Brake System Performance Reliability

Improved Brake Systems

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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

<table>
<thead>
<tr>
<th>Specific Topic</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Root Cause of Cold Wheel Cars</td>
<td>Cars are being monitored</td>
</tr>
<tr>
<td>Prevention of Air Hose Separations</td>
<td>Tests were completed</td>
</tr>
<tr>
<td>Cold Weather</td>
<td>Tests are being conducted at TTC</td>
</tr>
<tr>
<td>Off-Air Time Limits</td>
<td>Testing underway</td>
</tr>
</tbody>
</table>
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.
Cold Wheel Cars

Cold Wheel Cars Leading Reasons

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

*Leaking Seal*

*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.
Cold Weather Investigation

♦ 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
    ▲ Δ = 90 psi – 87 psi Δ = 3 psi ✓
    ▲ Δ = 90 psi – 74 psi Δ = 16 psi ✗

● Individual segments qualify but if combined will not qualify
Cold Weather Investigation

♦ Small Terminals
  ● Common practice to prequalify cars
  ● Multiple segment testing

Car No.: 70 cars
Leakage: 3 psi/min
Gradient: 8 psi

Car No.: 50 cars
Leakage: 4 psi/min
Gradient: 6 psi

Car No.: 120 cars
Leakage: 3 psi/min
Gradient: 19 psi

● Individual segments qualify but if combined will not qualify
Cold Weather Investigation

♦ Train delays especially prevalent with cold weather
  ● Can we predict these failures?

  ● Can you predict where the leaks are?

Photo courtesy of Rich Reiff
Cold Weather

♦ Brake Lab Repairs
  ● Repairs for single car test rack
  ● Rack repairs for induced leaking
    ▲ Use chokes to simulate cold weather leakage
Off-Air Limits

♦ 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

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

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