Field Characterization of Rail Friction

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Overview

- Background
- Characteristics of OnTrak tribometer
- Goals of Project
- Test plan and needed site characteristics
- Summary

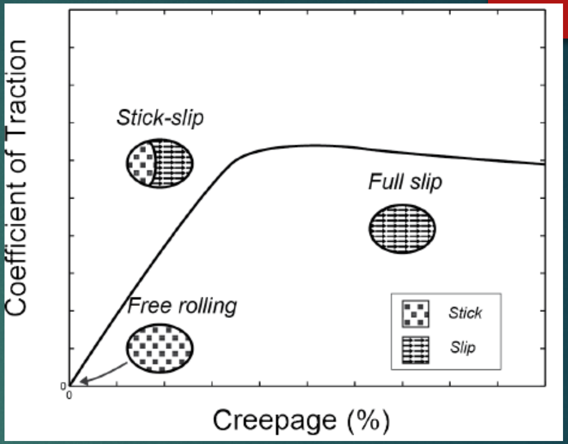
Background

- Wheel / Rail friction is a fundamental parameter influencing RCF and wear
- Multiple methods* have been used to measure "rail friction", each with drawbacks, e.g.
  - BR tribometer train
  - Salient push tribometer
- Results from different instruments cannot be compared
  - Creep level unknown and likely variable
- Traction / creepage relationship unknown / difficult to measure under real world conditions
  - Impacts accuracy of dynamic models

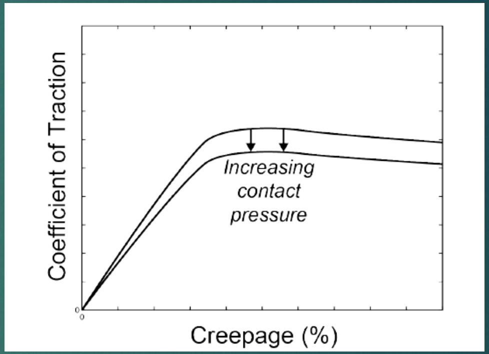
**ICRI conference presentation, Vancouver, August 2017*

Factors affecting friction levels

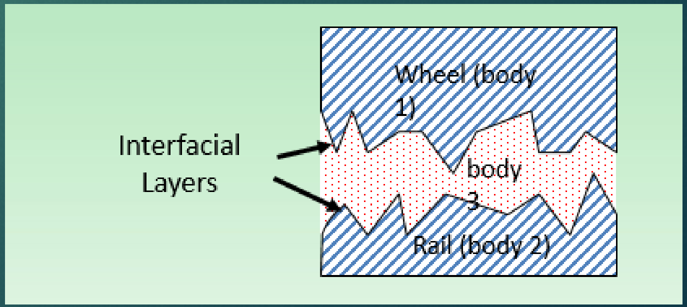
- Creep (slip)



- Contact pressure



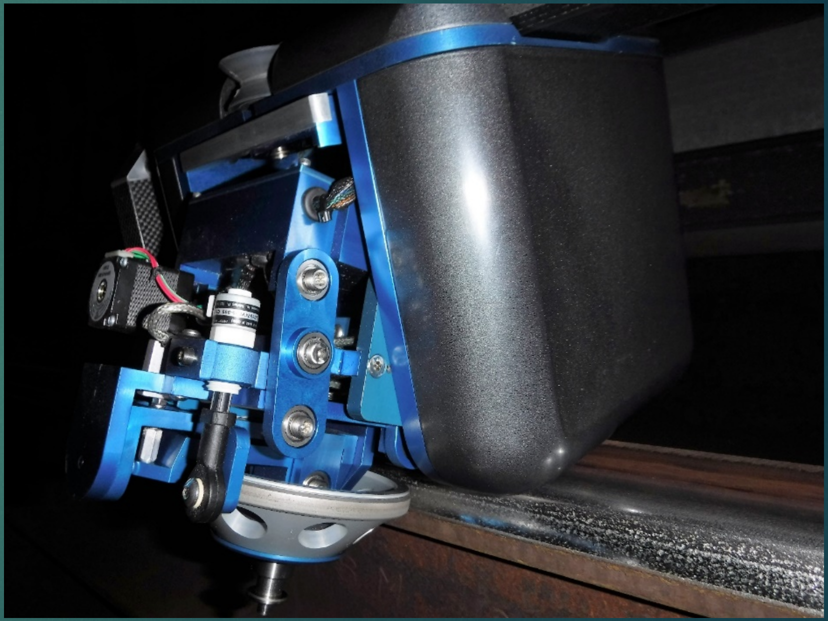
- Third Body layer: accommodating velocity differences



- Wheel and rail roughness

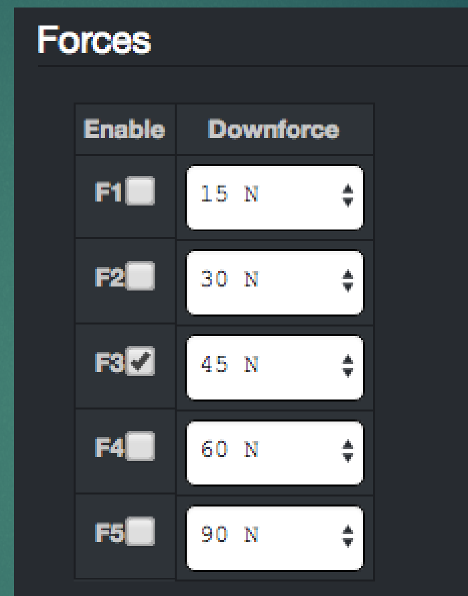
OnTrak tribometer characteristics

- Variable vertical load (Hertzian stress)
- Variable angle of attack between measuring wheel and rail (varying creep force)
- Varying lateral position on rail
- Measure 30 cm rail length forward and back

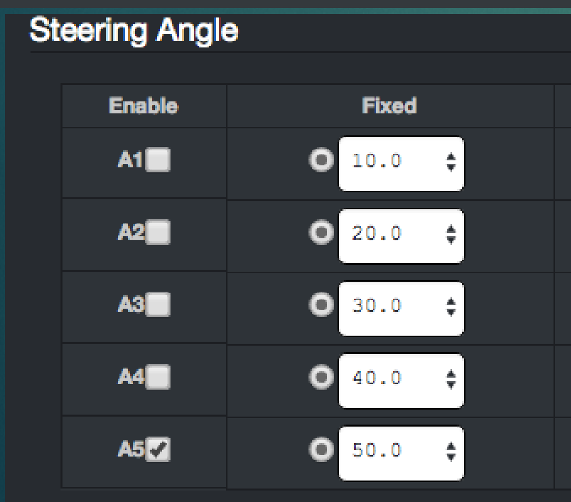


On Trak tribometer variables

Lateral position



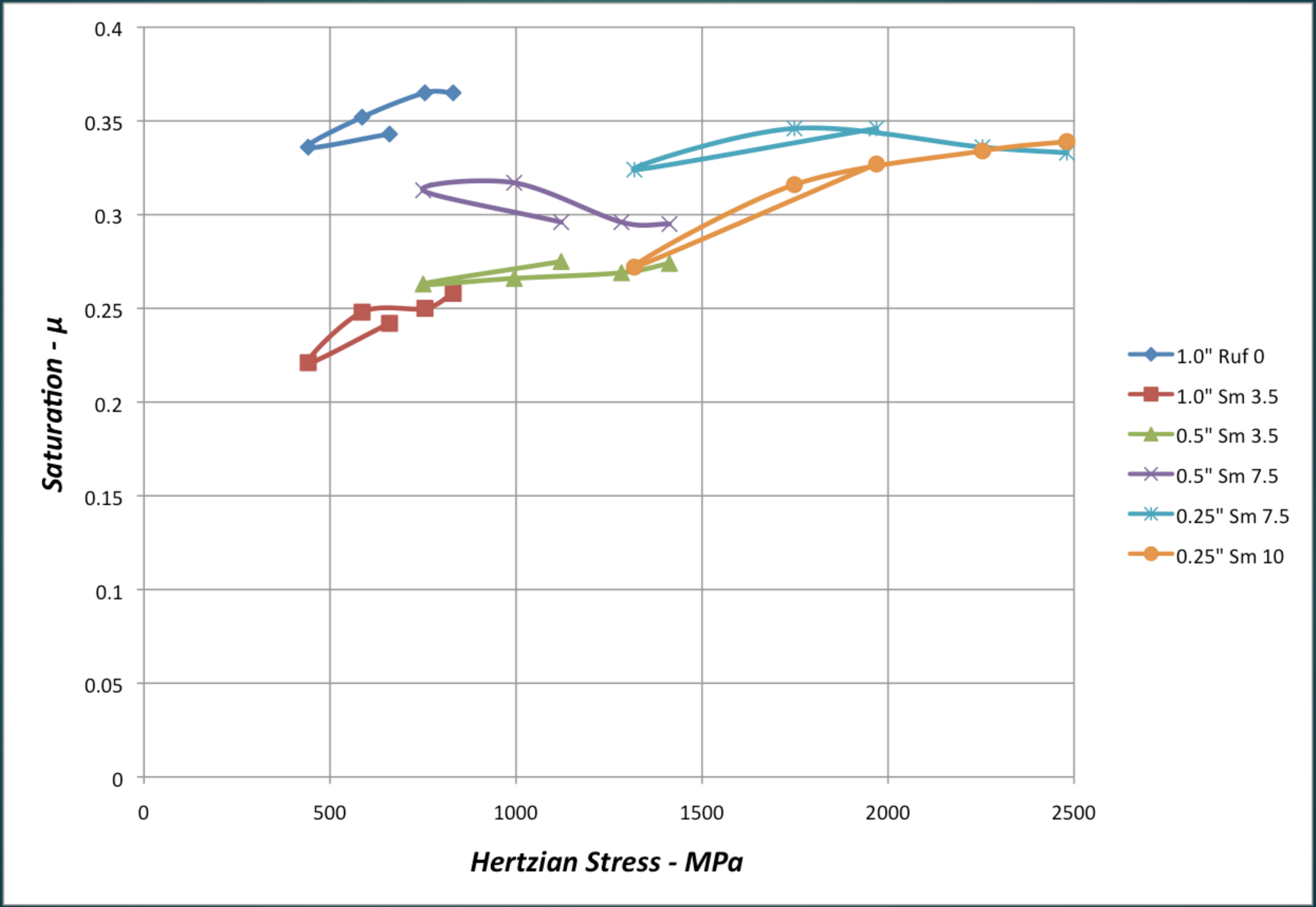
Vertical force variable: used 45 N, approx. 660 Mpa (heavy wheel)



Angle of attack (mrad) variable: we ran equivalent of 5% slip

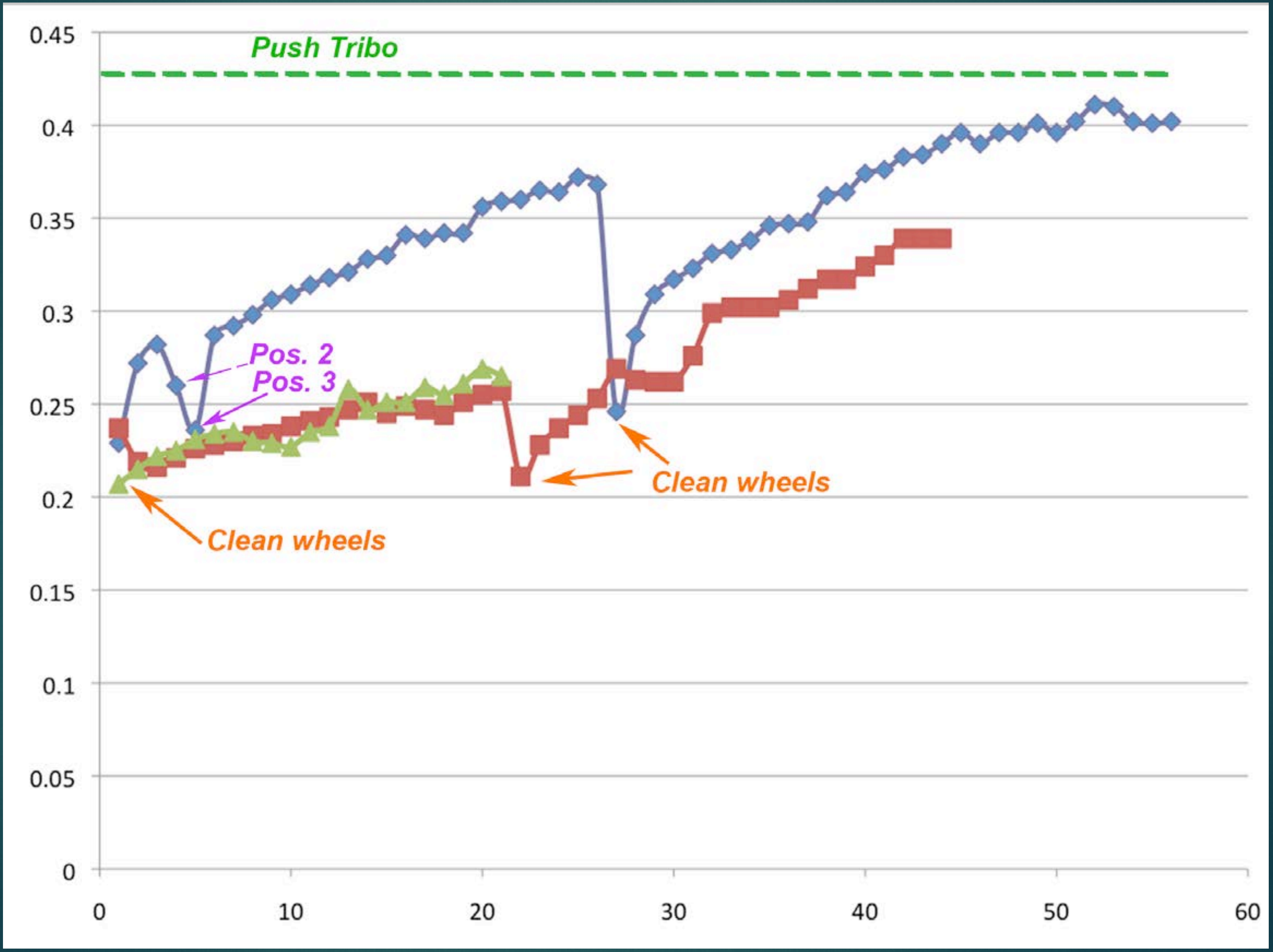
OnTrak tribometer: Early Field and Lab Results

- What are the 'Real' numbers?



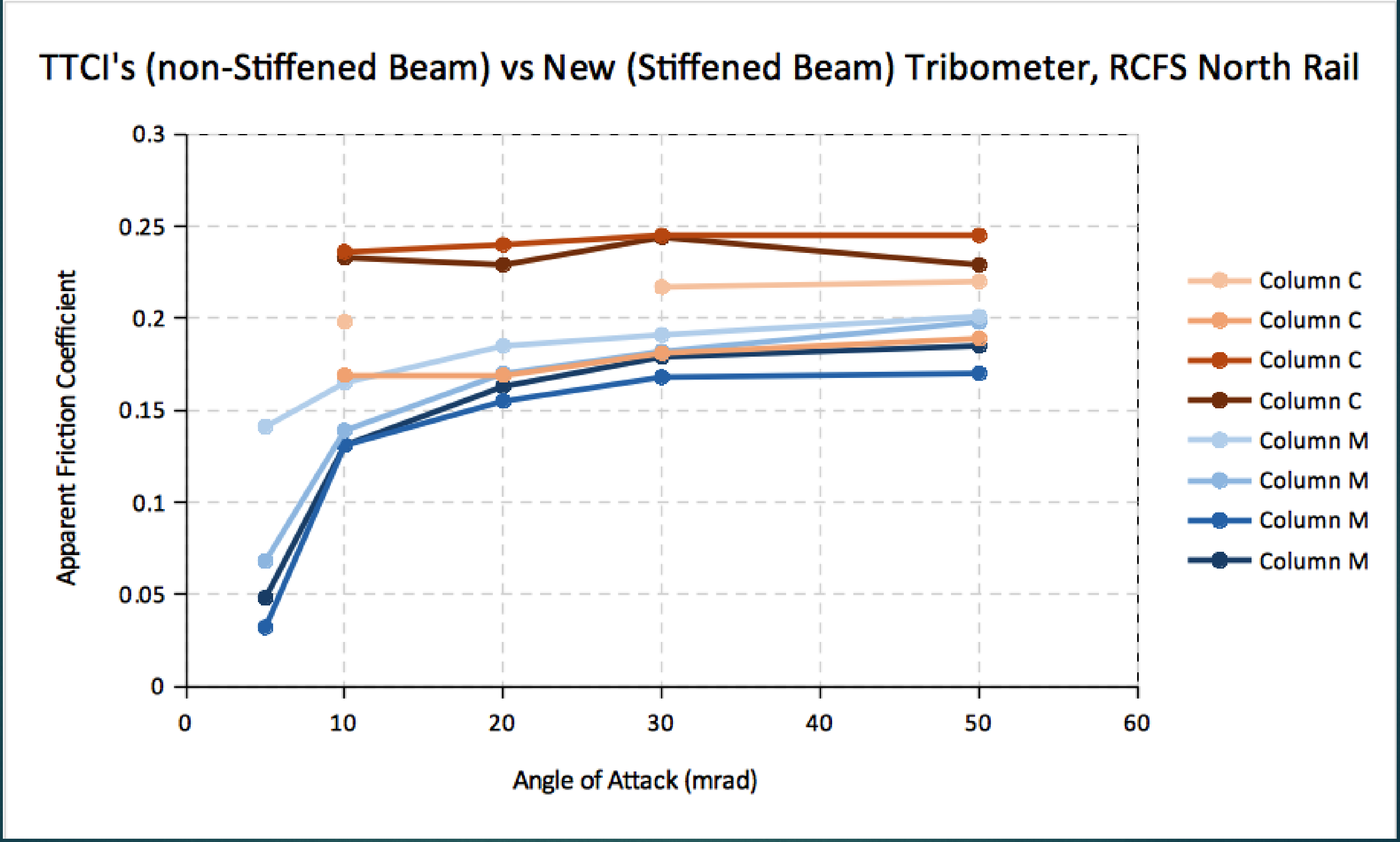
OnTrak tribometer: Early Field and Lab Results

- Correlation with other Techniques



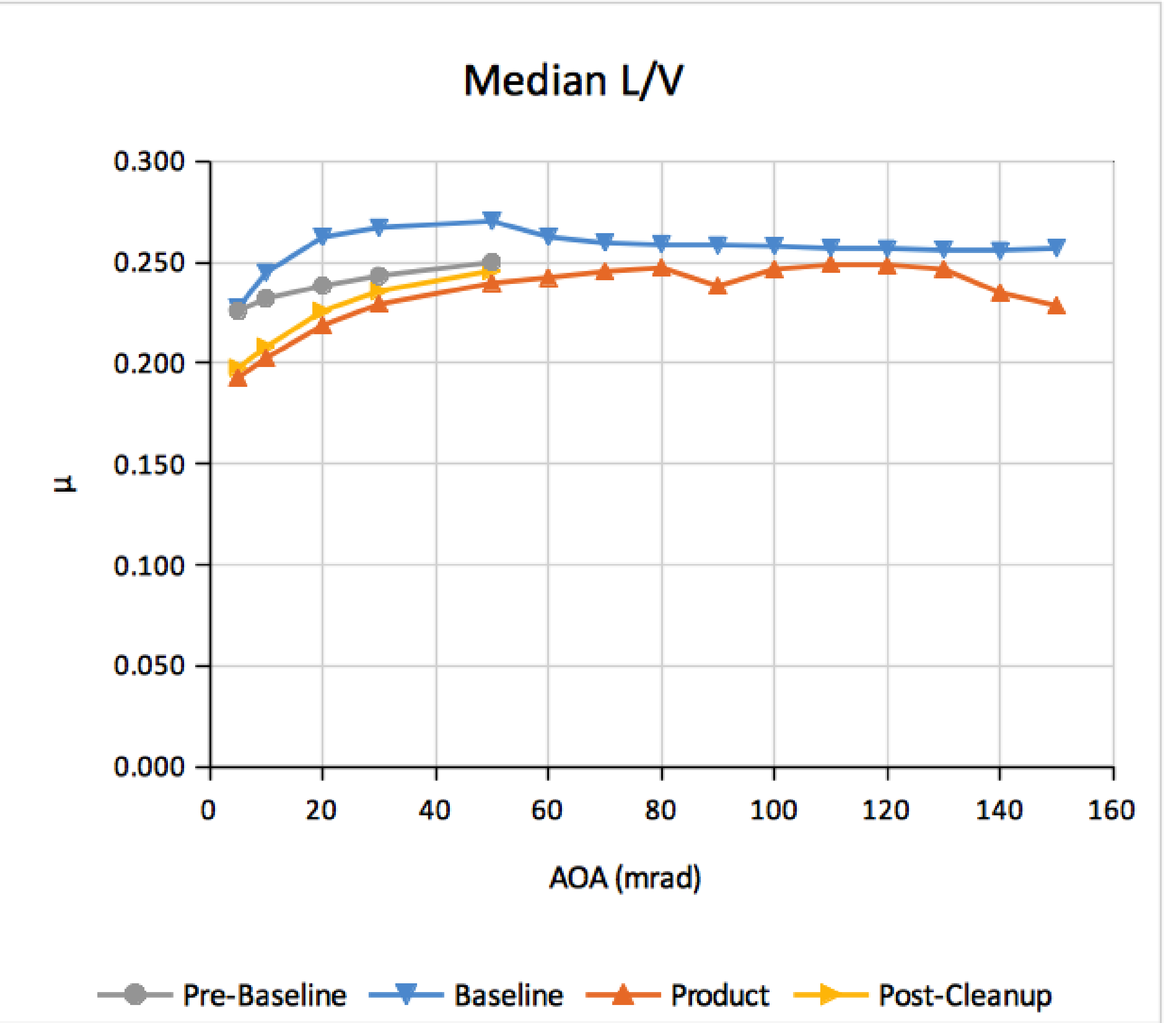
OnTrak tribometer: Early Field and Lab Results

- Correlation with Early/Late Beam Design



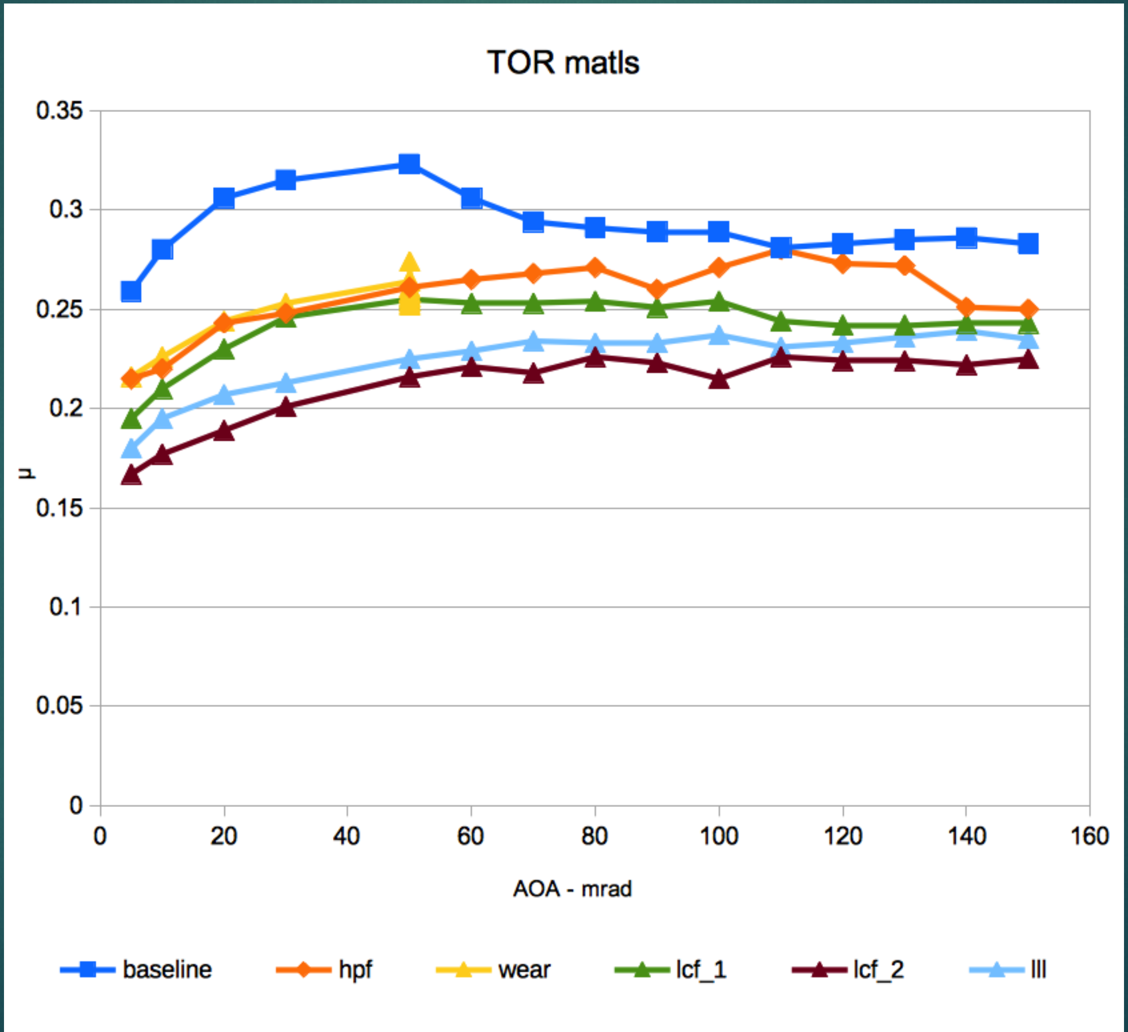
OnTrak tribometer: Early Field and Lab Results

- Early Lab Tests



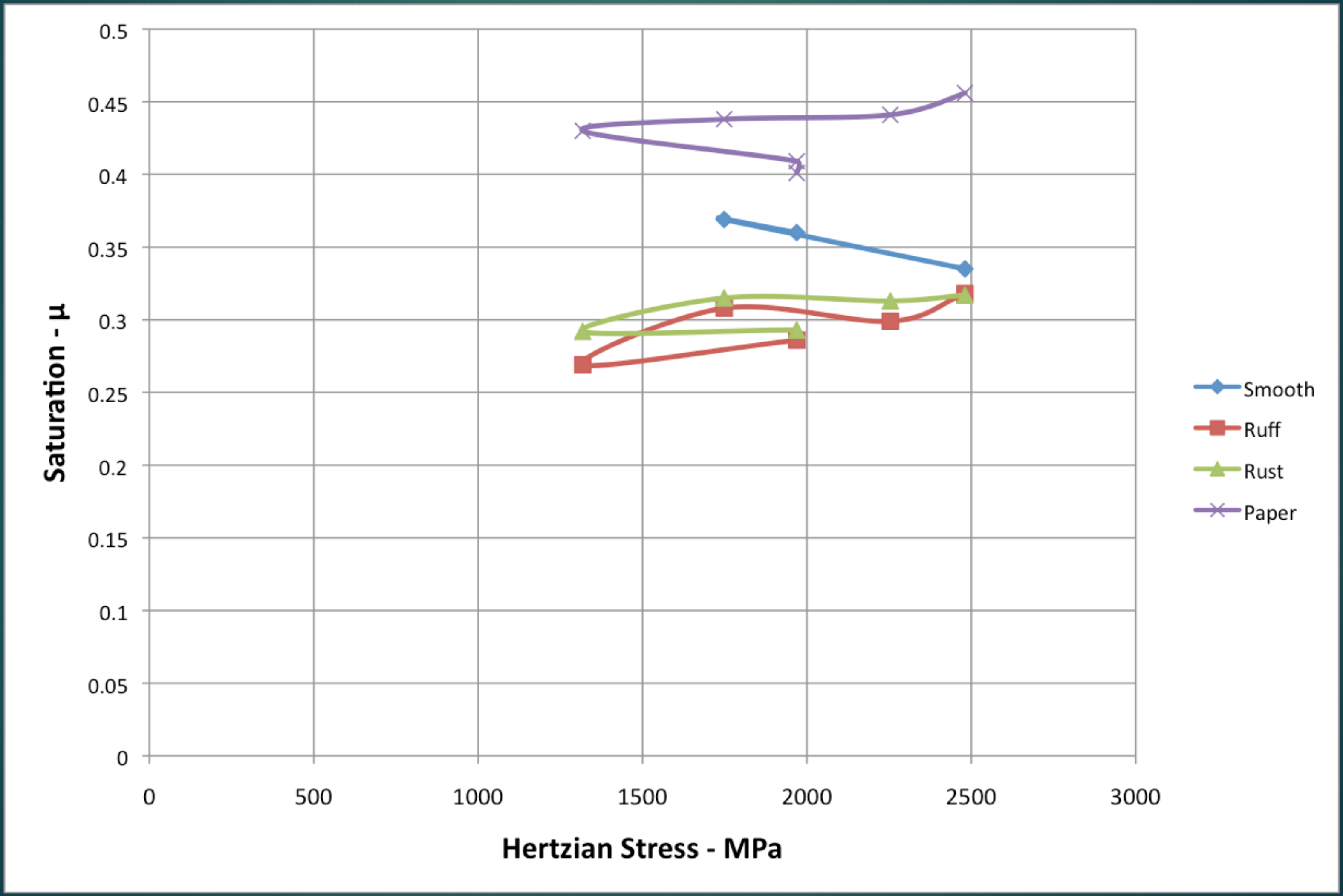
OnTrak tribometer: Early Field and Lab Results

- Early Lab Tests



New developments:

- OnTrak tribometer: Early Field and Lab Results



Project Goals

1. Use OnTrak tribometer to better understand rail friction variations under controlled measurement conditions:
    - Curves / tangent/ gradient / transverse position etc
    - Traffic effects
    - Lubrication / FM effects
2. Develop traction / creepage curves under real world (variable) conditions
3. Define operational best practices: (load, AOA, wheel cleaning etc), scaling to larger wheels
4. Relate friction / creepage to interfacial layer composition by sampling / analysis collaboration with U of Sheffield

Test site(s) requirements

Needed

- Access to measure rail: sharp curve, tangent track.
- 3-4 one day visits spread over different weather conditions, 4-6 hours measurement (traffic dependent)
- If TOR present, ability to shut off for 2-3 days prior

Preferred

- Active L/V measurement site on curve with data available
- In or close to BC or Washington State
- Road accessible

Third Body Layer Composition

- Third Body composition / shear strength is closely tied to friction and traction / creep curves
  - Iron oxides and wear particles influenced by wheel / rail interaction, temperature, humidity and traffic patterns
- New sampling technique developed by University of Sheffield plus new powder X-ray diffraction analysis showing promise in UK testing
- Samples will be collected in parallel with friction testing, and sent to Sheffield of analysis

Summary

- Systematic examination of friction / creep relationship with new tribometer
- Outputs:
  - Detailed mapping of friction / creepage under a range of conditions
  - Develop methodology and best practices
  - Composition of Third Body layer related to friction levels
- We need help in identifying suitable site(s)!