Grinding of New Rails

ICRI Assignment

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Questions

1. Is there a point that it is too late for a first grind? Does damage become irreparable at some point?
2. What is the role of improper shape and what is the role of mill scale when determining the optimal first grind time?
3. Should new rail be rolled with a profile closer to our high rail, low rail or tangent templates? If we use a high rail template, is there an adverse consequence for low rails and tangents?
4. What role does rail hardness play?
   - How much work hardening is removed by grinding?
5. Can modeling contribute to this assignment?
6. What field tests can be conducted?

Standard Practices

- North America
  - New rail is ground when it fits into the normal grind schedule.
  - Occasionally, schedules will be altered to address large out-of-face relay projects.
  - Transit systems generally grind for removal of mill scale prior to service.
- Australia?
- Europe?
- Others?
- Heavy Haul vs. Transits?

Are there scientific reasons to remove mill scale?

- What would be needed for a test or evaluation?
- Many transit systems require the removal of mill scale prior to service.
- How much should be removed?

(Note: These are not the same rails.)

New rail after first grind. Some “pock” marks remain. Will these develop further or are they arrested?

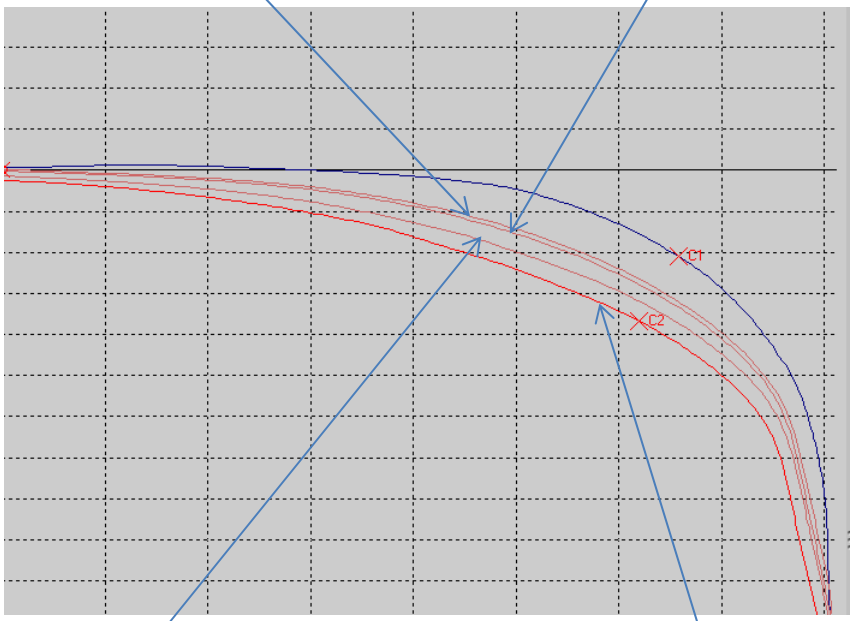
CN New Rail Tests

- Test 1 - 4 Curves (~ 3° curves) with 3 new high rails and 3 new low rails
  - 1 curve no grind
  - 2 different grind strategies on low and high rails
  - Rail was laid during fall 2016
    - Data includes profiles, MRX crack measurements and photographs
    - Measured pre-grind, post-grind & 3 months post grind
    - No definitive results to date
- Test 2
  - High rail on a 5° curve with 2% grade
  - Monthly traffic 3 MGT
  - Ground at 18 and 21 MGT

CN New Rail Test 2

Pre-grind
15 MGT

Pre-grind
18 MGT



Post-grind
19 MGT

2nd Post-grind
21 MGT

Additional revenue service tests

CSX tests

- As part of a larger study on RCF growth and preventive grinding 2 low rails, 2 tangent rails and 2 high rails have been replaced and are being monitored.
- Ground within 6 MGT of installation
- Thus far the only variables are degree of curve
  - 1° and 3 ° for the low rails
  - 1 ° and 6.3 ° for the high rails

Is another revenue service test needed?

- In 1st Q 2017, NS will be laying dual rail on the Narrows sub, which has a number of similar-degree curves that could be used in a comparison study.
- Would we learn anything more from another rev. svc. test?

TTCI – Premium Rail Performance Test

Figure 1 displays the RCF Assessment Scale, a subjective, visual assessment based on the 0 to 3 rating scale.

- Manual damage assessments
- 6 rail types

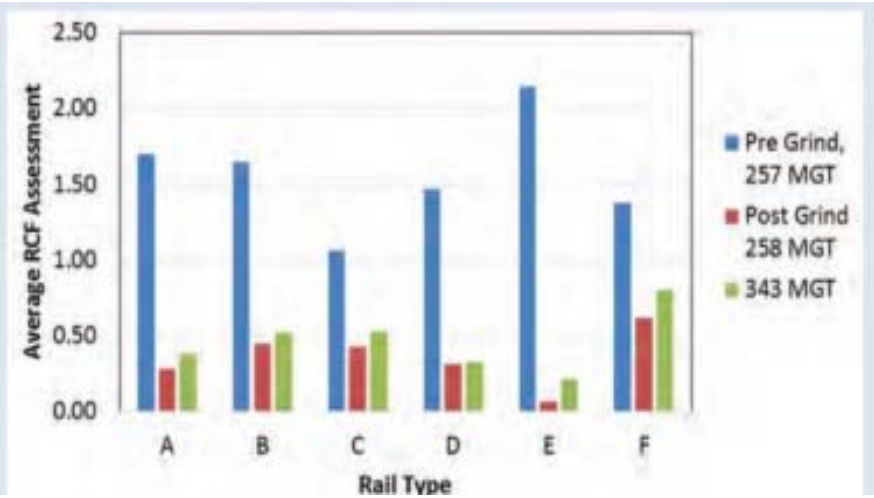
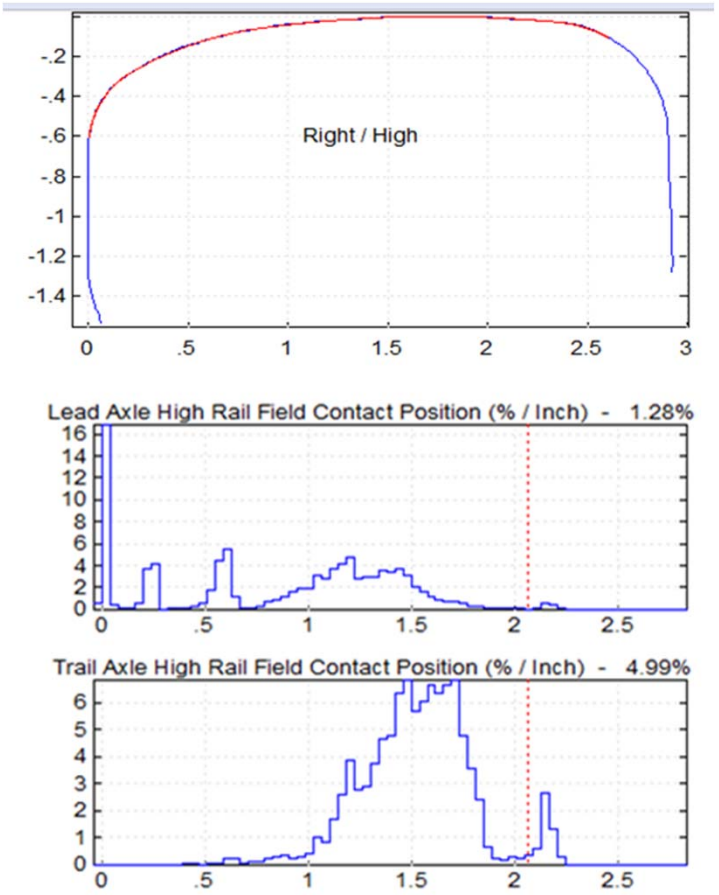


Figure 2, top, presents the Visual RCF Assessment results, with the tie-by-tie ratings averaged by rail type.

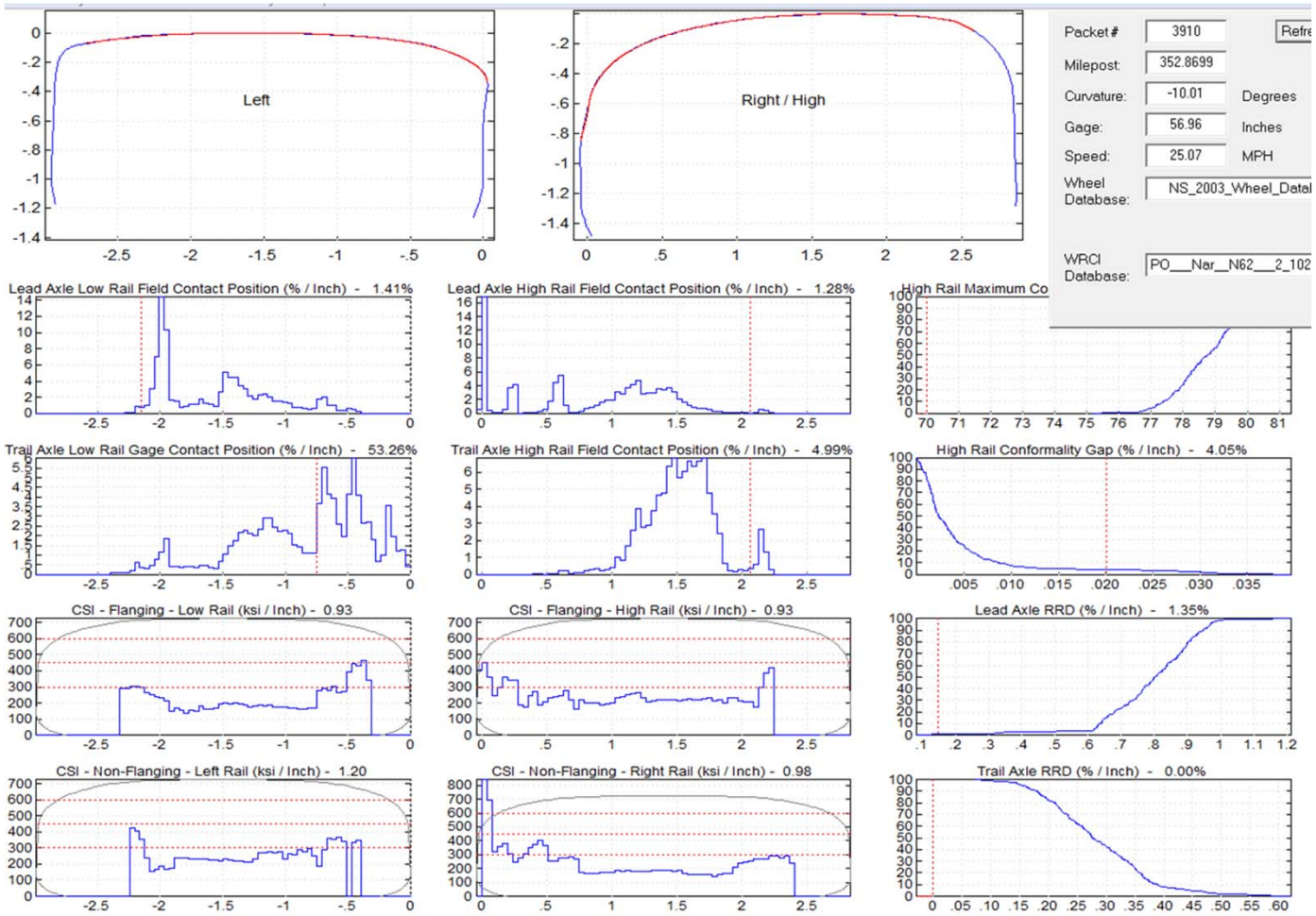
- What would damage level have been if ground prior to 257MGT?

Wheel-Rail Contact Interface (WRCI) as a method to evaluate wheel/rail contact?

- WRCI is a wheel-rail contact prediction model developed by TTCI that uses:
  - A population of wheel profiles that are representative of the railroad (for NS, WRCI includes 100 wheel sets with a variety of wear conditions ranging from new to 4 mm hollow-worn).
  - The measured rail configurations – rail profiles, cant angles and gage.
- The model results are presented as histograms showing the percentage of wheels running on each 0.05 inch of rail head width.



WRCI results using a new (unground) high rail, low rail & tangent rail



This is a sample WRCI output showing worn low & high rails; plan is to obtain profiles of new, unground rail and run the model.

WRCI results using new rail with a single pattern 5 grind pass

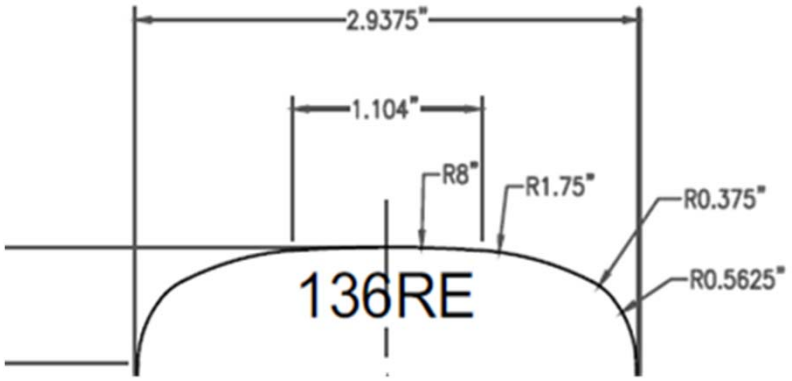
- Placeholder for WRCI graphs

WRCI results using a rail shaped to the desired template

- Placeholder for WRCI graphs

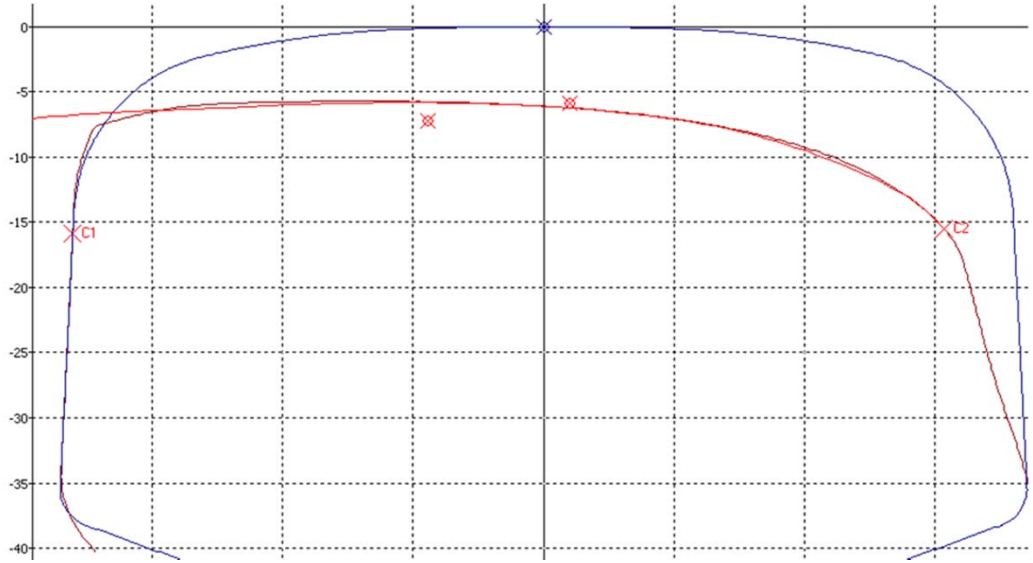
Creating a new rail profile

- The shape of the 136RE rail head is defined by four radii. The most often-mentioned radius is the crown – 8” in the case of the AREMA standard section.



- Should we propose a new profile based on what WRCI identifies as having the most desirable wheel contact? (This shape is likely to be very similar to one of our templates.)
- Which template should we use to define most-desirable contact – high, low or tangent?
- Ask rail mills, what is involved in changing the rail head profile?

Action plan



1. Continue with revenue service grind comparison tests on CSX and CN; determine whether a third test is needed, on NS.
2. Develop a rail profile based on most-desirable wheel/rail contact, using the WRCI model. Determine which template (high, low, tangent) the new rail profile should copy.
3. Determine work required for rail mills to change their new-rail profile.
4. Prepare recommendation for AREMA Committee 4.