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Initial Experiences of Premium Rail Steels on London Underground

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Contents

- Changing rail failure modes
- Initial premium rail installations
- Identified issues
- Performance Indicators
- Developing the Strategy

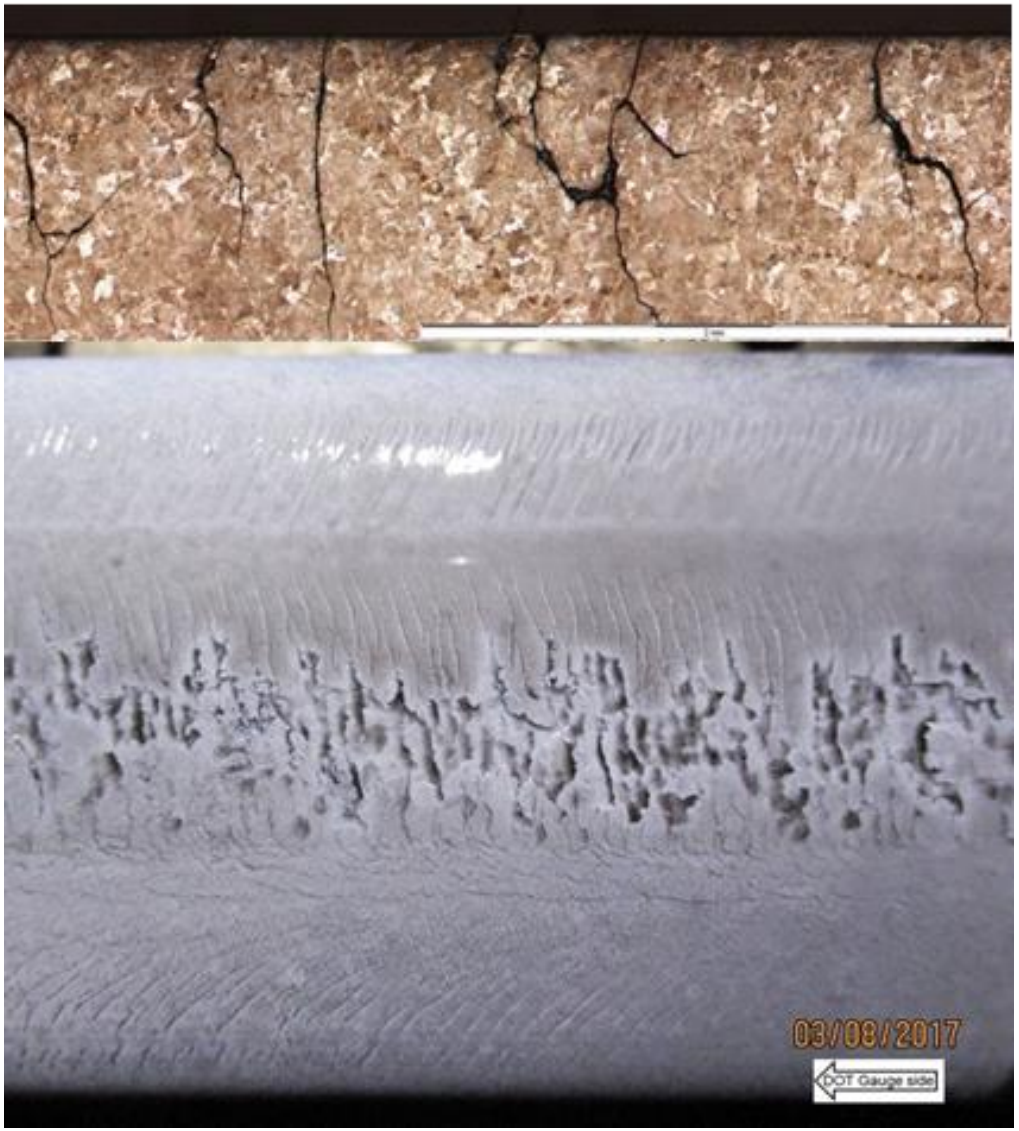
Wear Dominated Railway

Wear Dominated Railway

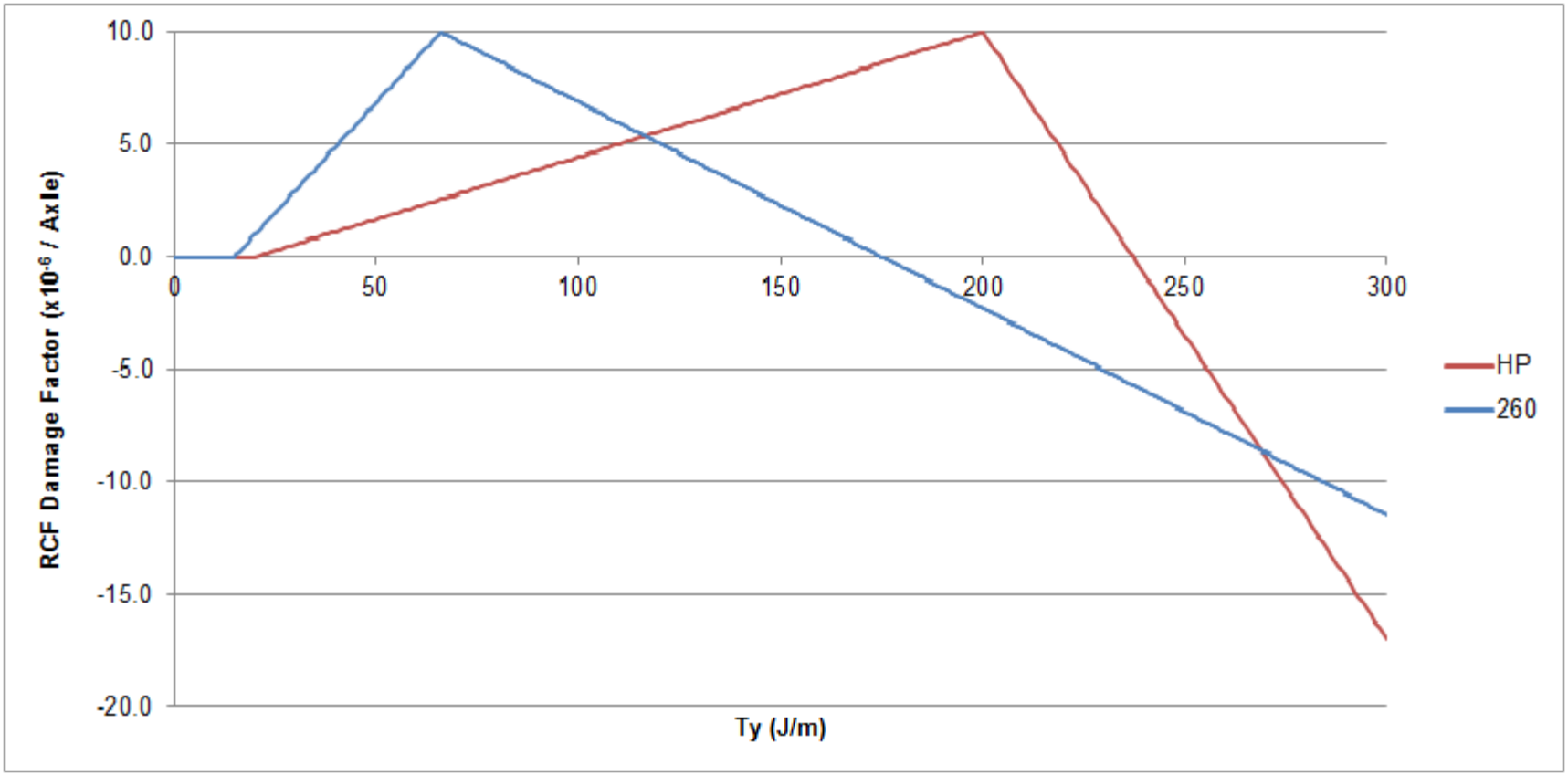
RCF/Corrugation Dominated Railway

RCF leading to UUR

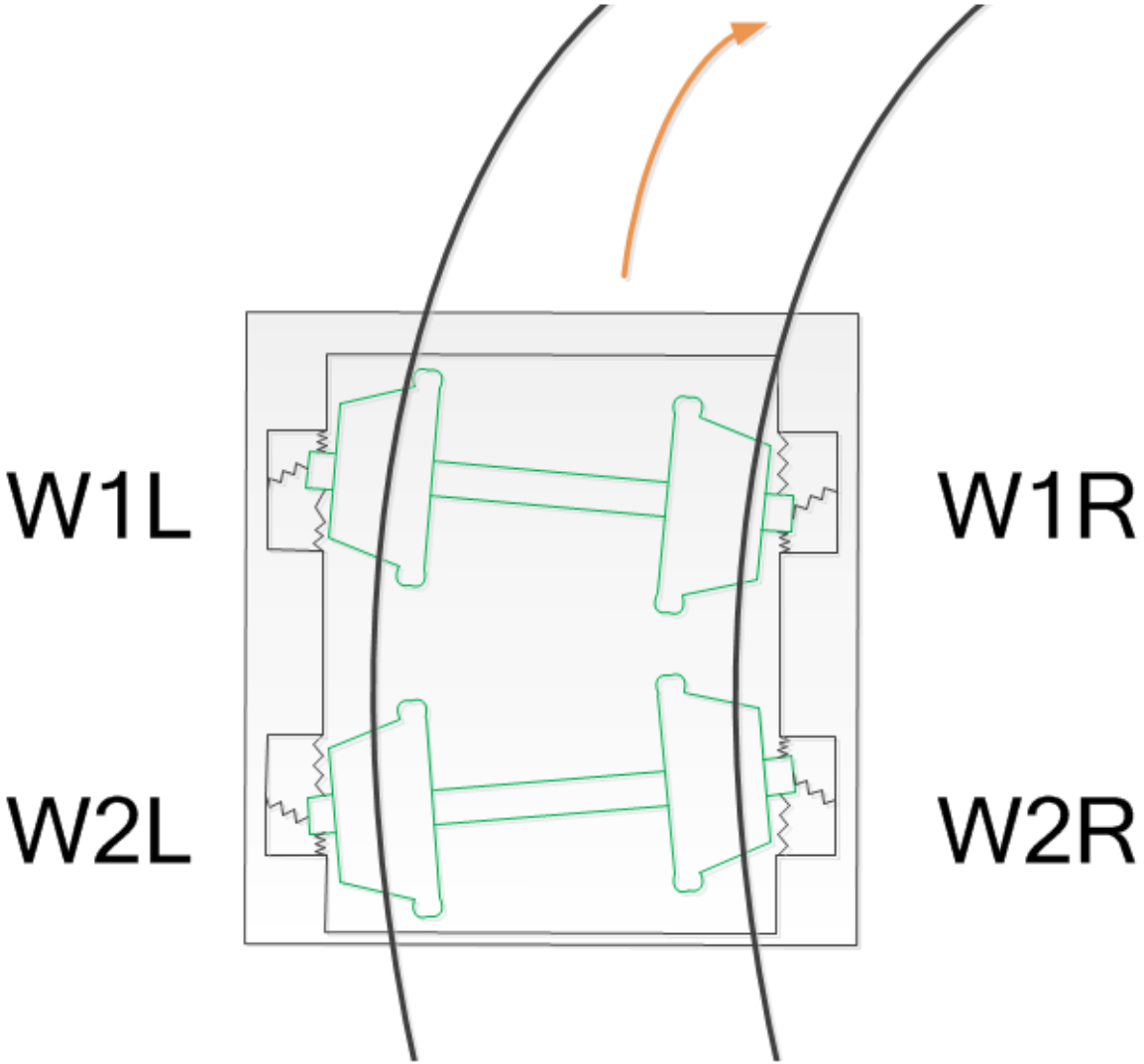
Why is it untestable?



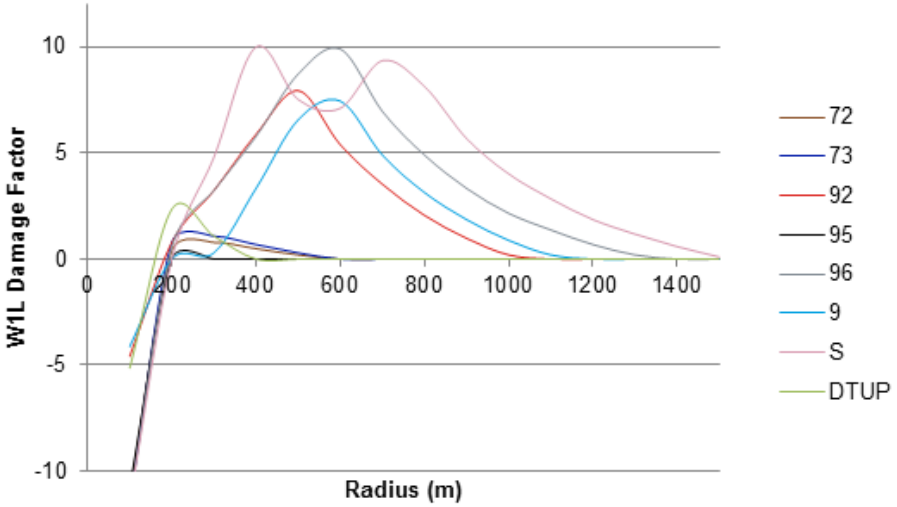
Whole Life Rail Model

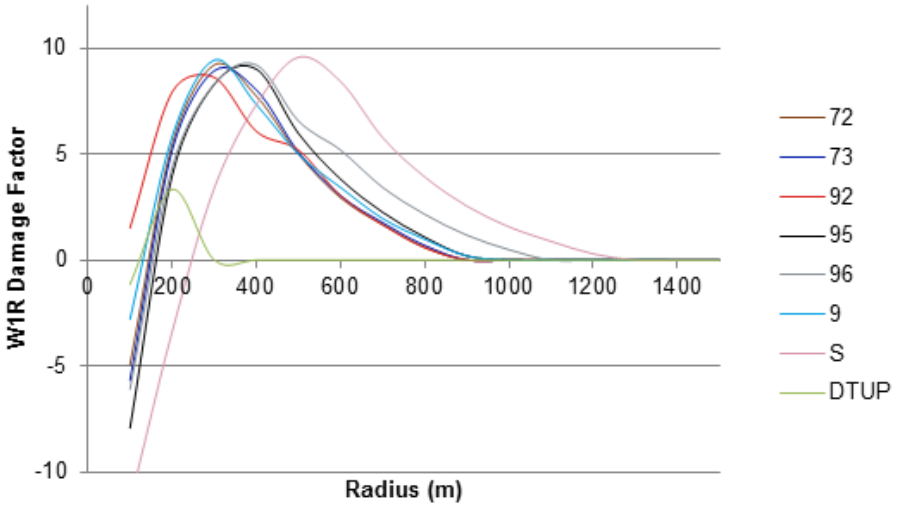


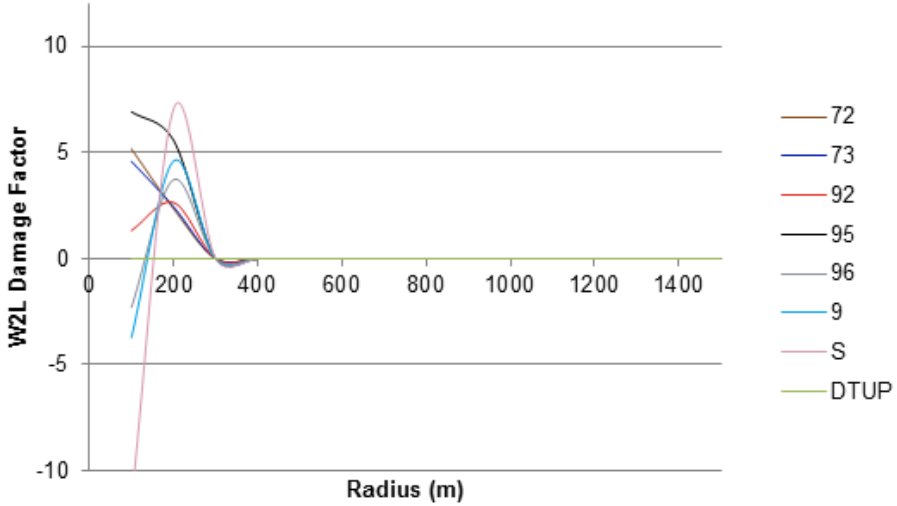
Wheel-Rail Forces

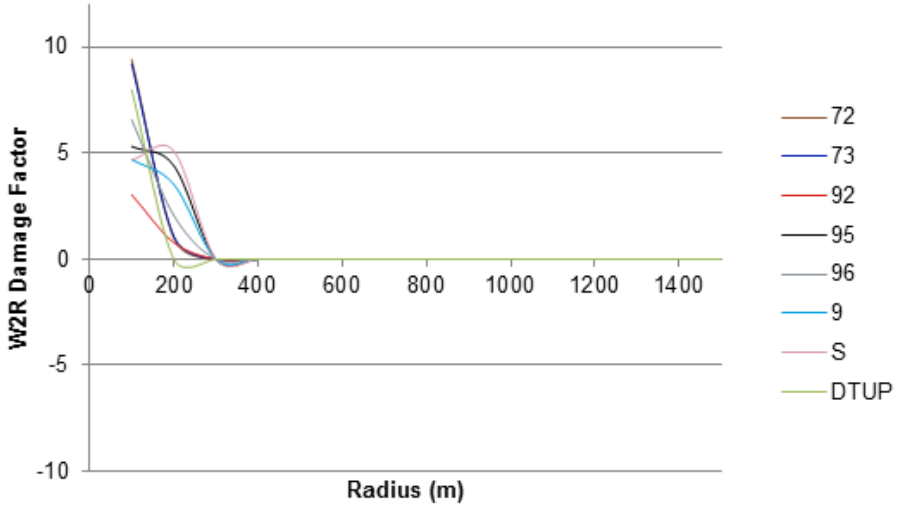


Whole Life Rail Model

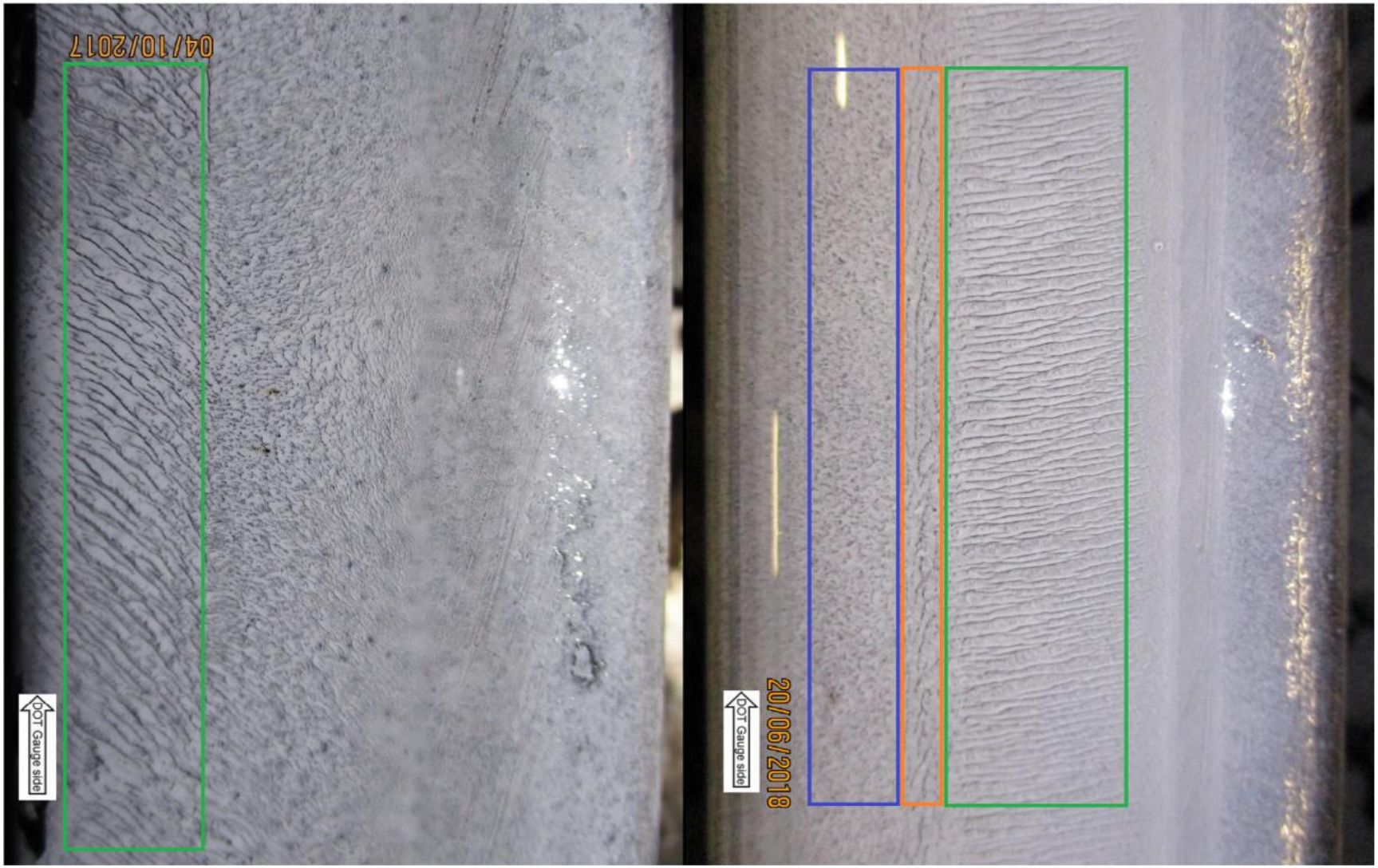




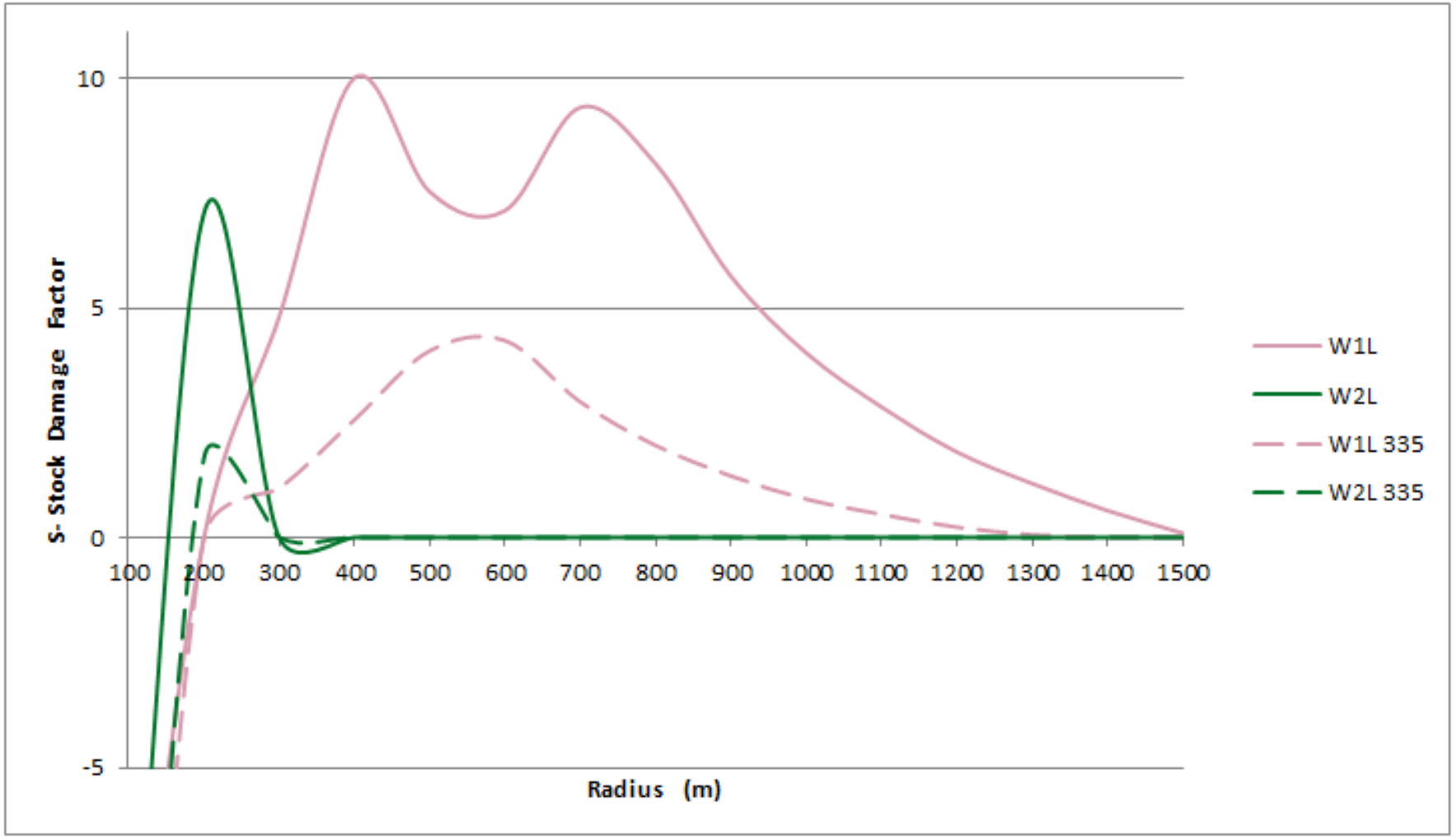




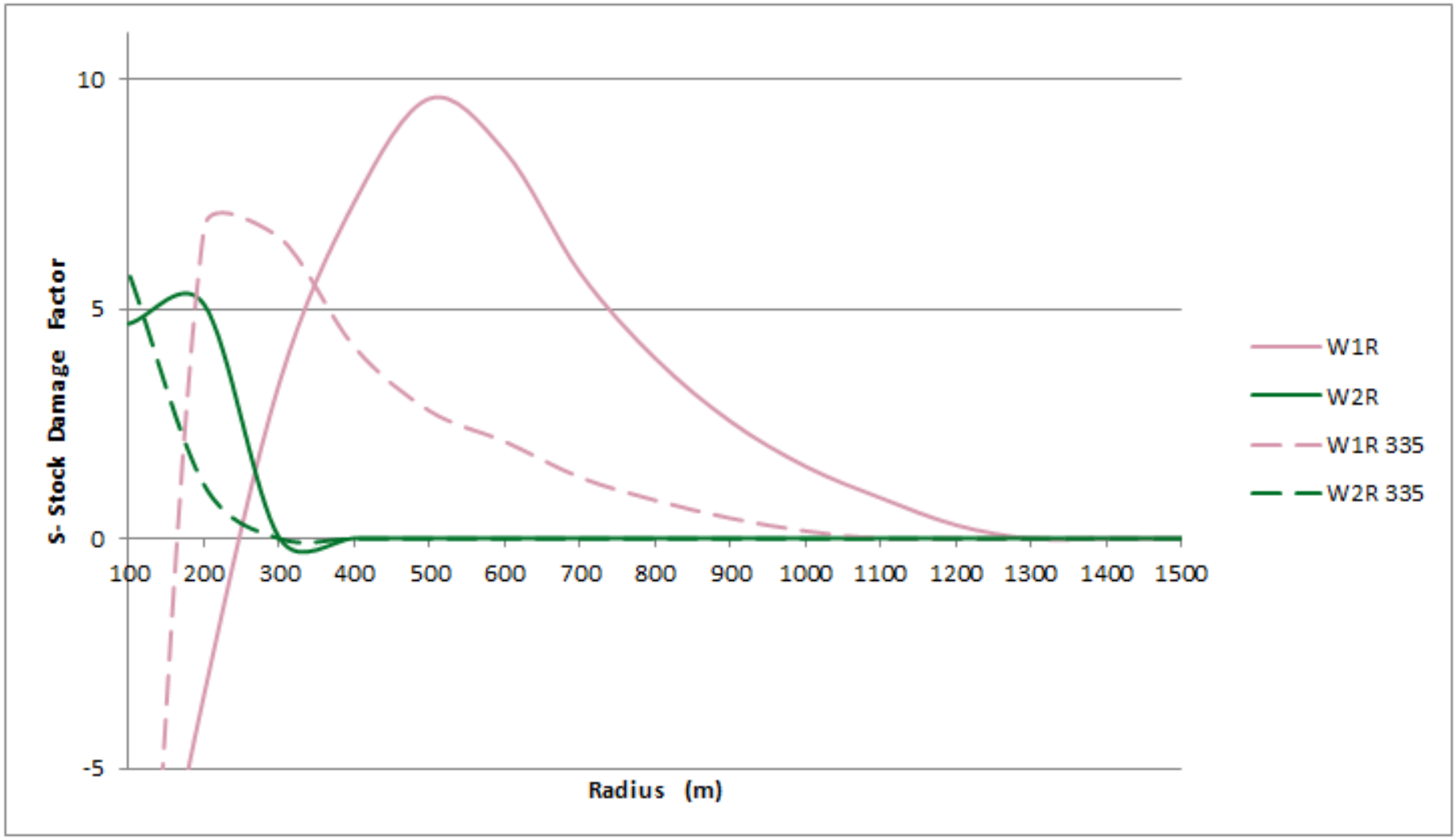
400m v 200m Radius Curves



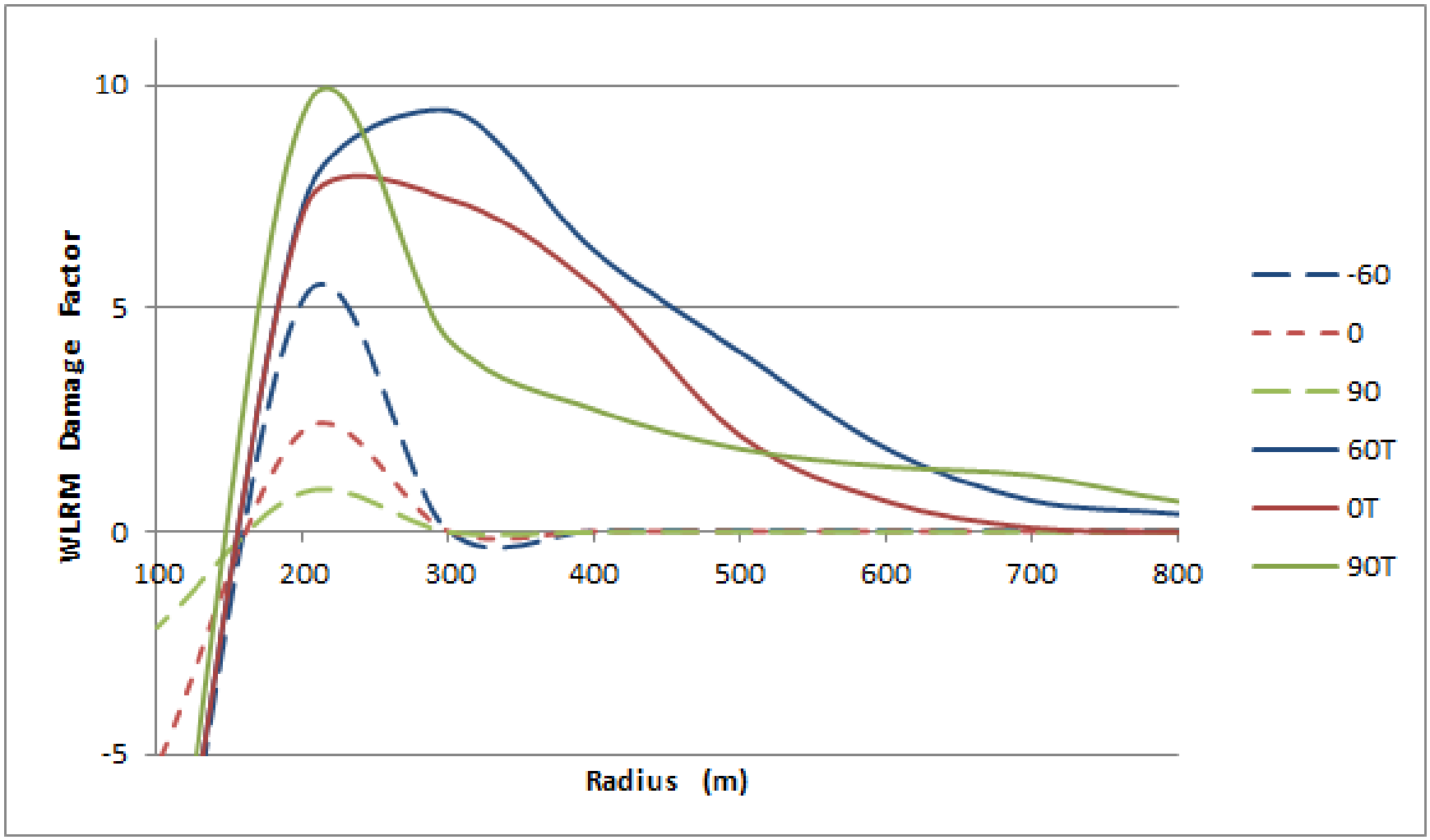
S-Stock 260 v 335: High Rail



S-Stock 260 v 335: Low Rail



Cant Def v Torque: W2L for 92TS



Broken Premium Rail

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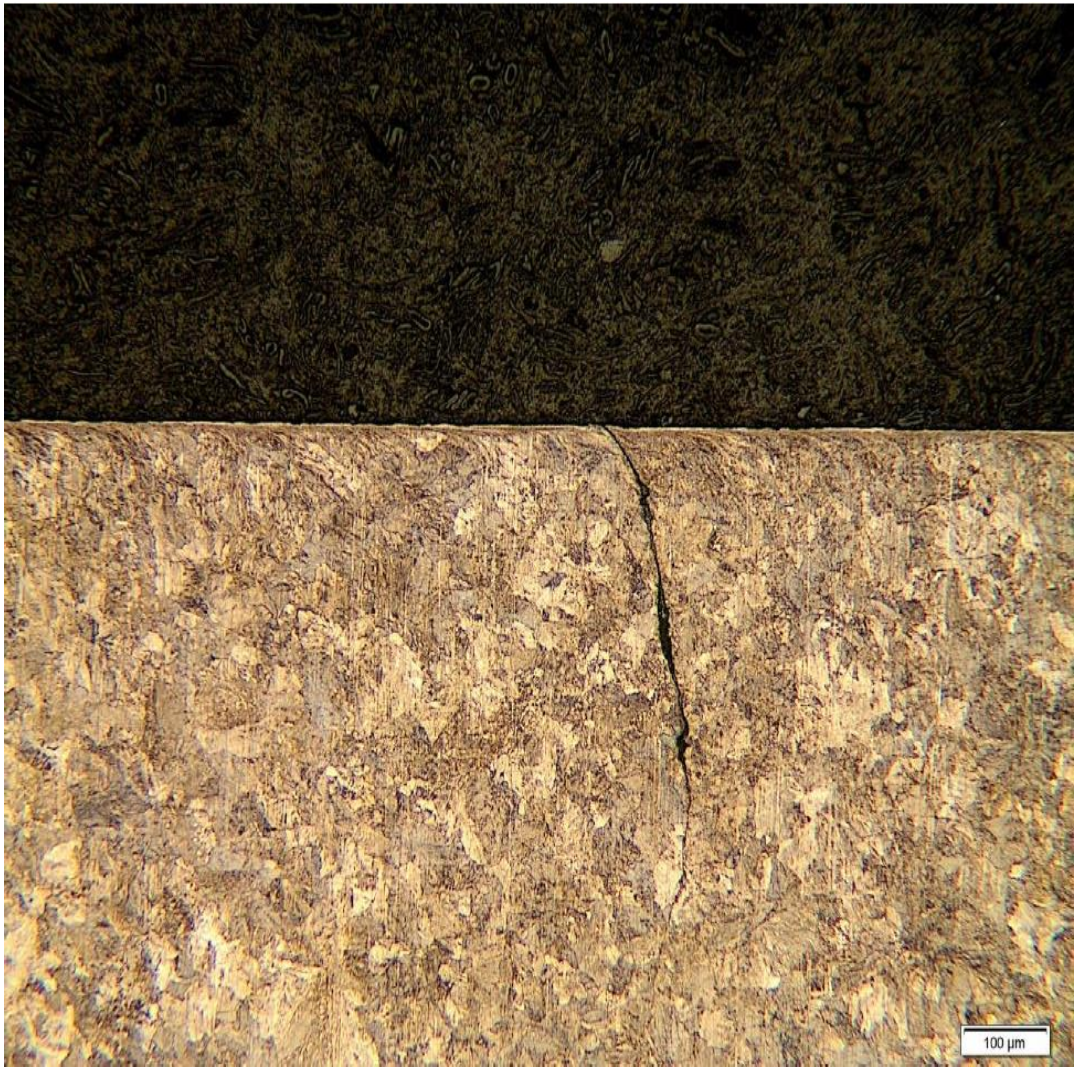
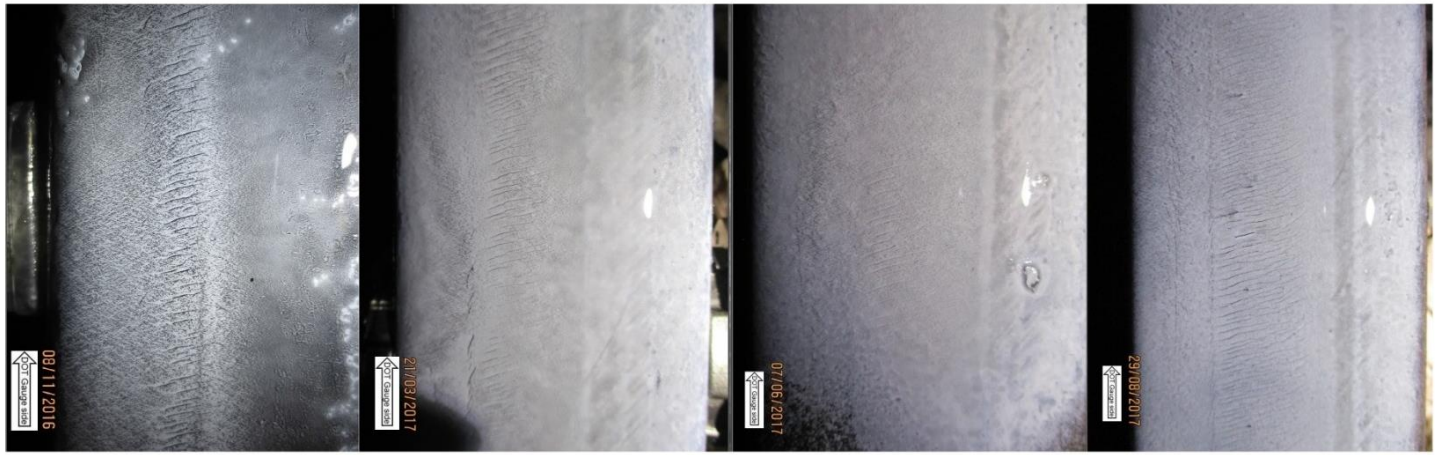


Severe Defects in Premium Rail

200m Curve in HP335

260



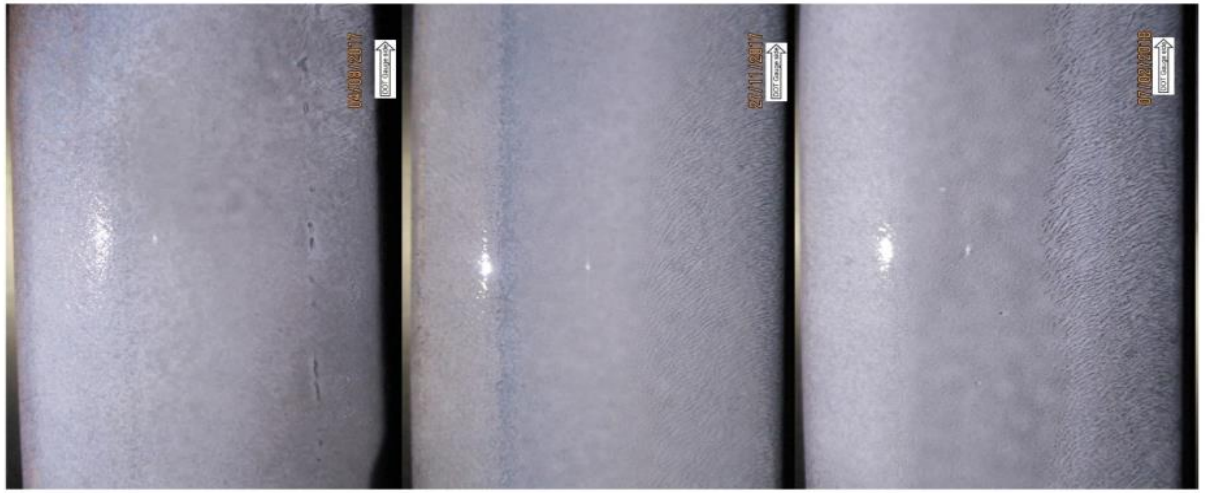
18MGT 32MGT 40MGT 49MGT

3MGT 8MGT 24MGT 37MGT

335

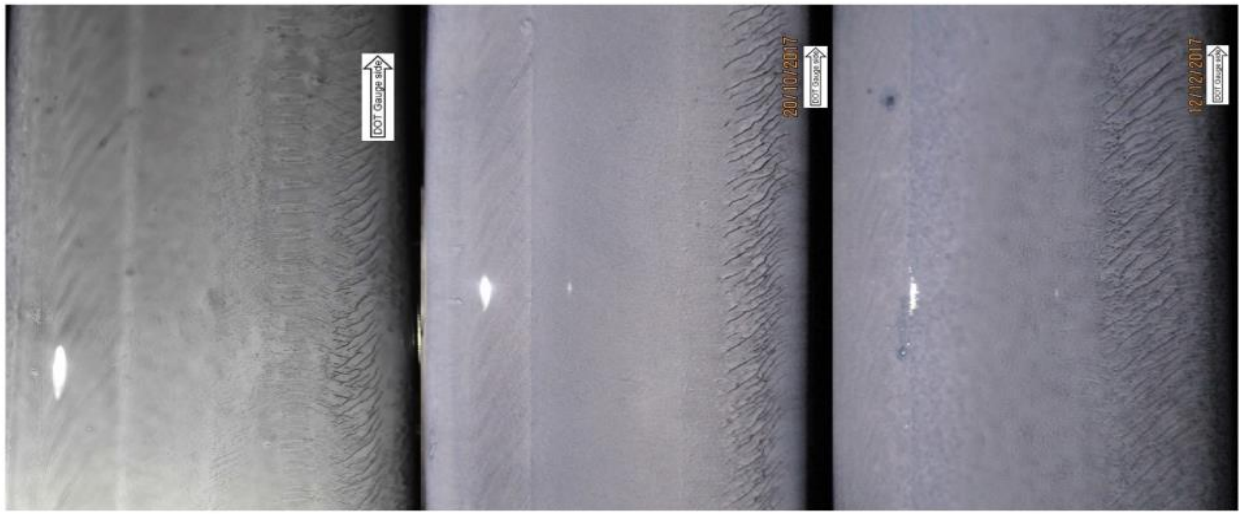
400m Curve in HP335

335



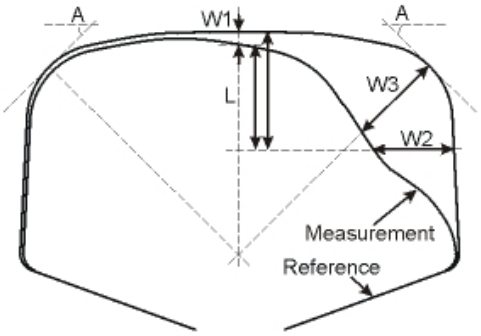
3MGT 12MGT 18MGT

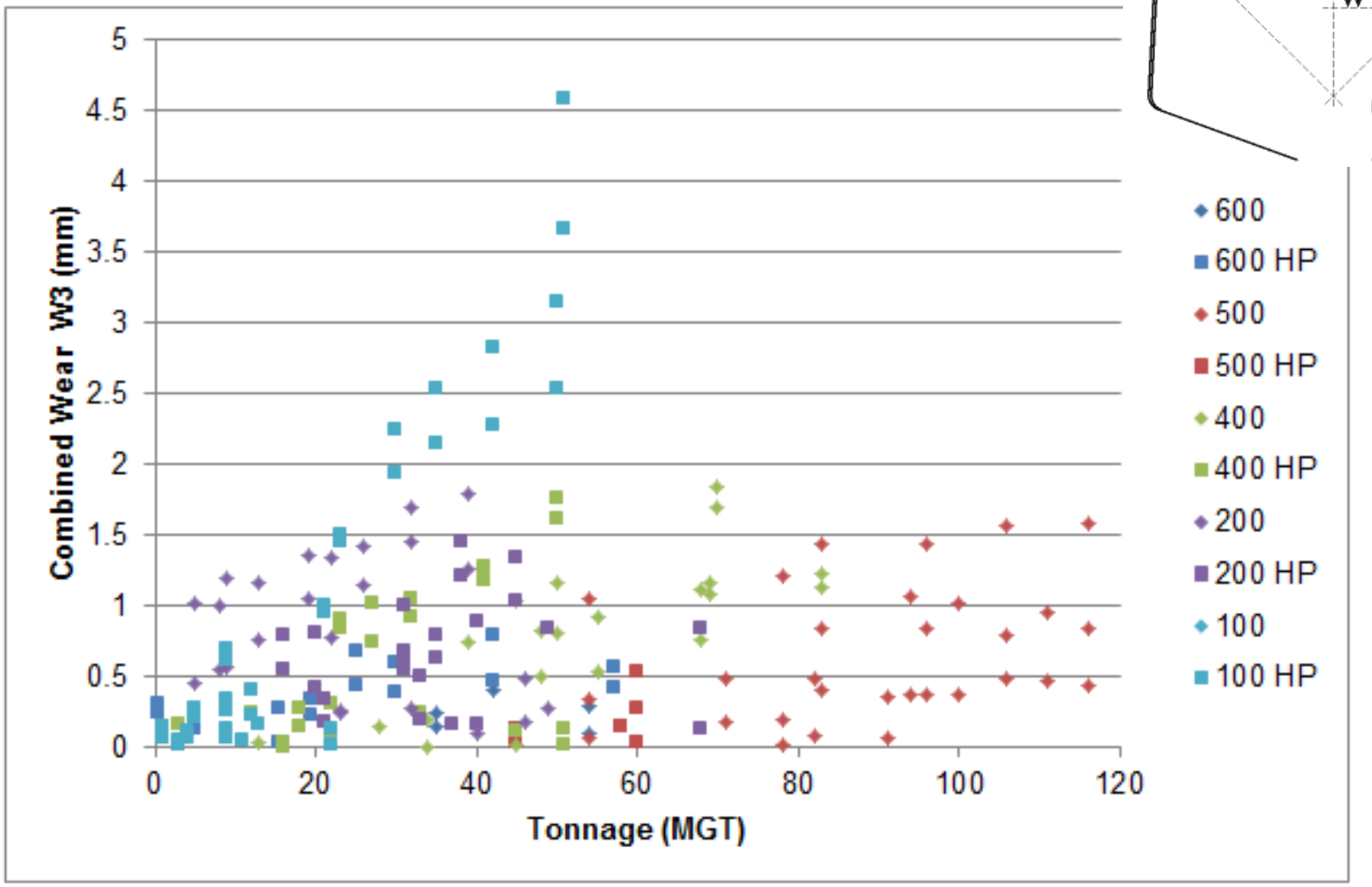
260



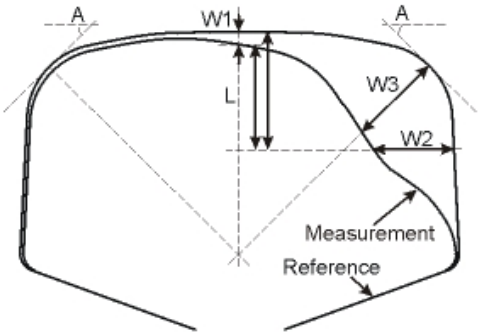
13MGT 25MGT 28MGT

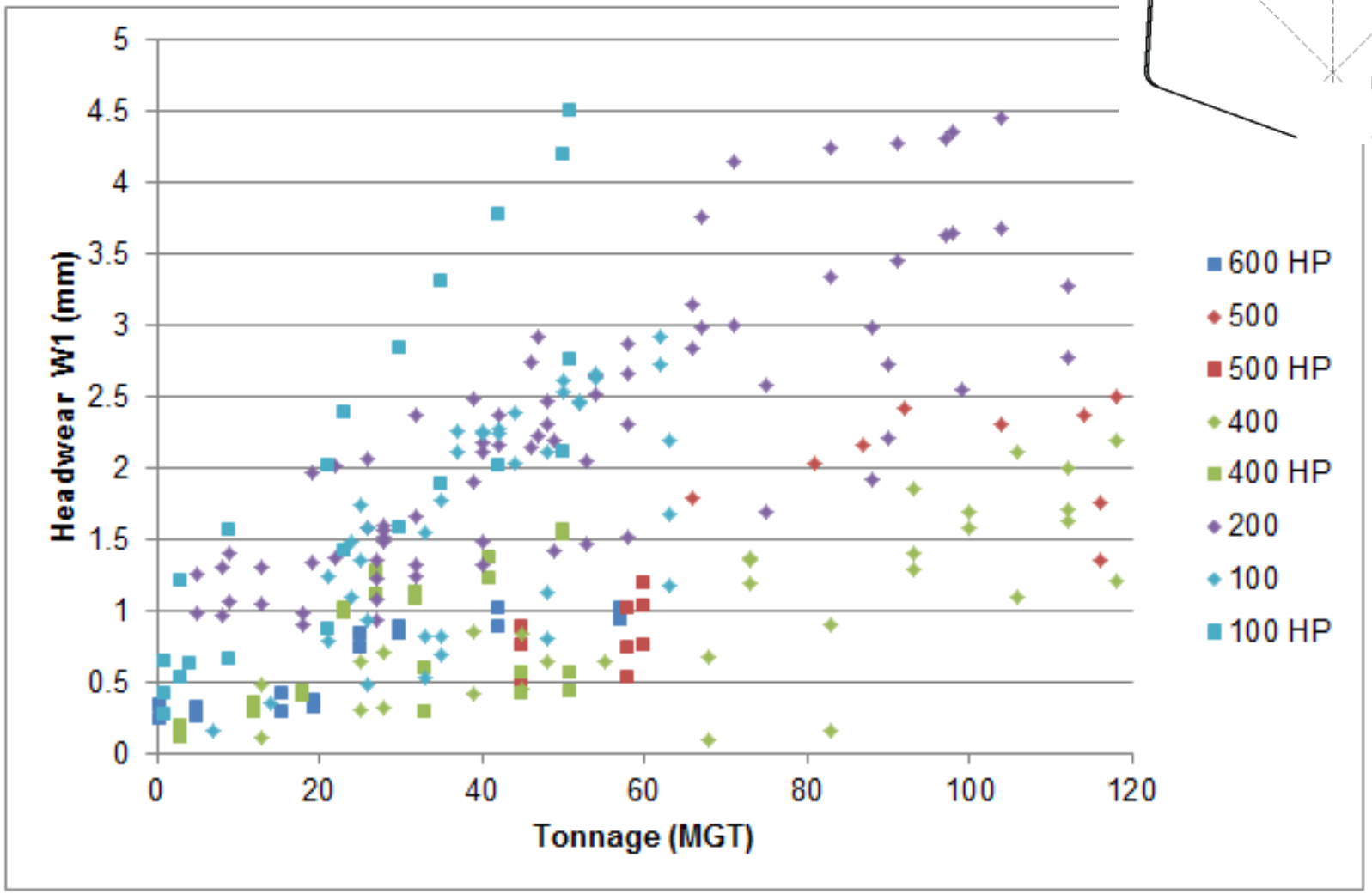
High Rail Wear



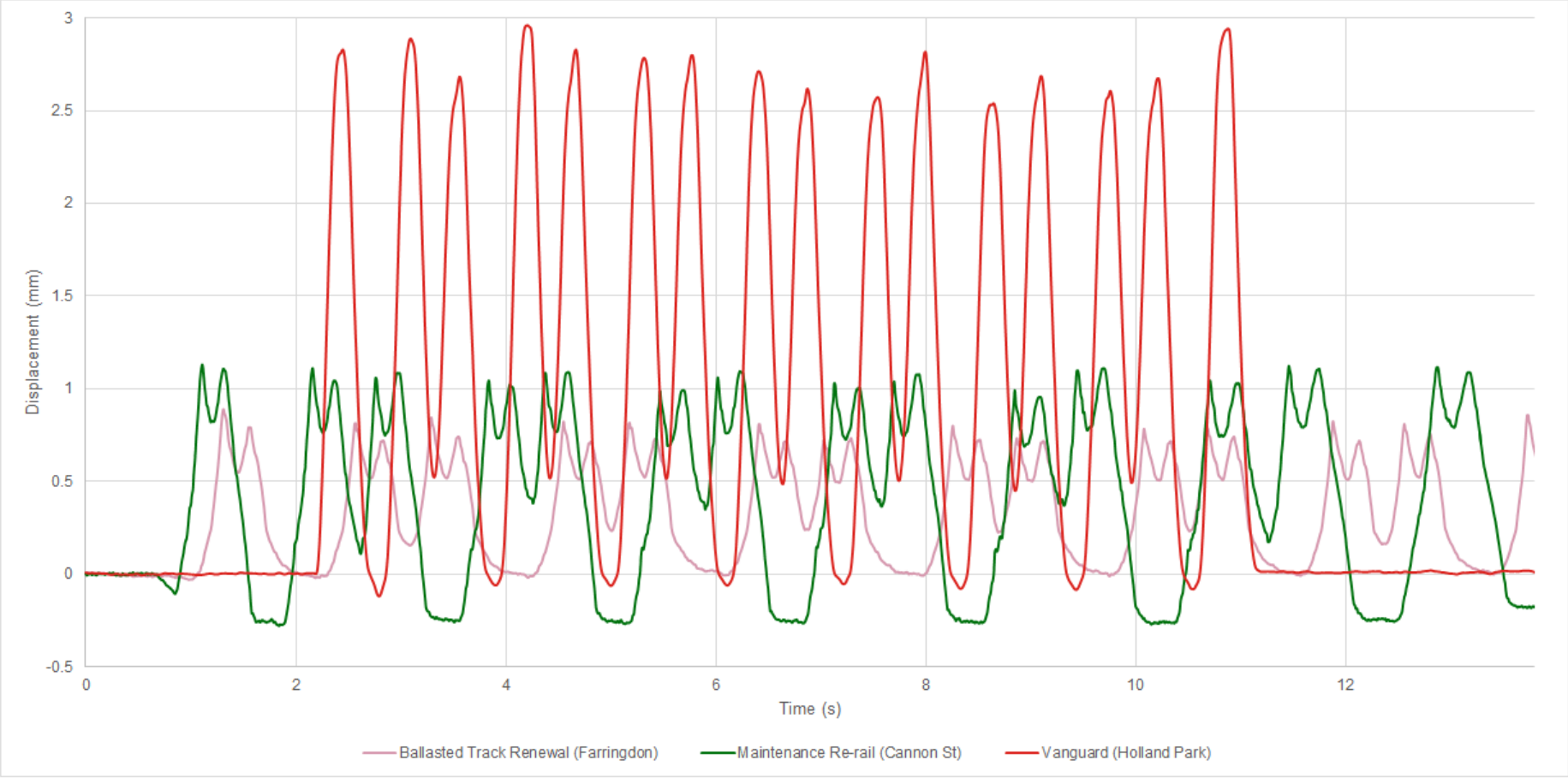


Low Rail Wear



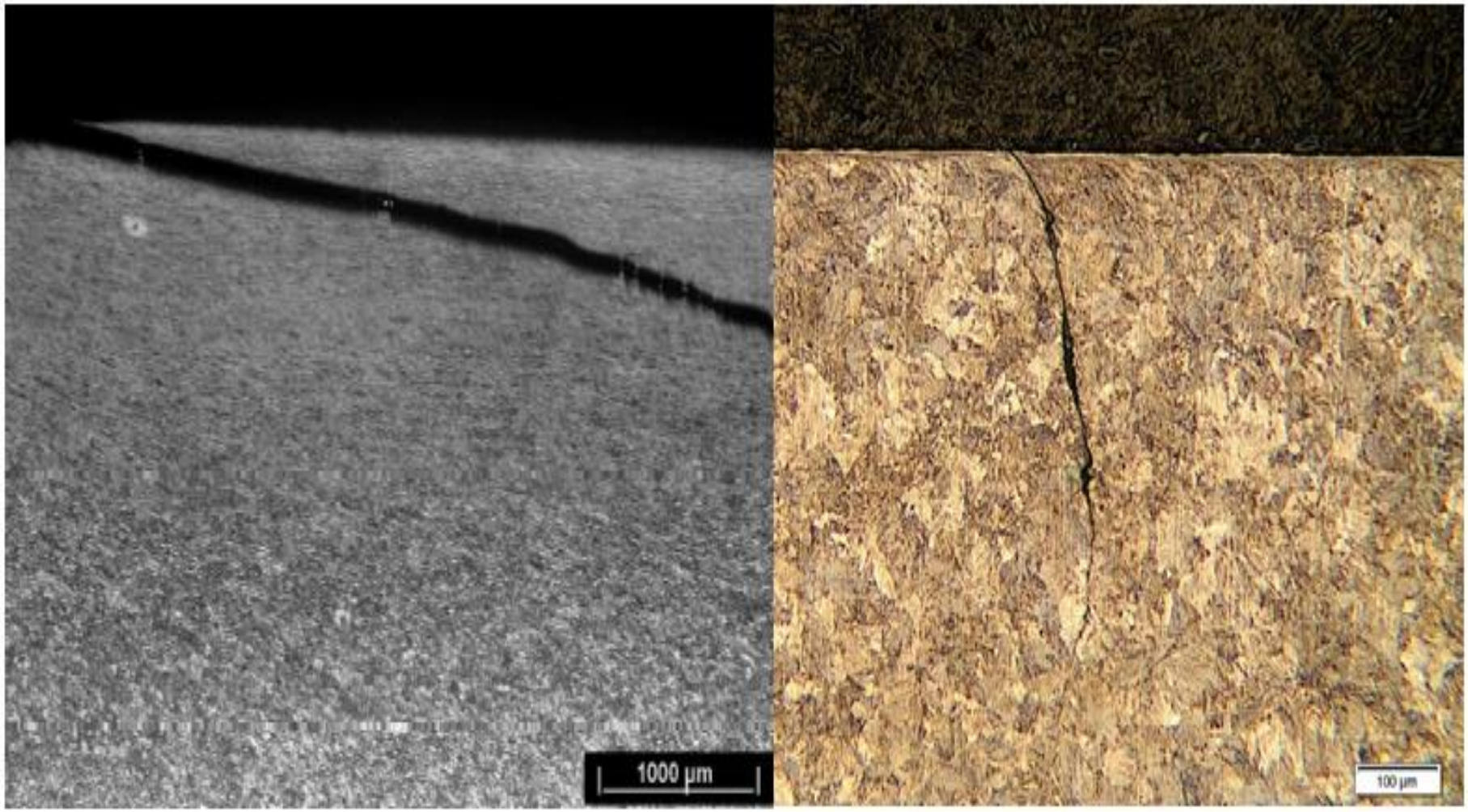


Rail Deflection: Trackform

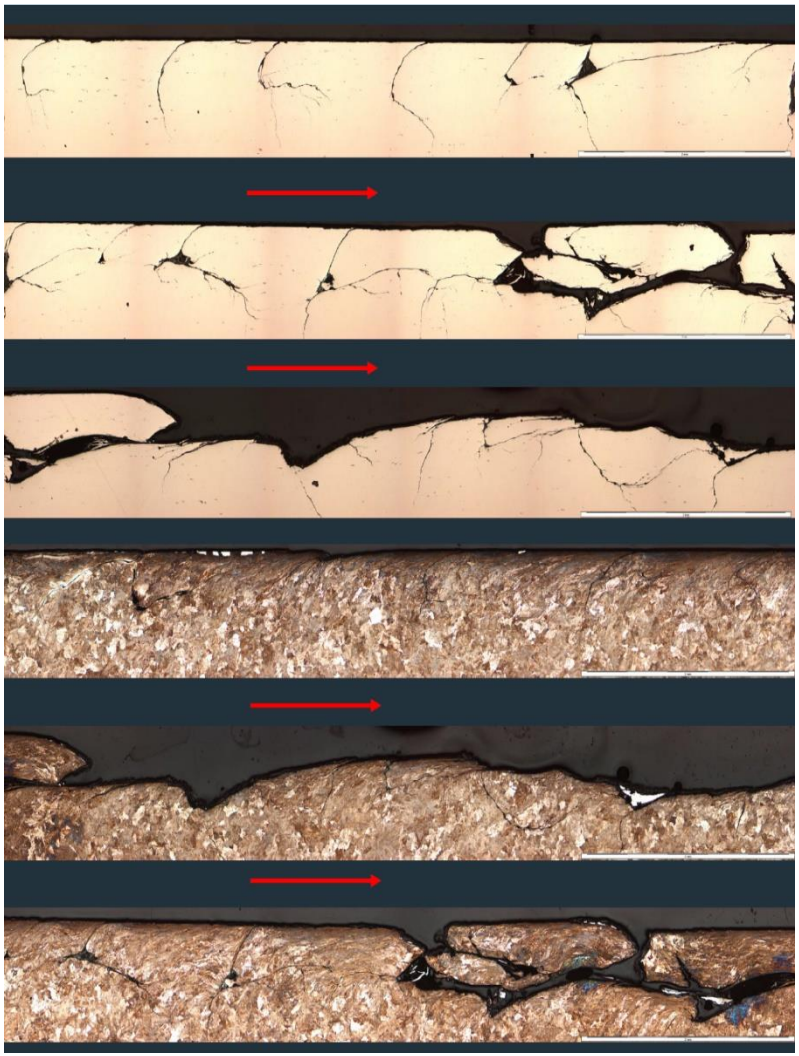


Rail Deflection: Flash Butt Welds

Crack Angle



Plastic Deformation



	HP 335	R260
Depth of Deformation	15 – 110 µm (Mean 38 µm)	135 – 293 µm (Mean 206 µm)
Crack Initiation Angle	22 - 47° (Mean 36°)	23 - 65° (Mean 34°)

Conclusions

- Crack initiation angle appears similar but turns much more quickly in 335
- LUL suffers from centre railhead cracks caused by trailing axles in tightest curves
- Leads to mainly UUR with very shallow crack depths in 260 but lower risk of leading to fast fracture in 335
- Rail deflection certainly appears to be a contributing factor as sites with new track with less issues?
- Depth of work hardening layer much greater in 260 providing a layer of protection?
- Higher wear in gauge corner removing cracks at sufficient rate?
- 80% of the cost of re-railing is in the process so very little performance improvement to justify extra material costs
- Currently trialling a 400 grade heat treated site but very interested in bainitics because....

Is wear a bad thing?