ICRI Residual Cracks

WebEx 06JUL17

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Conseil national de recherches Canada

Canada

Example: High rail, freight

Initial

1 pass

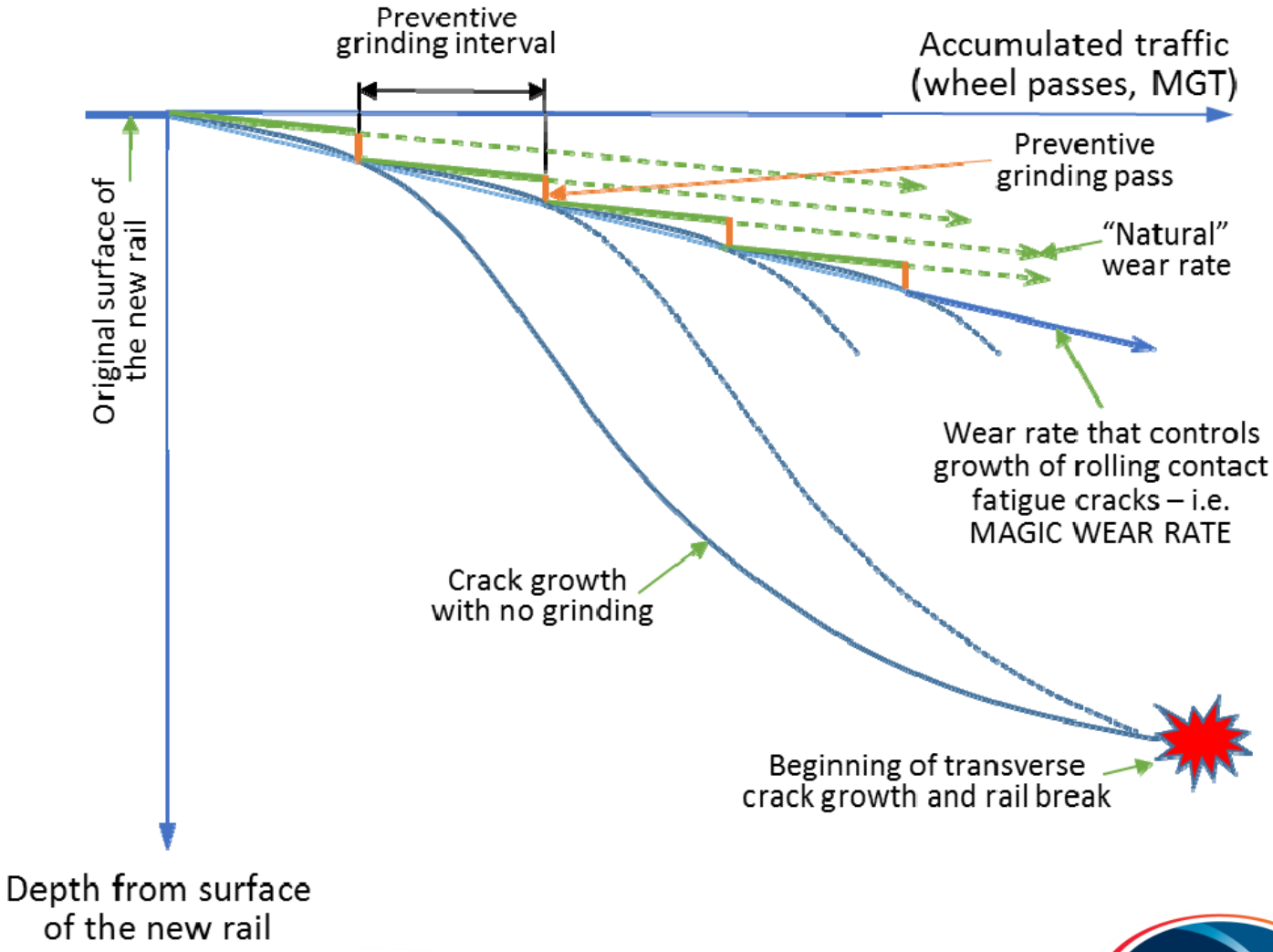
2 passes

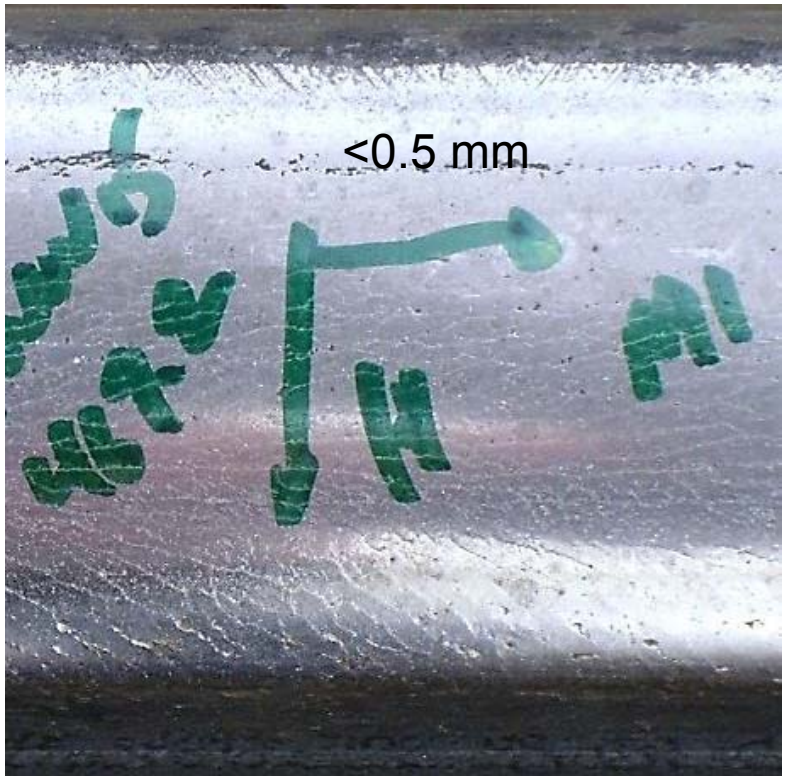
Example: Low rail, freight

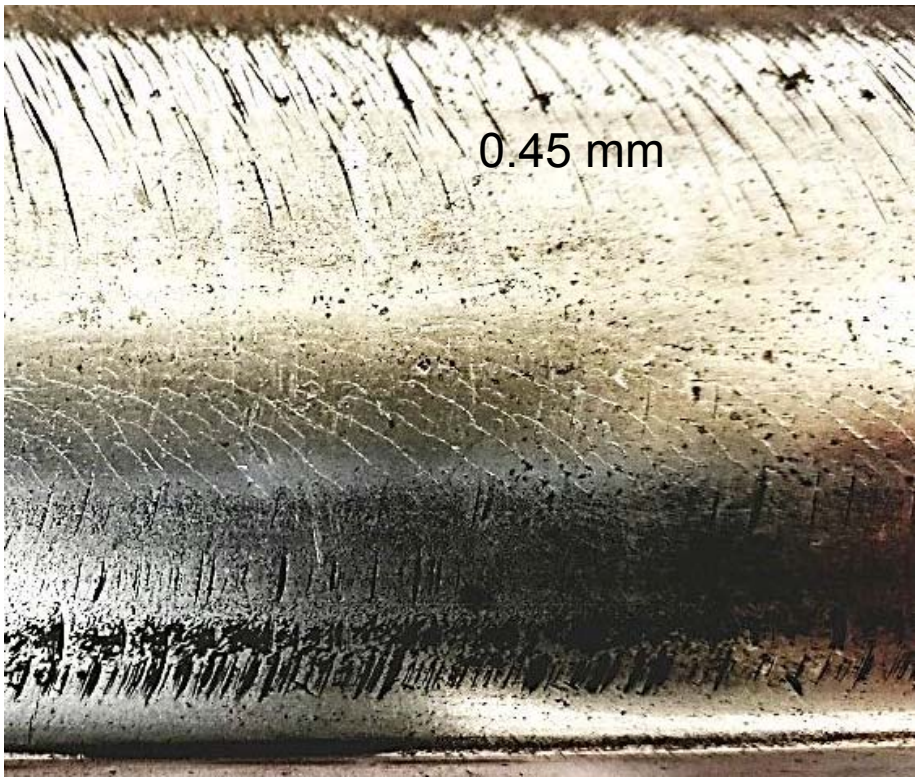
Initial

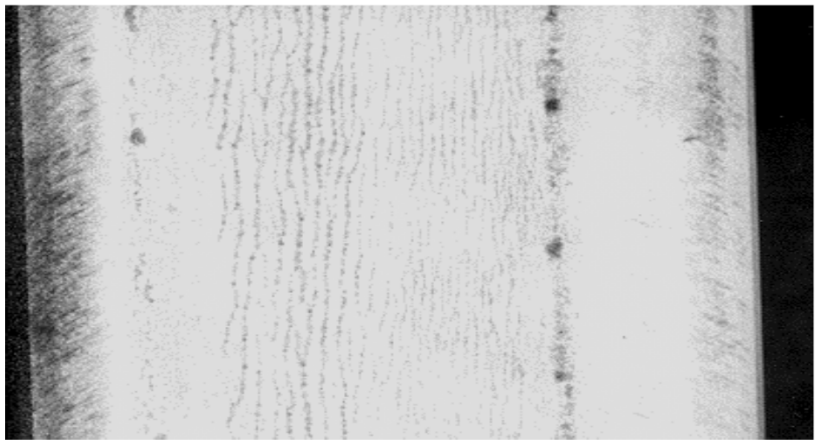
After 3 passes

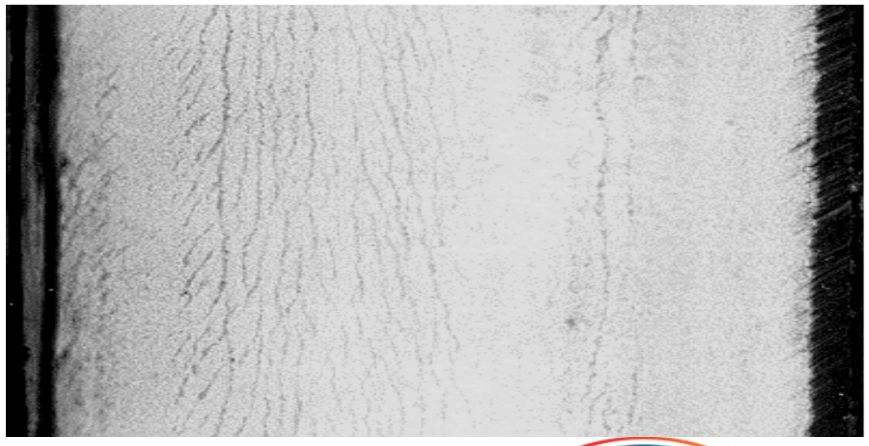
Preventive Rail Grinding




<0.5 mm


0.45 mm





Problem

It is common practice in rail grinding to apply only a limited number of passes, not necessarily to remove all cracks.

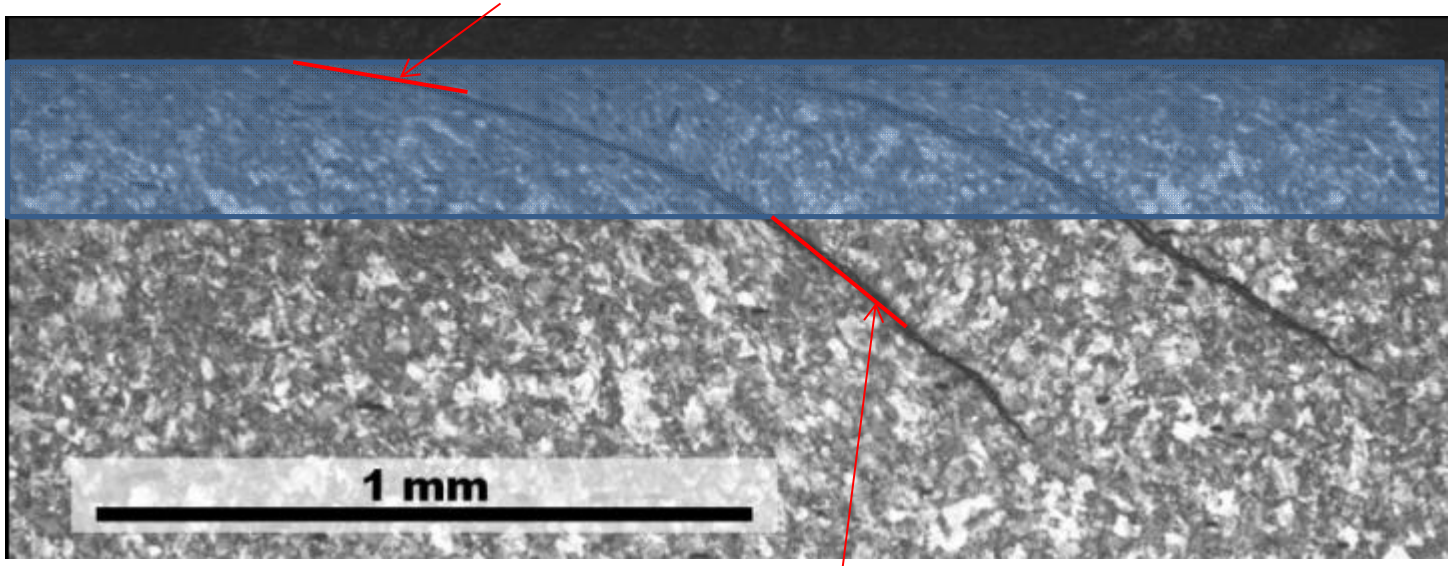
The residual cracks

- Are they dangerous? Benign? “Better” or “worse” than new cracks?
- How much residual cracking is “OK”?

Q1: Are residual cracks dangerous? Benign? “Better” or “worse” than new cracks?

Classical “new” cracks

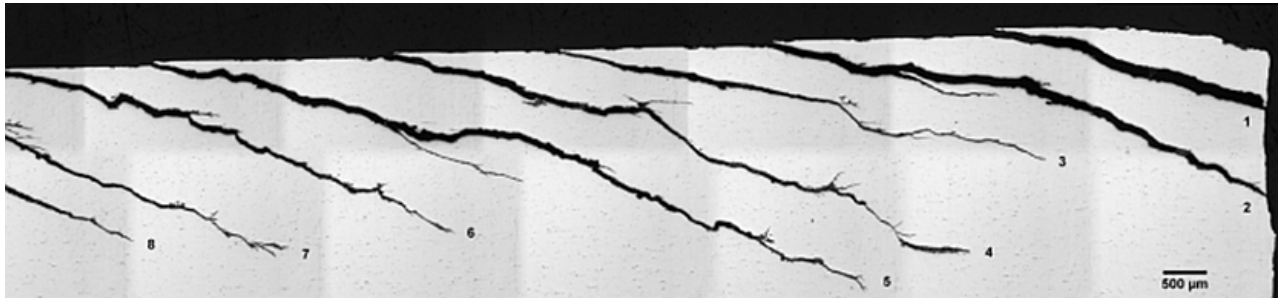
initial propagation angle
approximately 10°

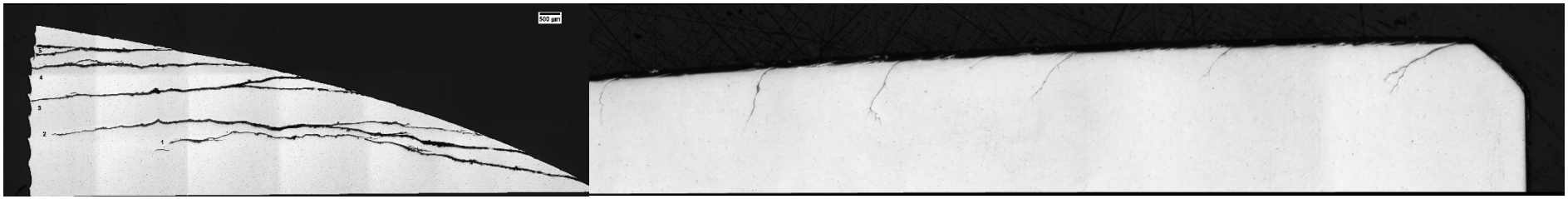


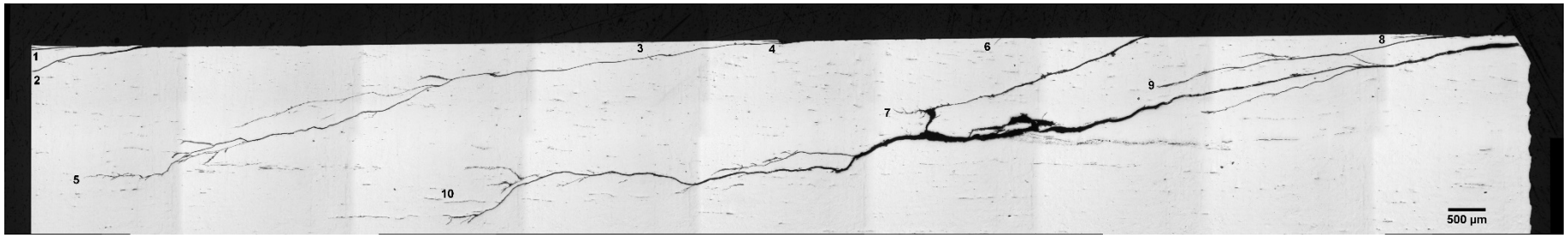
1 pass grinding: approx. 0.25 mm

later stages propagation angle
approximately 40°

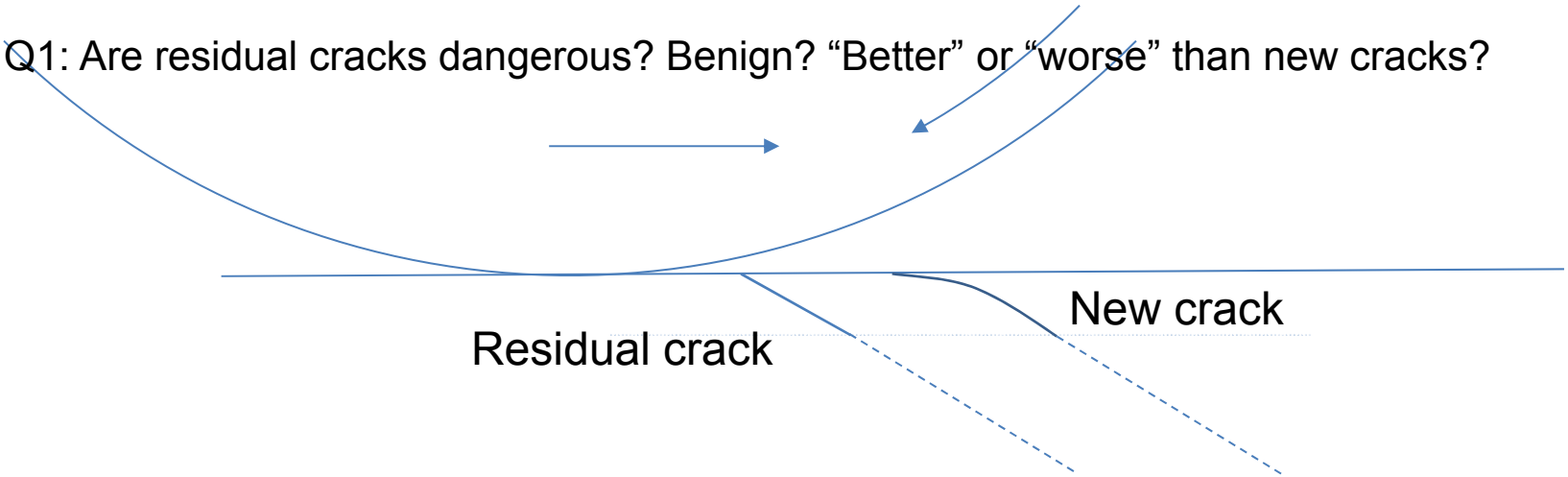
“Residual” cracks





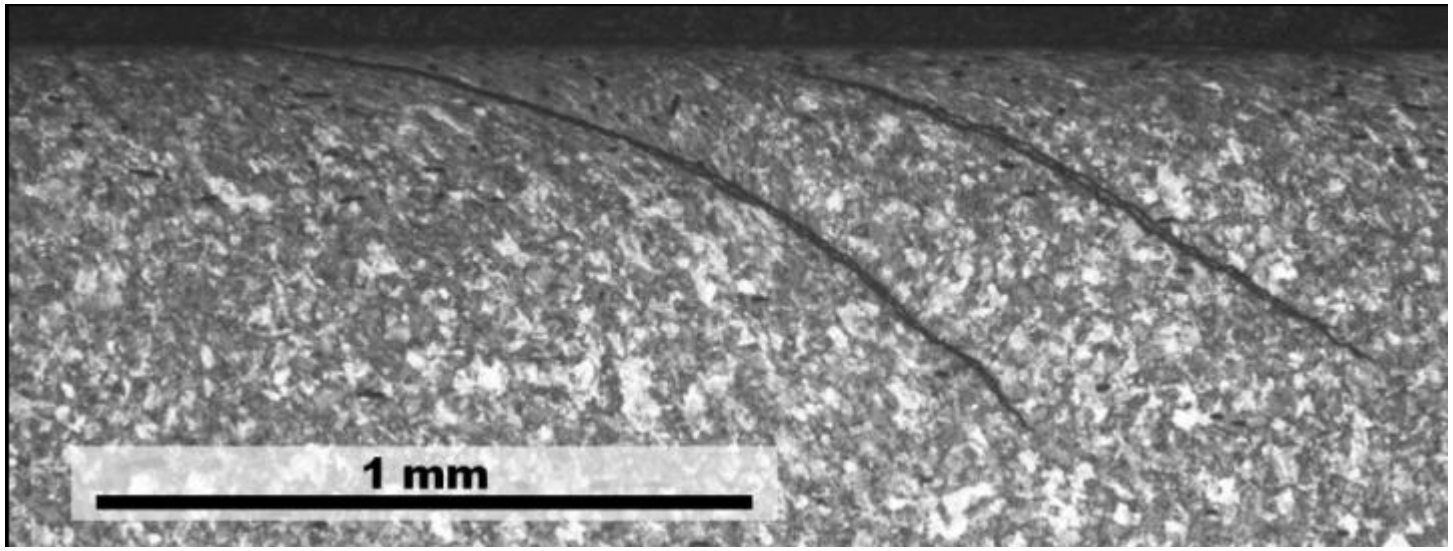


Q1: Are residual cracks dangerous? Benign? “Better” or “worse” than new cracks?



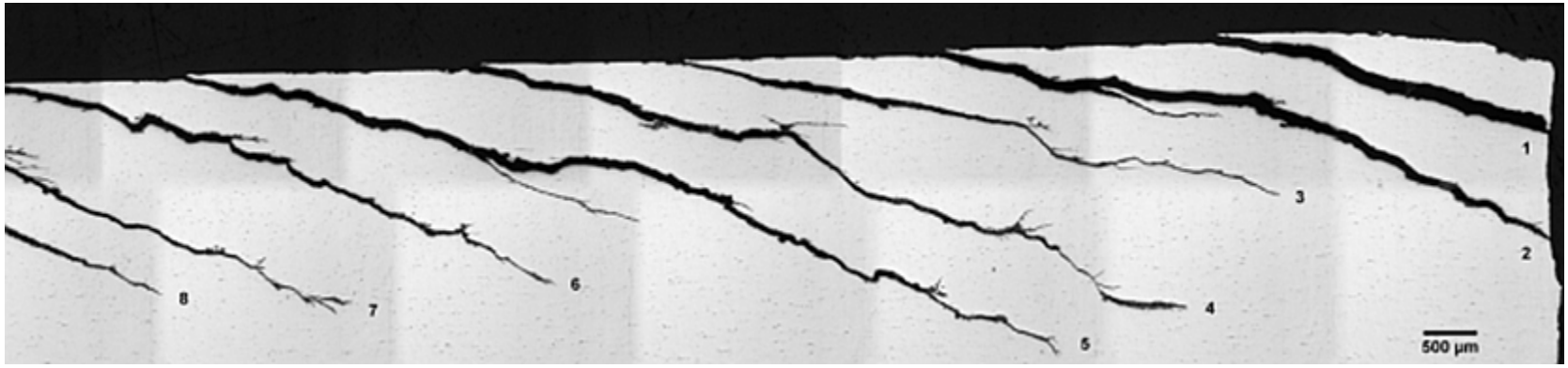
Residual	Crack type	New
Shorter	Length (at same depth)	Longer
Straight	Subsurface path	Curved
Steeper	Angle at crack tip	Shallower or same
Older/fretted/smoother?	Crack faces	Younger, rougher (?)
More contamination and corrosion	Crack interface	Less contamination or corrosion
Less strained, possibly softer (?)	Steel properties	More strain hardened

Classical “new” cracks

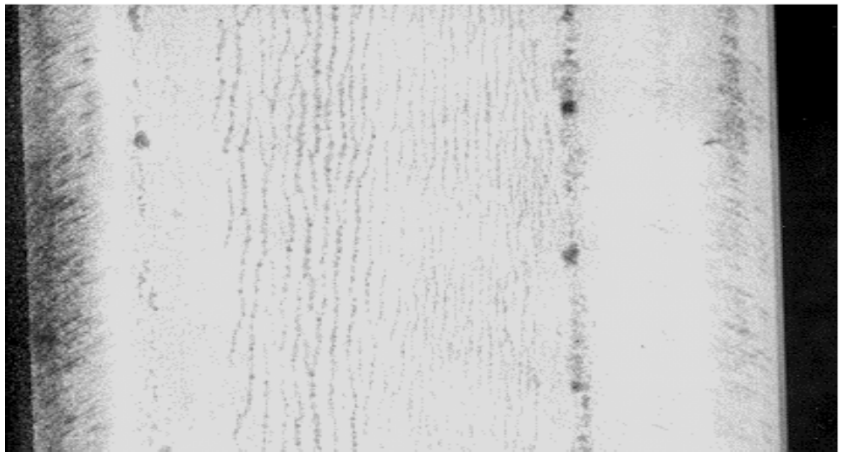


Sample #7

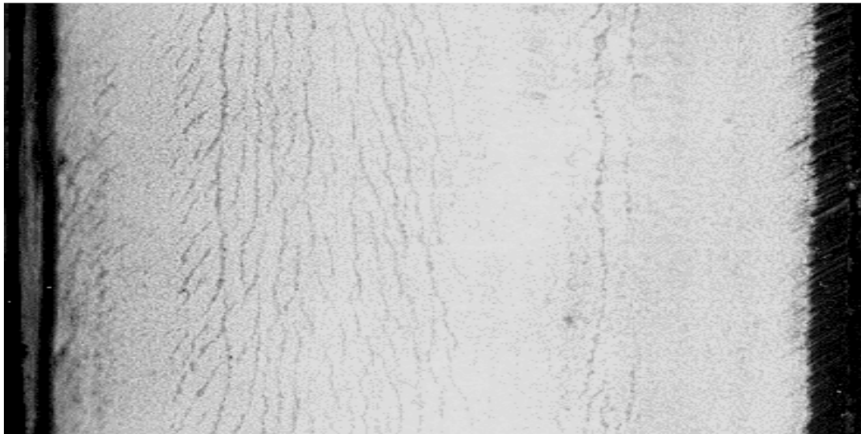
2-2.5mm deep cracks



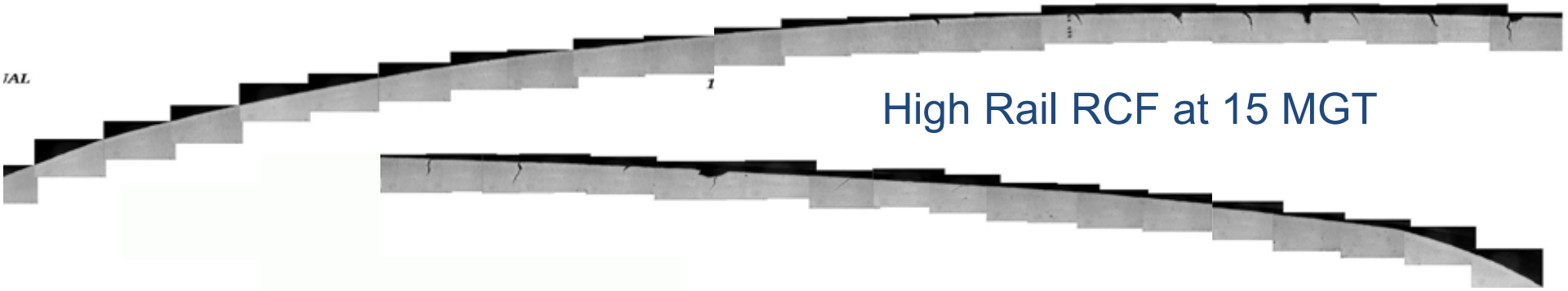
RCF at 15 MGT Cycles - BNSF



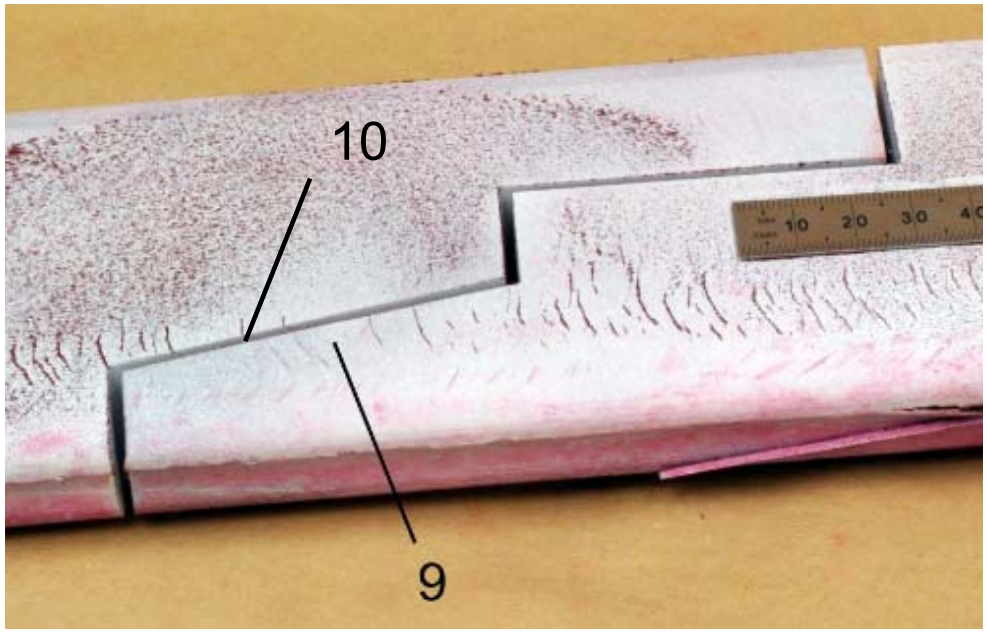
low rail

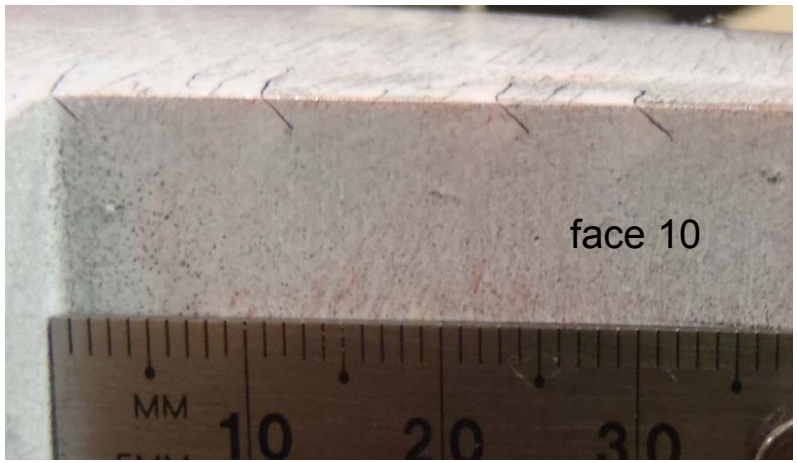


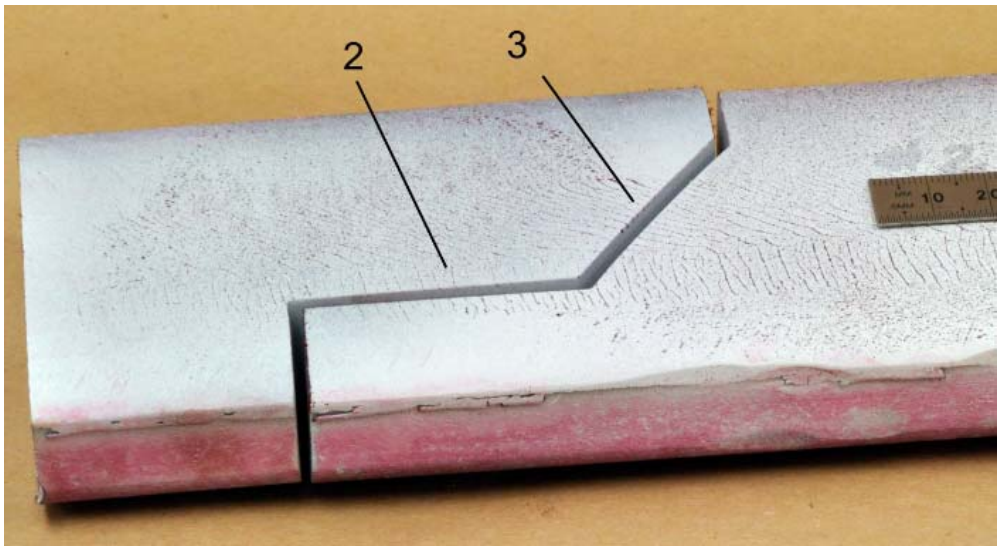
high rail

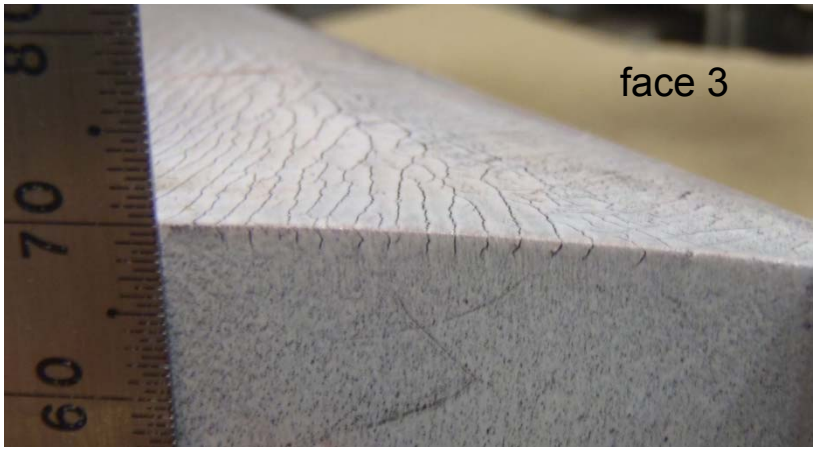


High Rail RCF at 15 MGT


10
9


face 10
MM
10
20
30


2
3


face 3
70
60

Residual versus Classical cracks

Observation:

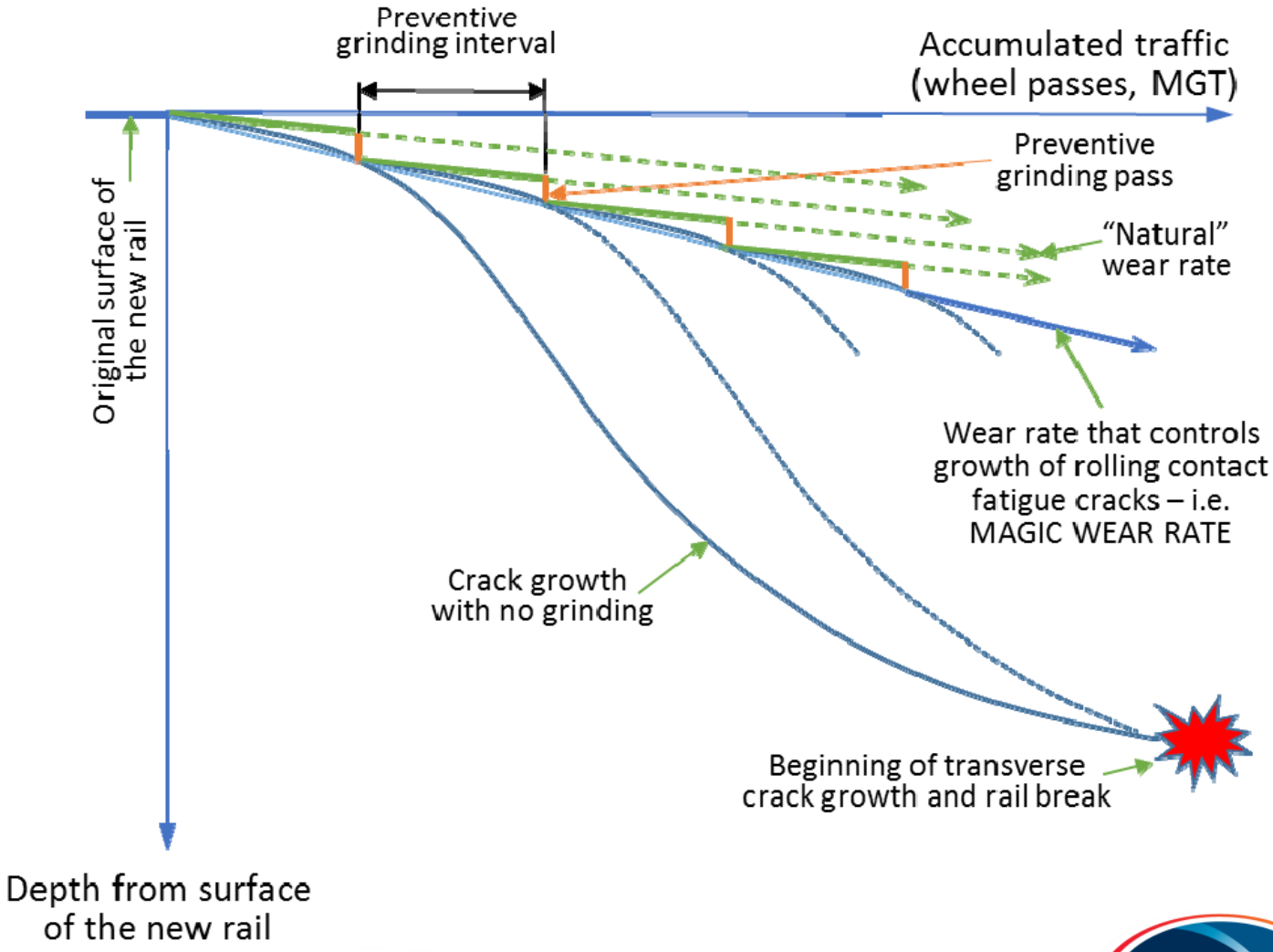
Very few “classical cracks” seem to exist in practice

Question:

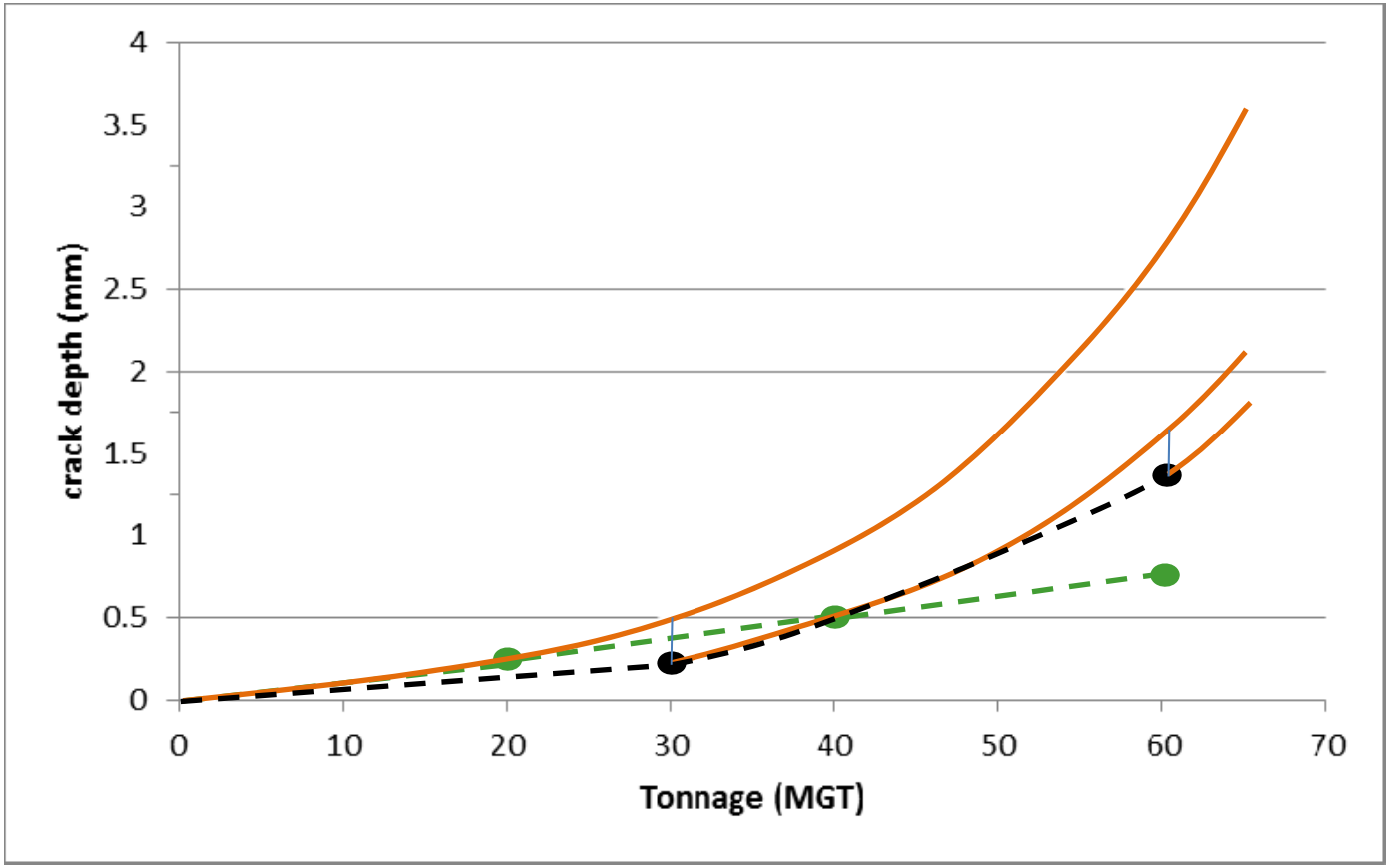
Even if/where they do exist, as soon as they grow longer than a fraction of a millimeter, are they much different than residual cracks?

Q2: How much residual cracking is “OK”

Preventive Rail Grinding



Preventive grinding



How much residual cracking is OK?

- "The only good crack is a dead crack!"
- Residual cracks
  - Compromise ultrasonic detection
  - Reduce strength of rail steel
    - More rapid deformation and wear
  - Increase risk of rail breakage

    o service failures, derailments
- "OK" is defined according to cost, risk, logistical limitations, current state of wear, rail steel, position on rail, season, etc.

Conclusions

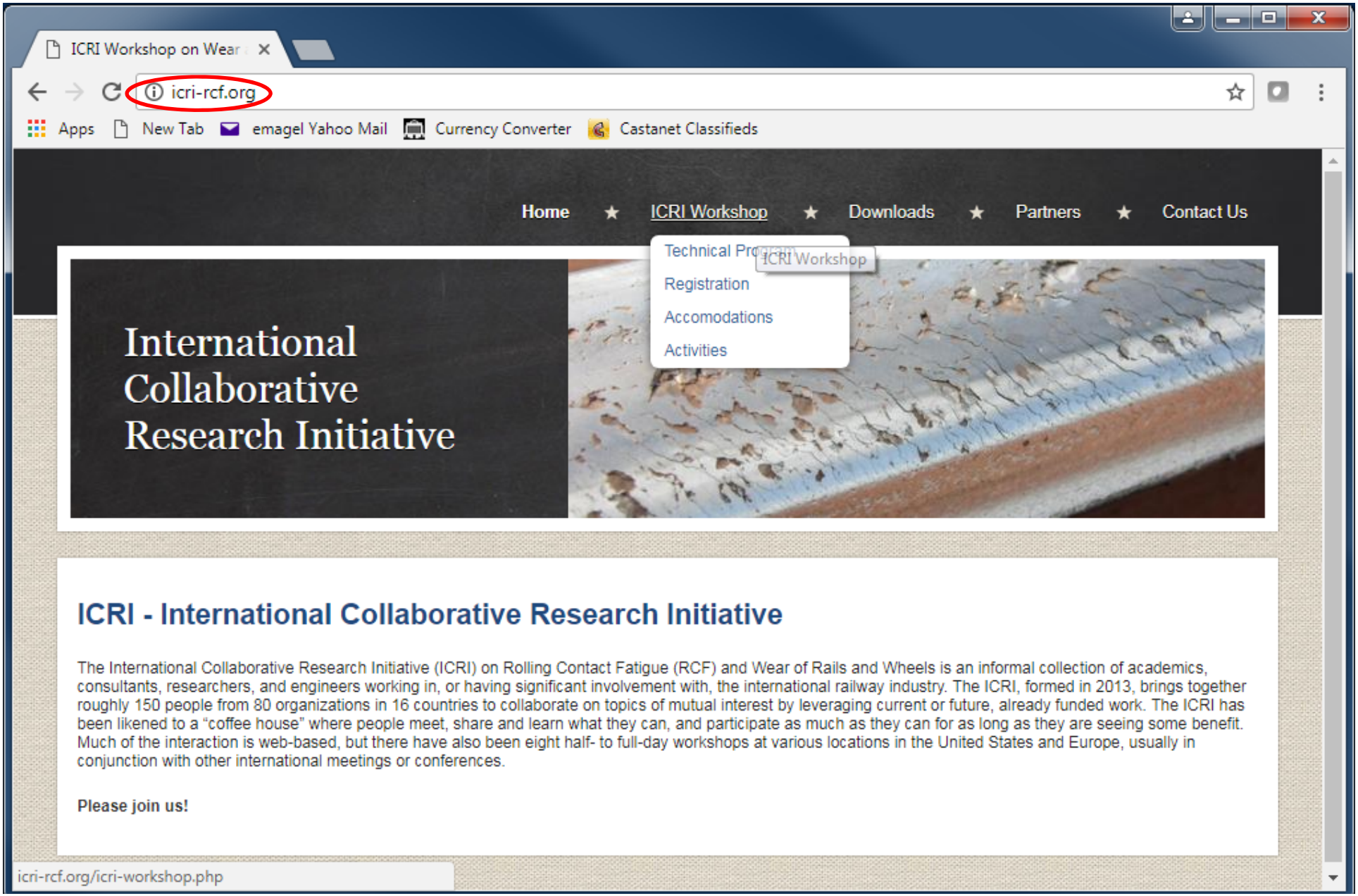
- In practice – rail condition is dictated by residual cracks.
  - o i.e. railroads are already dealing with residual cracks.
- ~~"how dangerous are residual cracks?"~~
  - o "how dangerous are RCF cracks
    - – of this surface length
    - – of this subsurface depth
    - – at that position (gauge, crown, field)
    - – having this density (# cracks/inch)
    - – having this angle, this shape, etc."

Conclusions (cont'd)

- Several existing ICRI projects looking at RCF cracking and grinding addressing "generic" questions
  - ICRI-Quantify Surface Fatigue
  - ICRI-Magic Wear Rate
  - ICRI-Predictive Grinding
  - ICRI-Performance of Rail Before First Grind
  - ICRI-Safety

→ Close ICRI-Residual Cracks topic

Reminder!


ICRI Workshop on Wear
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New Tab
emagel Yahoo Mail
Currency Converter
Castanet Classifieds
Home
ICRI Workshop
Downloads
Partners
Contact Us
Technical Program
Registration
Accomodations
Activities
ICRI Workshop
International Collaborative Research Initiative
ICRI - International Collaborative Research Initiative
The International Collaborative Research Initiative (ICRI) on Rolling Contact Fatigue (RCF) and Wear of Rails and Wheels is an informal collection of academics, consultants, researchers, and engineers working in, or having significant involvement with, the international railway industry. The ICRI, formed in 2013, brings together roughly 150 people from 80 organizations in 16 countries to collaborate on topics of mutual interest by leveraging current or future, already funded work. The ICRI has been likened to a "coffee house" where people meet, share and learn what they can, and participate as much as they can for as long as they are seeing some benefit. Much of the interaction is web-based, but there have also been eight half- to full-day workshops at various locations in the United States and Europe, usually in conjunction with other international meetings or conferences.
Please join us!
icri-rcf.org/icri-workshop.php