



Rolling Contact Fatigue problems at railway turnouts – experience of ProRail

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ProRail

Outline

- Introduction about ProRail
- Introduction: “What is RCF?”
- Rolling Contact Fatigue problems at railway turnouts

ProRail network

24/7

Passenger transport



1.1 million
passengers per day

9 operators
of passengers

147 million km.
passenger transport per year



Safety
Reliability
Punctuality
Sustainability

24 hours
per day

7 days
a week

365 days
a year

16.9 million
population

4 million
local residents



Freight transport



3.3 million
trains per year

54 milliard
Freight tonne-kilometers
per year

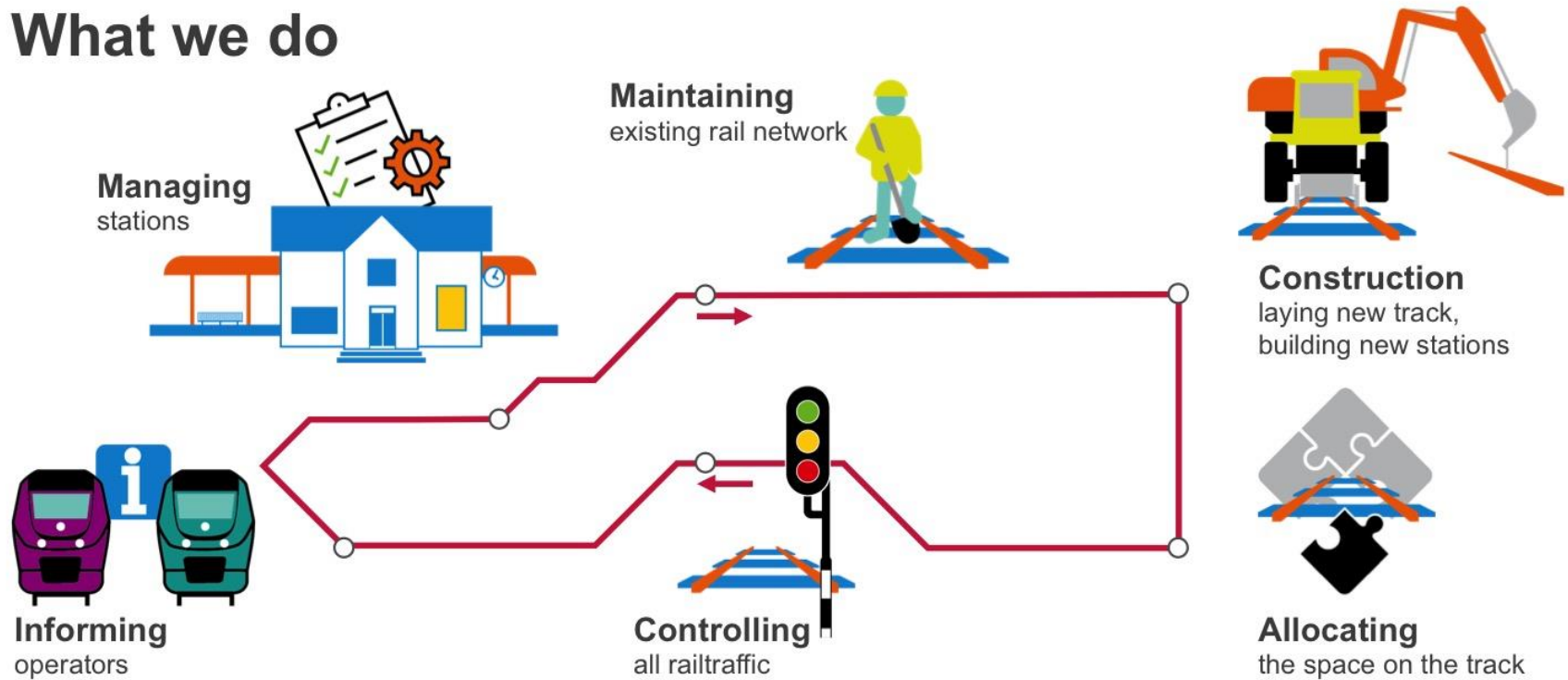


21 railway
undertakings

11 million km.
freight transport per year

ProRail

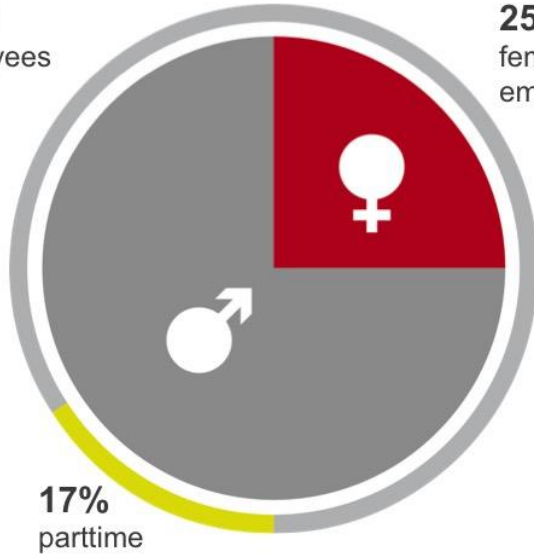
What we do



ProRail

Our professionals

4,179
employees

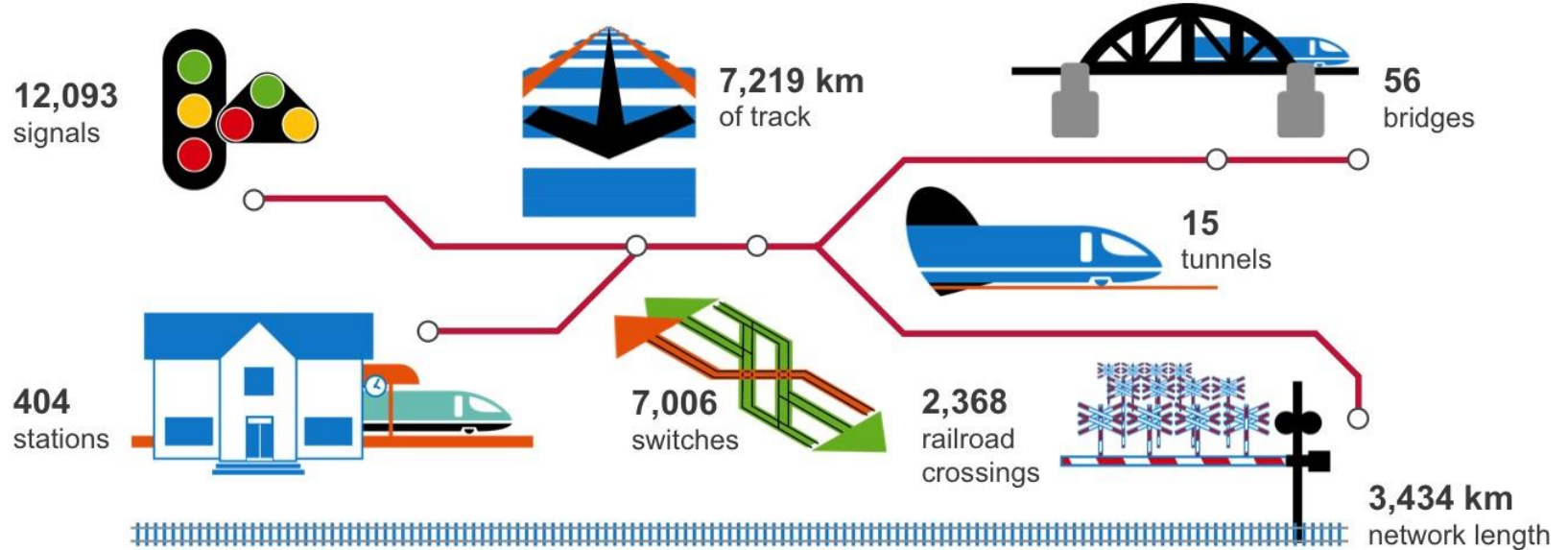


25%
female
employees



ProRail

Infrastructure



ProRail

Our mission

We connect people, cities and companies, now and in the future. We make pleasant travel and sustainable transport possible.



ProRail Connects. Improves. Makes sustainable.

ProRail

ProRail build a new track



Or has already a railway junction



New rail. Top condition!



First defects. Sure to be safe.



Defects are bigger. Yes, still safe.



Defects are yet bigger.
Safe? Or should we do something?



Defects are very big!
Is it still safe!??
Or should we call to ProRail?



Introduction: “What is RCF?”

- Rolling Contact Fatigue is a general name of rail defects which caused by material fatigue under repeated rolling loading
- RCF at ProRail track manifest in two serious defects at rail head:

Head Checks

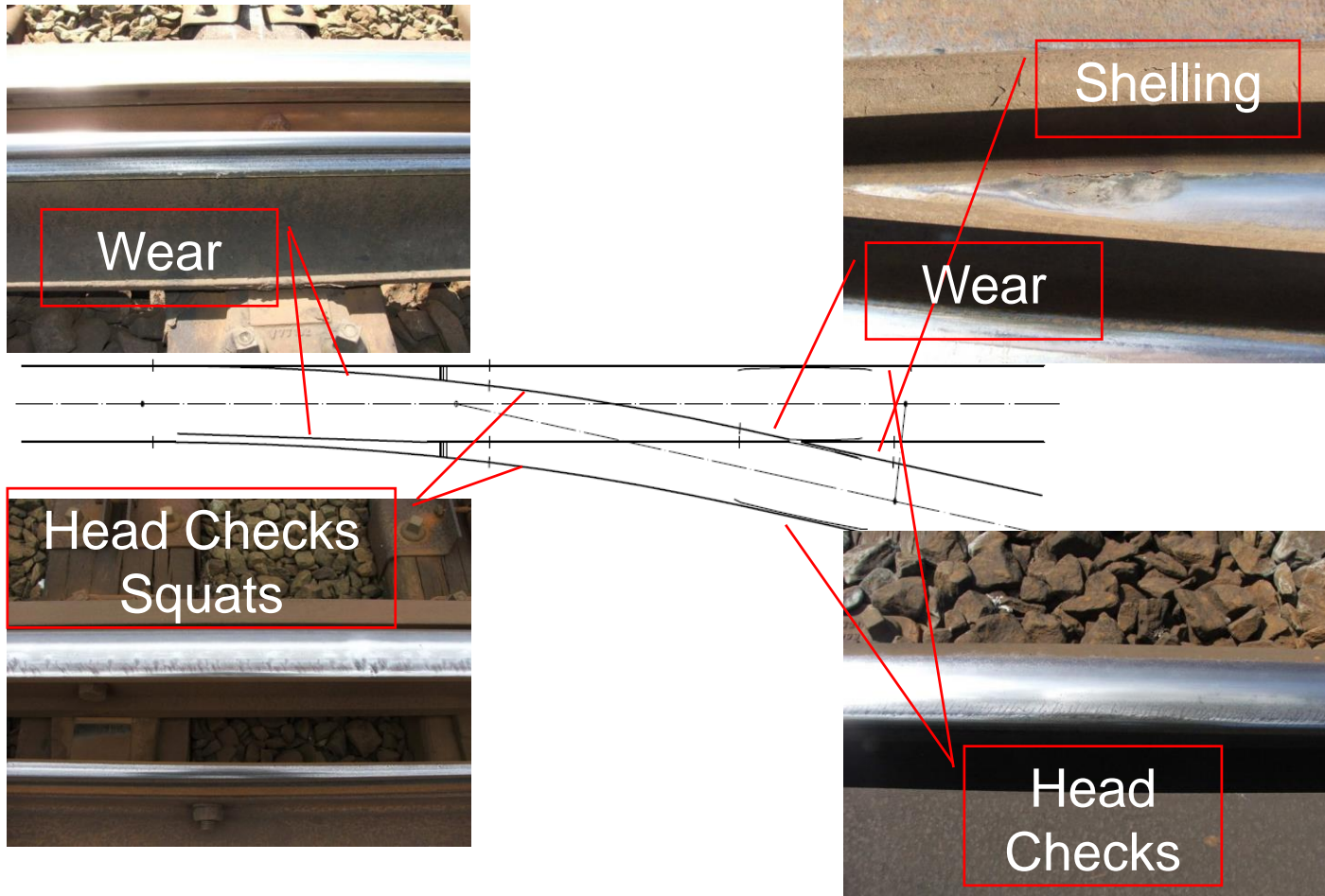


Squats



- These defects eventually lead to rail fracture (safety problem)

Defects in the railway turnouts

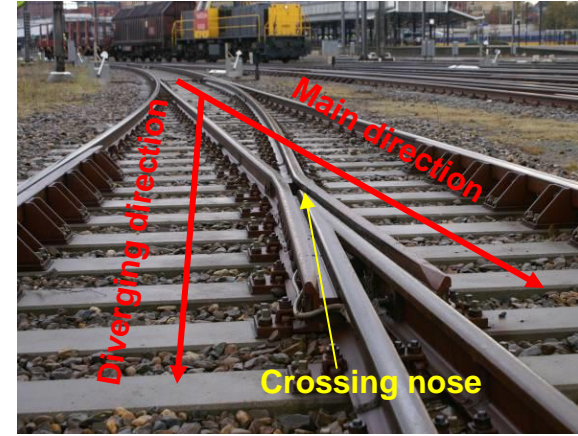
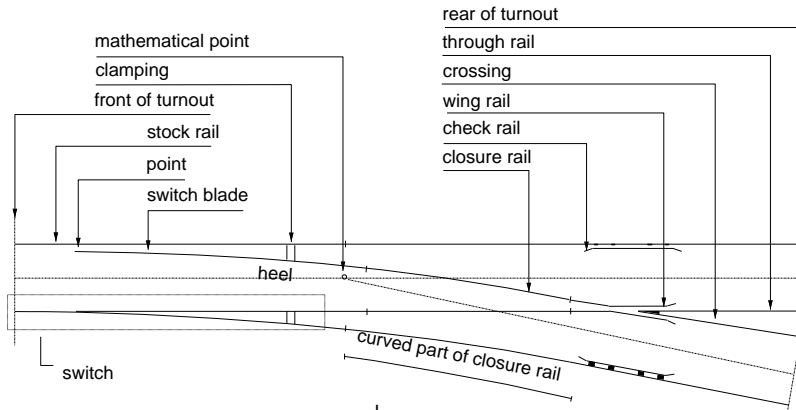


ProRail connects, improves, makes sustainable

- Safe railway - controlling the safety, no breaches
- Sustainable railway - reduce the maintenance budget for RCF defects
- Reliable railway - less disruptions and less urgent actions
- Punctual railway - more space for the trains and fewer delays

Railway turnout

- Turnout is important and vulnerable element
- Increased damage of common crossings (frogs)
- Lifetime between 2 years and 10-15 years





Factors affecting lifetime of turnout

based on previous research, field observations and maintenance experience

- Turnout mechanical properties (elasticity and damping)
- Wheel/rail interaction and turnout geometry (geometry of the crossing in particular)
- Rail material properties (hardness and toughness)
- Maintenance regime (grinding, welding, tamping etc.)



Materials of the crossing

- Casted crossings
 - Manganese steel (Hadfield steel)
- Constructed crossings
 - R260
 - Heat-treated R260 => R350HT
 - MHH (to be discontinued)
 - S1100 (to be discontinued)
 - Bainite 1400 (to be tested)
 - Cr Bainite (to be tested)
 - DILLIDUR 400 (to be tested)

Challenges of constructed common crossing

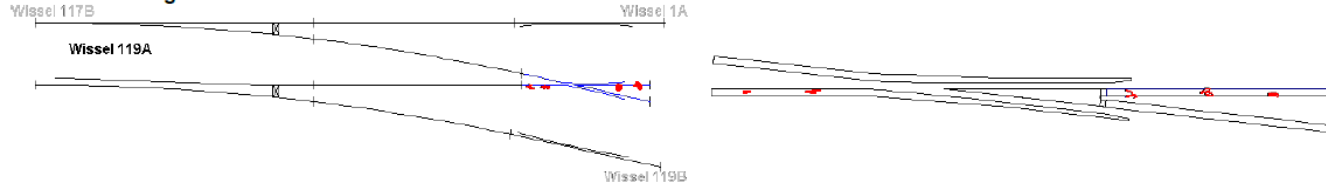
- Some are broken within 2 to 5 years due to pummelling on the nose
- Even after repair welding, cracks would come back within 2 years



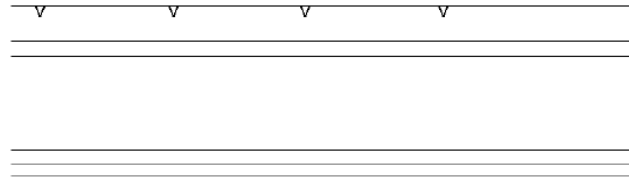
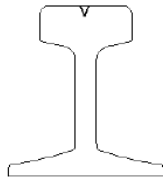
Challenges of constructed common crossing

- However, if the crossing get a chance to work 10+ years - it gets another type of defects

Situatietekening:



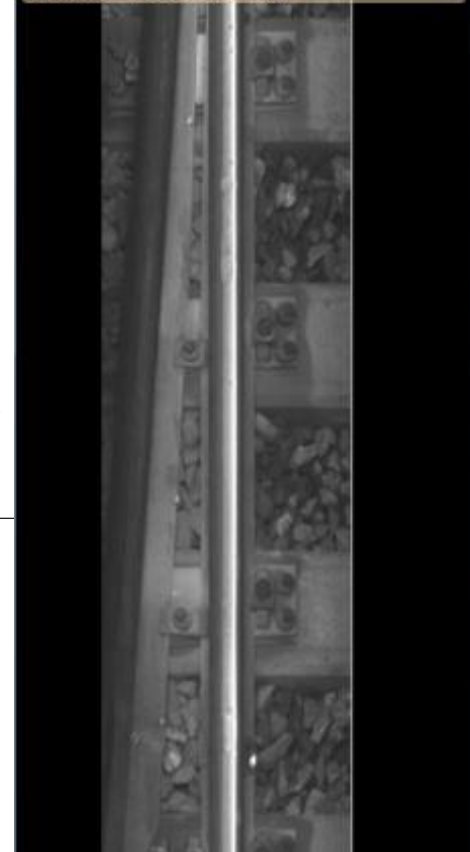
Detailtekening:



Plaats v/h gebrek:

- Wissel, gewoon rechts, Puntstuk, Achterbeen L
- Dwarsfout van 0 mm tot 12 mm diep

Positie: wl_119A_L_087 16,653#087
Datum: 27-10-2017 14:45:07
Beeld: L_002056.jpg



Shelling defects in constructed common crossing

- At the moment defects are locating only on the crossing
- They start and stop at thermite welding
- The R350HT material seems to be more sensitive than R260(Mn)



Shelling defects

on grinded rails

2-3 mm deep



Shelling defects

on grinded and not grinded rails



Shelling defects on not grinded rails



Improvements which making turnouts sustainable are opening new challenges to the researchers and engineers.

**Be proud for your innovation, because
Mother Nature has a new challenge ready for you!**



ProRail

Thank you for your attention!



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