

Crane Wheel / Crane Rail Interface

Testing of Material Wear Properties



History of Wheel / Rail Interface Materials and Heat Treatment

- ✓ **No test data available for Hard Wheel / Soft Rail Combination**
 - ✓ **Information almost all anecdotal**
 - ✓ **Application successes and failures**
- ✓ **Many variables to consider**
 - ✓ **Crane Operation**
 - ✓ **Runway and Building Condition**
 - ✓ **Wheels and Rails**
 - ✓ **Sizes, Materials, Heat Treatments**
- ✓ **Users concerned about switching to Hard Wheel**
 - ✓ **Initial belief is the Hard Wheel may act like a tool and cut into the soft rail**

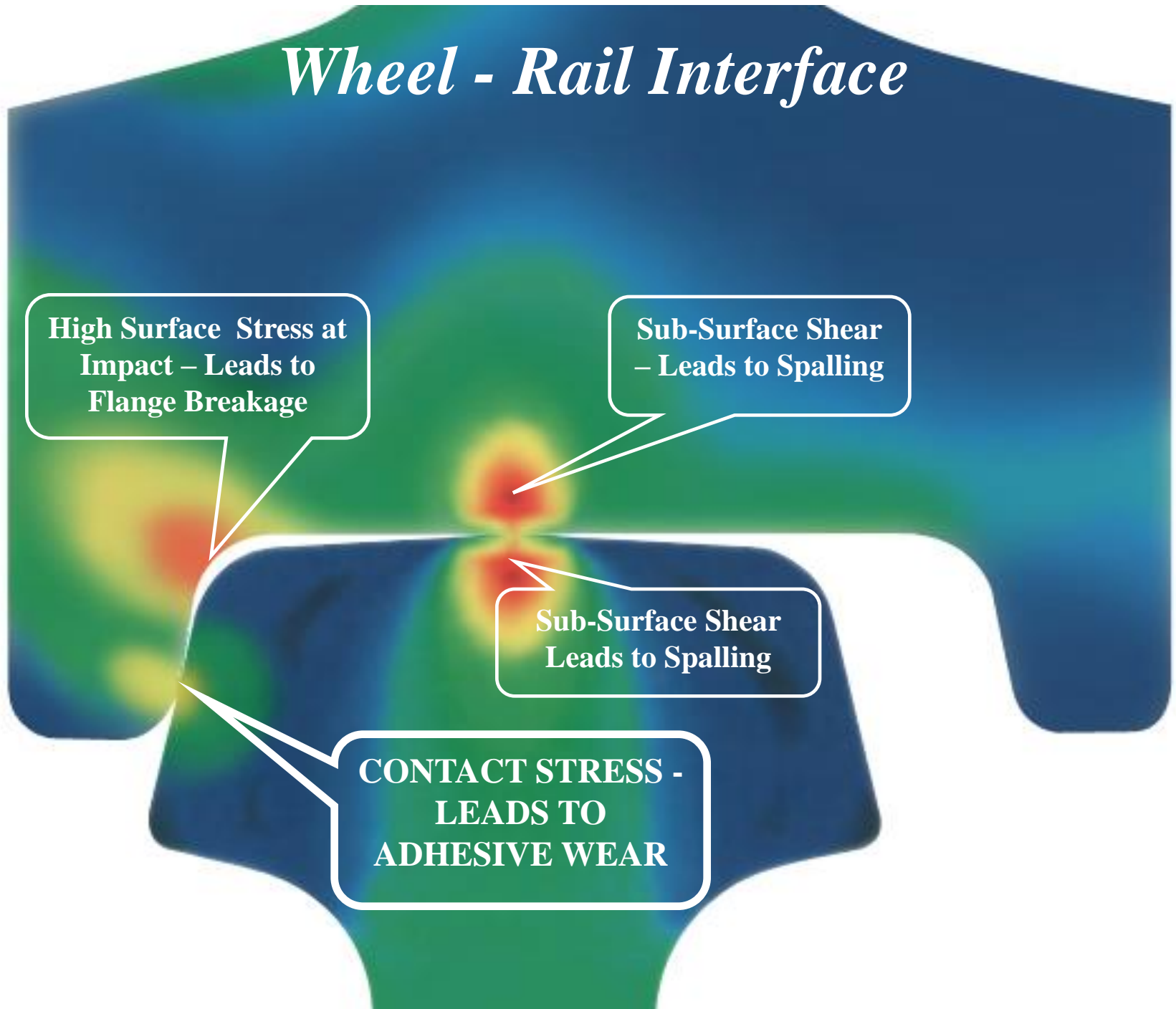
Wheel - Rail Interface

High Surface Stress at Impact – Leads to Flange Breakage

Sub-Surface Shear – Leads to Spalling

Sub-Surface Shear Leads to Spalling

**CONTACT STRESS -
LEADS TO
ADHESIVE WEAR**



Adhesive Wear on Flanges
Non-Lubricated Metal-to-Metal Contact



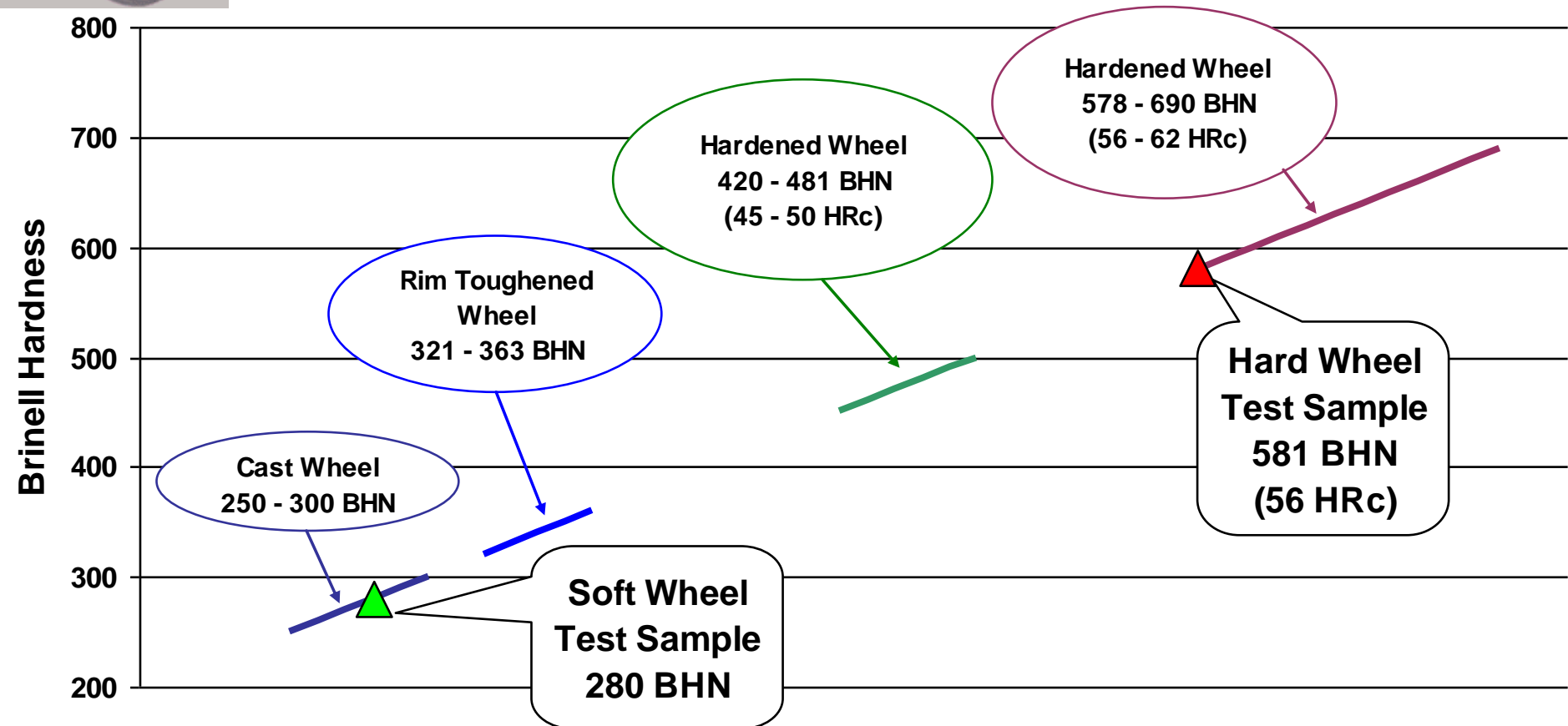
Adhesive Wear on Flanges

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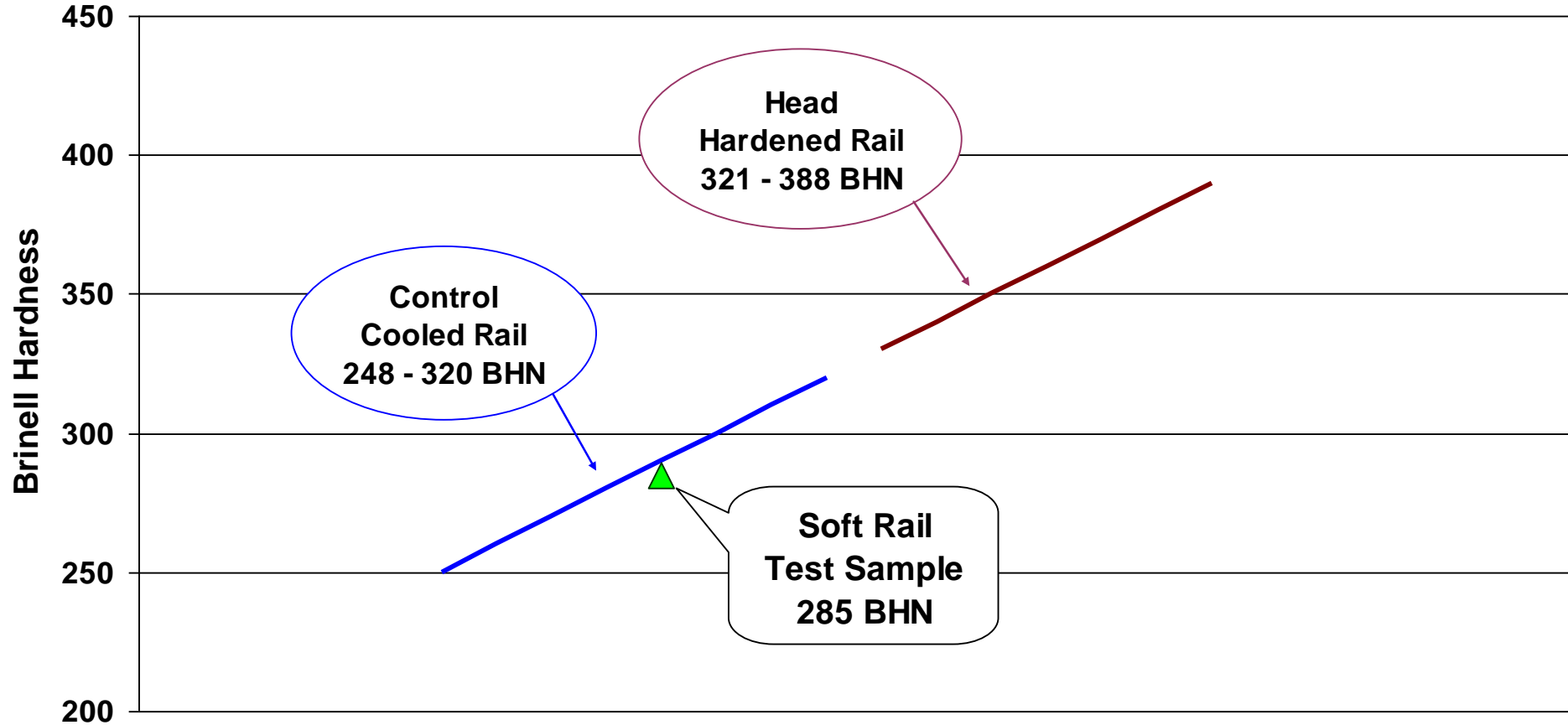


Wheel Test Samples v. Wheel Hardness



Materials AISI 1055, 1070, 4140

Rim Toughened based on ASTM A504 Class C



Material based on ASTM A759
Carbon 0.67% - 0.84%

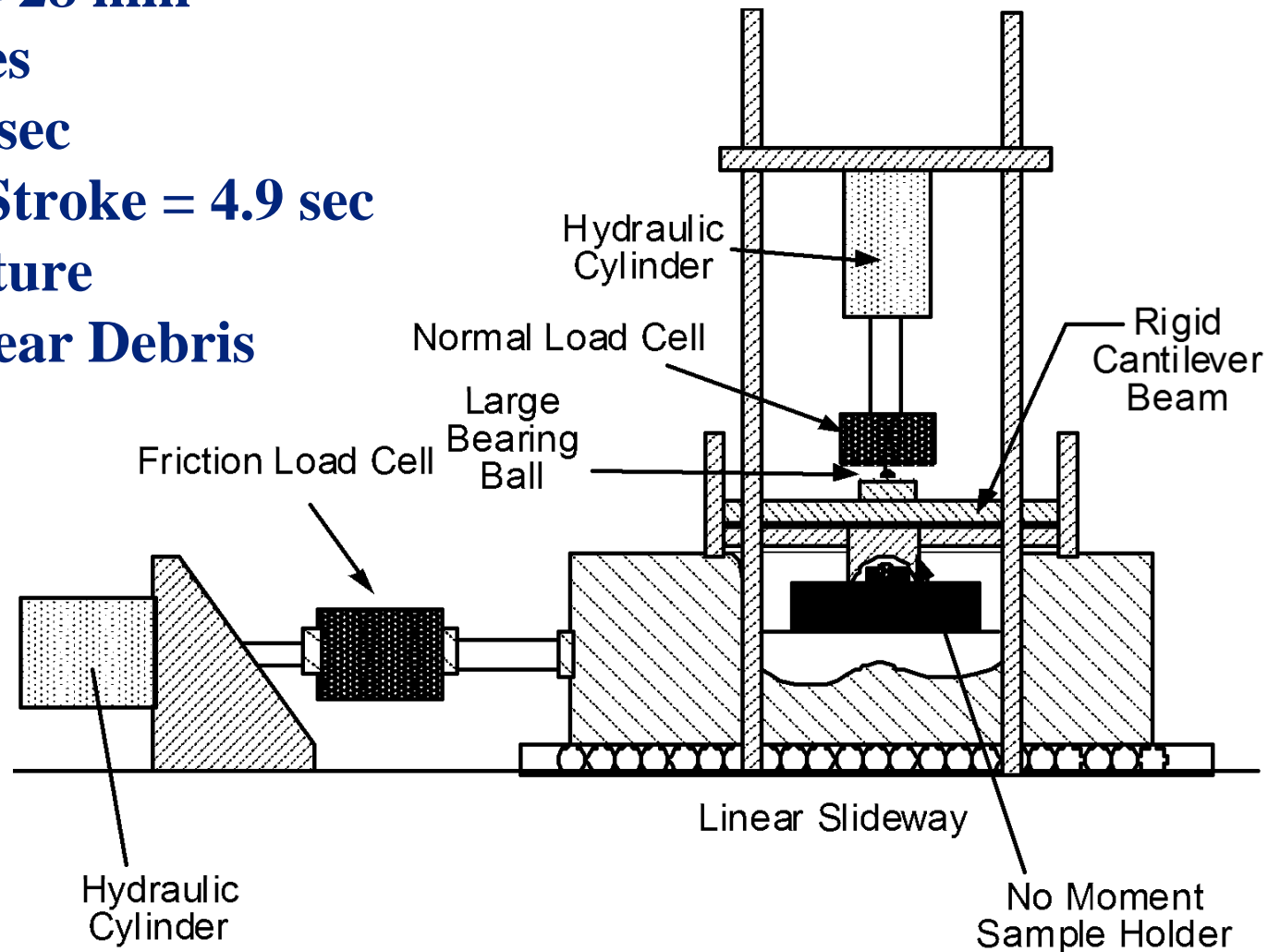
The Battelle Institute

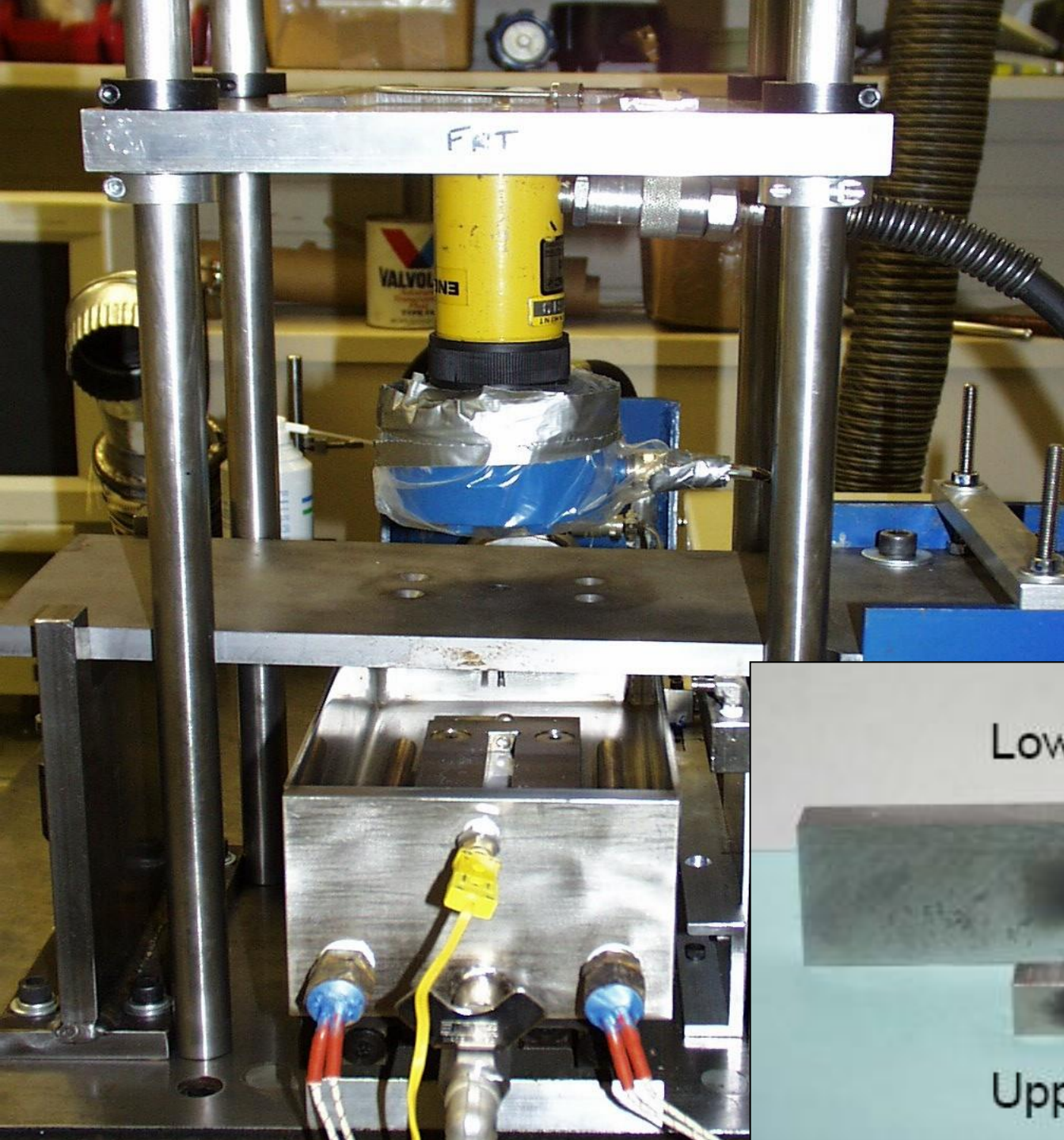
Information on Test Laboratory

- ✓ **Technology Development for Industry and Government**
 - ✓ **Based in Columbus, Ohio**
- ✓ **7,500 Research Scientists and Engineers**
- ✓ **Euro 1 Billion Annually in Revenue for Research**
- ✓ **Serves over 2000 Companies and Government Agencies**
- ✓ **50-100 Patents / year**
- ✓ **Operates 4 National Laboratories**

Material Test Parameters

- ✓ Pressure = 13.8 MPa
- ✓ Stroke Length = 28 mm
- ✓ Cycle = 2 Strokes
- ✓ Speed = 25 mm/sec
- ✓ Delay Between Stroke = 4.9 sec
- ✓ Room Temperature
- ✓ Air Blown to Clear Debris





Battelle Test Rig

Lower Sample

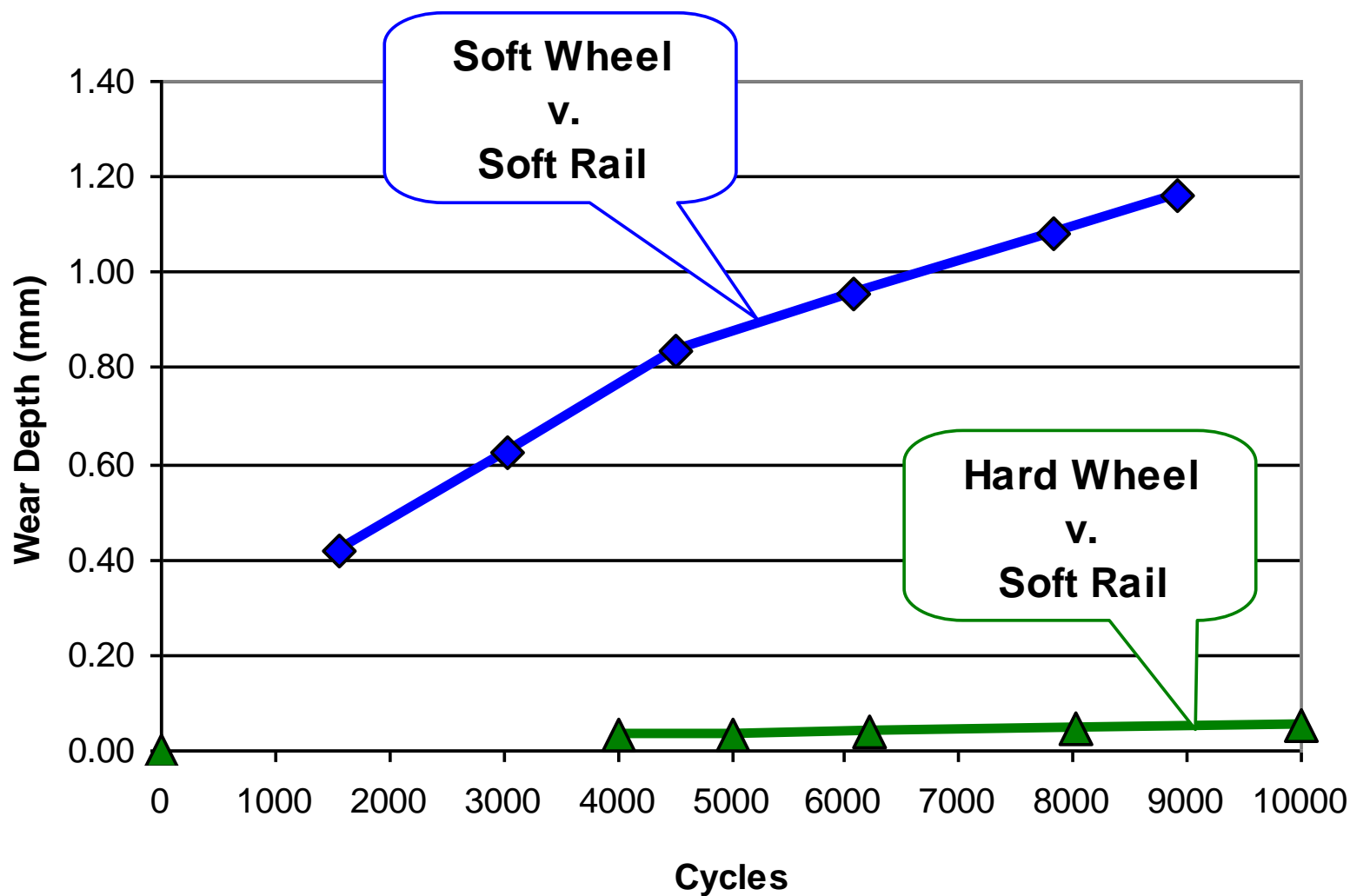


Upper Sample

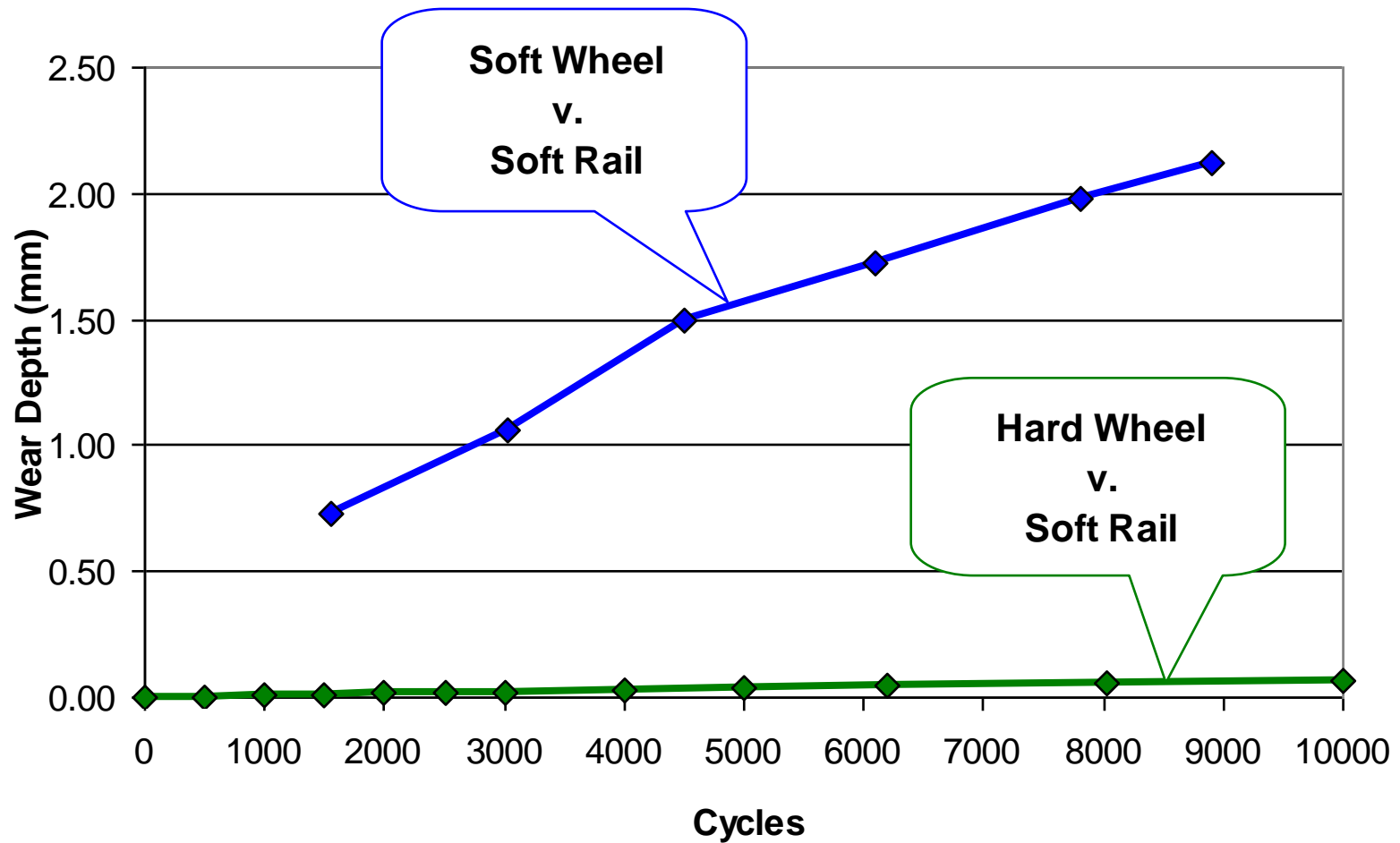
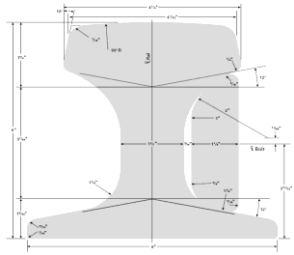




Wheel Wear



Rail Wear



Material Test Samples after 10,000 Cycles

Soft Wheel Material



Hard Wheel Material

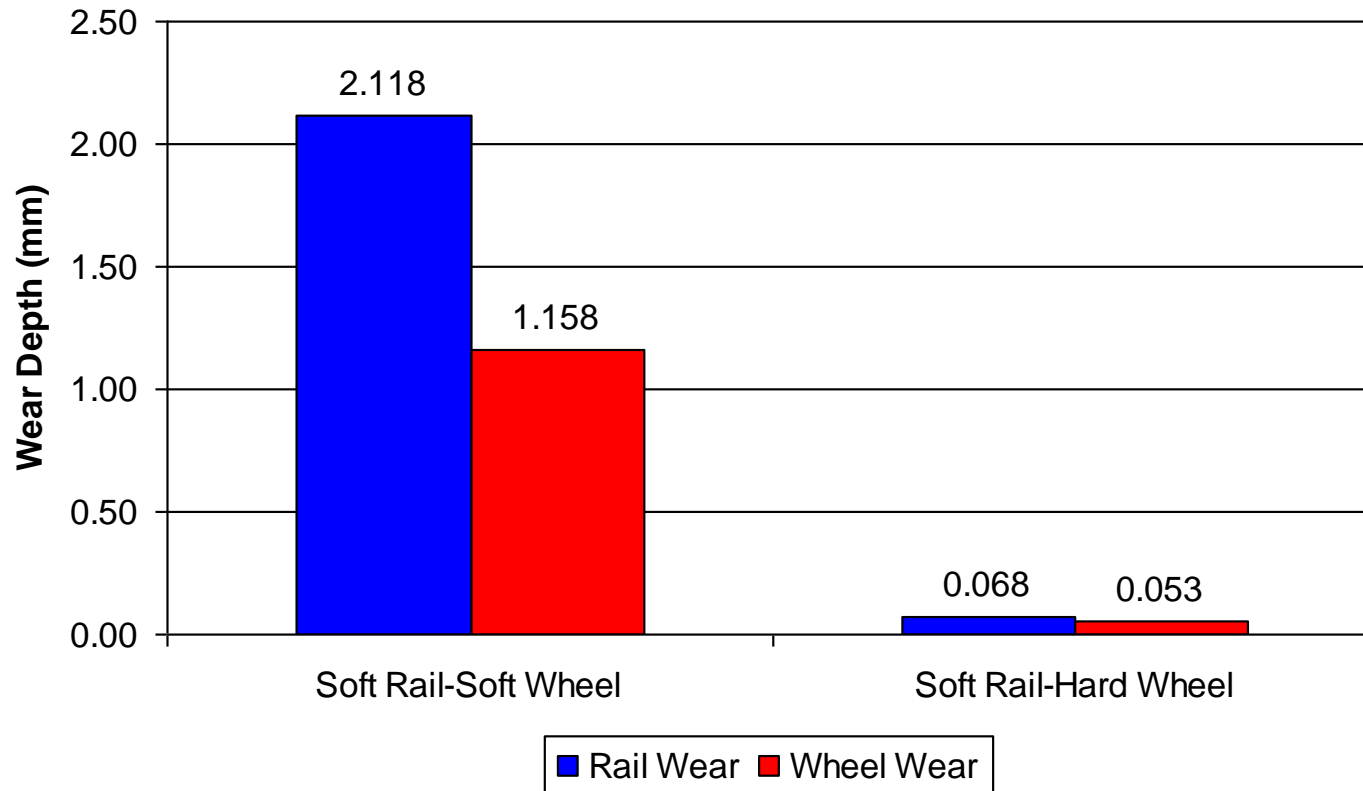


Soft Rail Material



Soft Rail Material

Wear Depth Test Results 10,000 Cycles



- ***Worst combination for wear is Soft Wheel – Soft Rail***
- ***Best combination for wear is Hard Wheel – Soft Rail***

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Thanks for your attention!

