cars	Leading causes identified	Report on findings
Prevention of Air Hose Separations	Tests show improved gaskets provide higher separation force	Focus on gages
Cold Weather	Brake lab repaired Test plan prepared	Additional leakage testing
Off-Air Time Limits	TBD	Proceed as directed
Root Causes of UDEs (new)	Asset Health Strategic Initiative data mining	Root cause analysis