

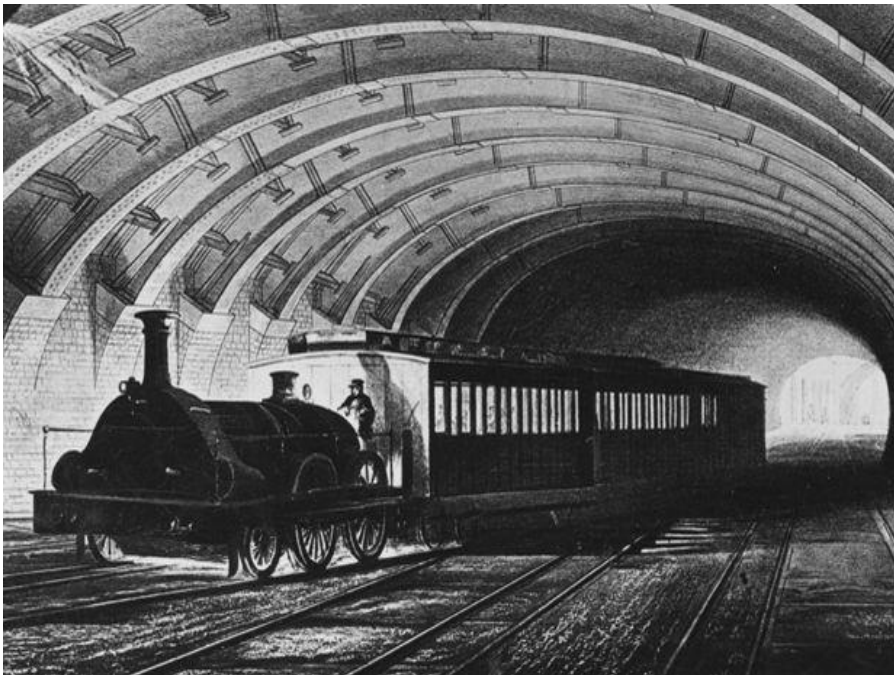
21st Century Demand, 19th Century Infrastructure: Future proofing the Wheel-Rail Interface

Andy Vickerstaff

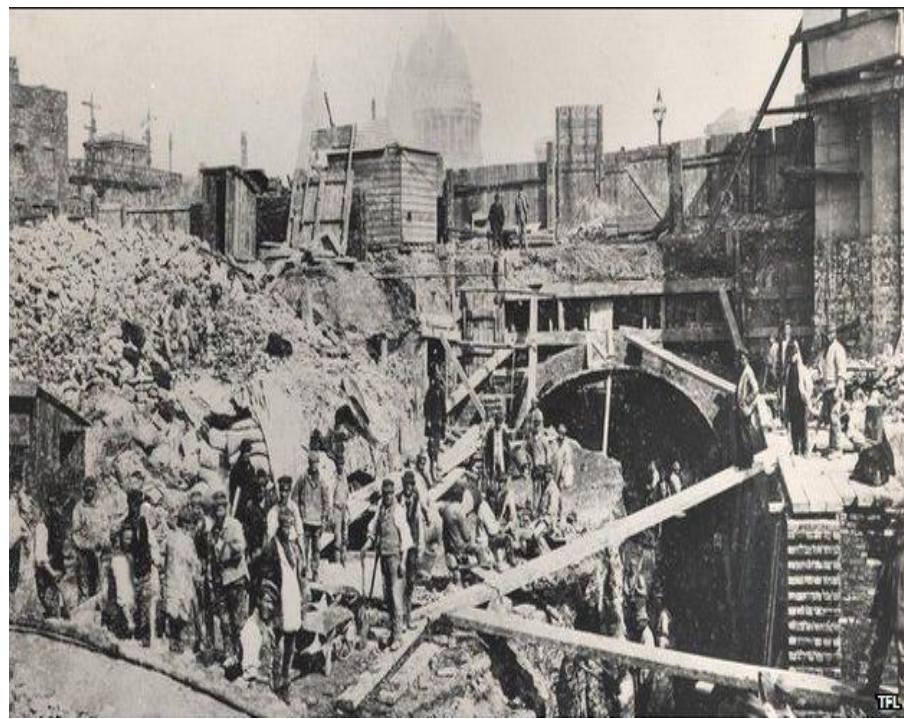
Senior Wheel-Rail Interface Engineer, Transport for London



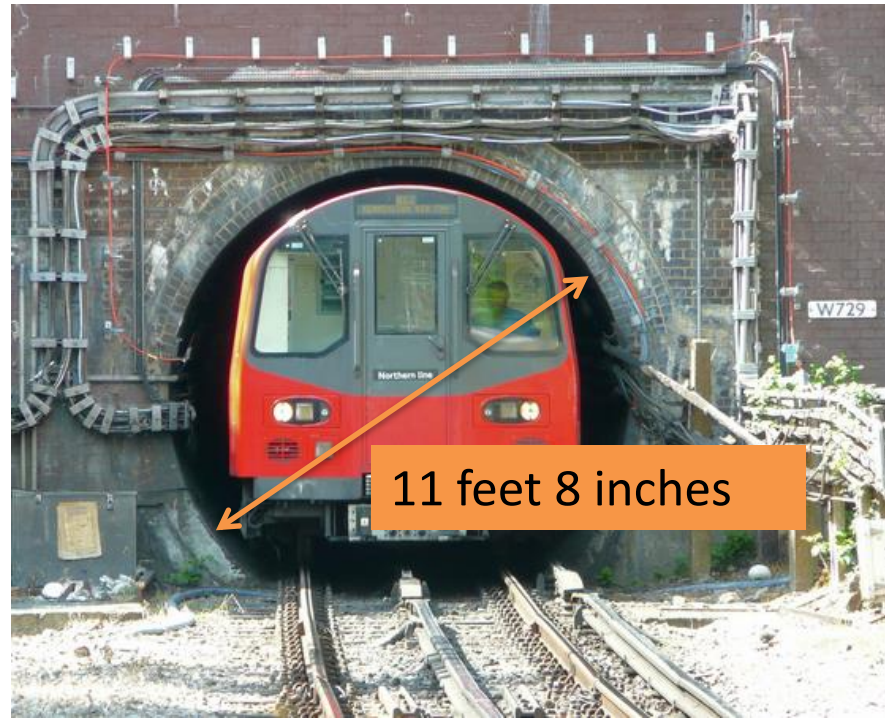
10th January 1863/2013



Cut & Cover: 1863 - 1890



Deep Tube: 1890 - Present



Mind the Gap



Modern Demand

Night Tube
Operates on Friday and Saturday nights

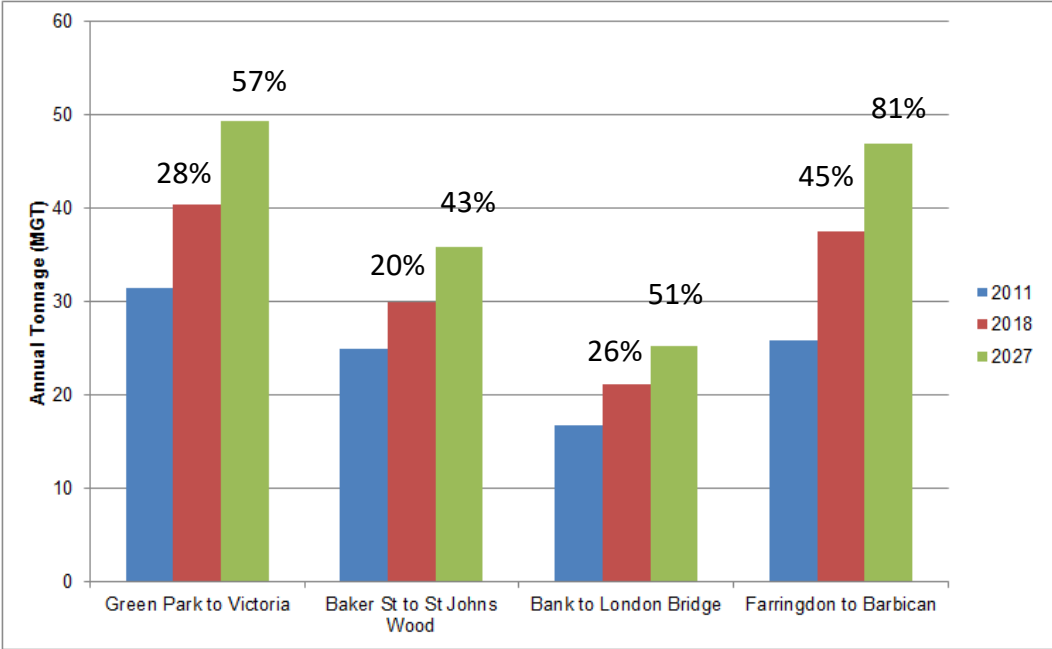
Night Tube operates on Friday and Saturday nights

- Central line
- Jubilee line
- Northern line
- Piccadilly line
- Victoria line

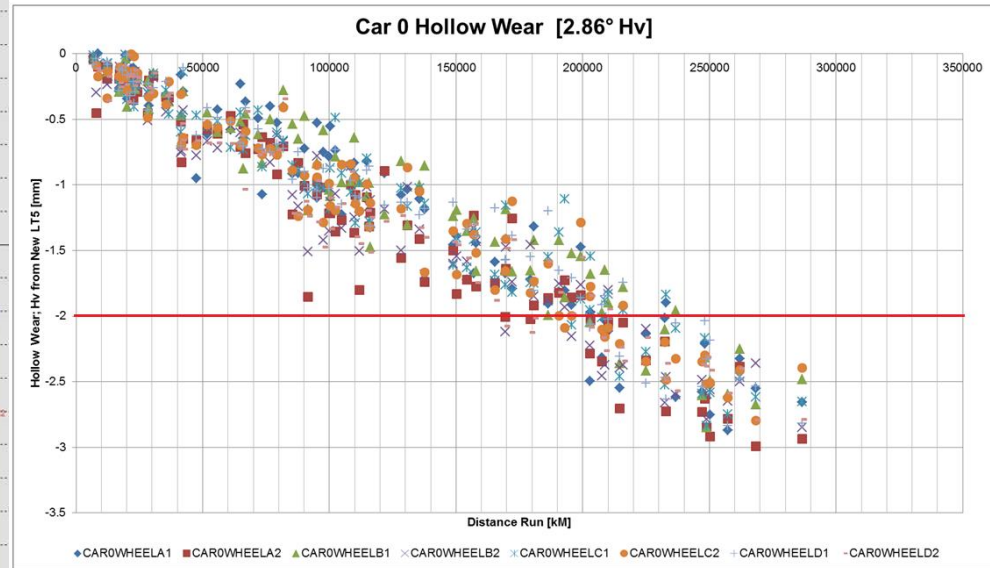
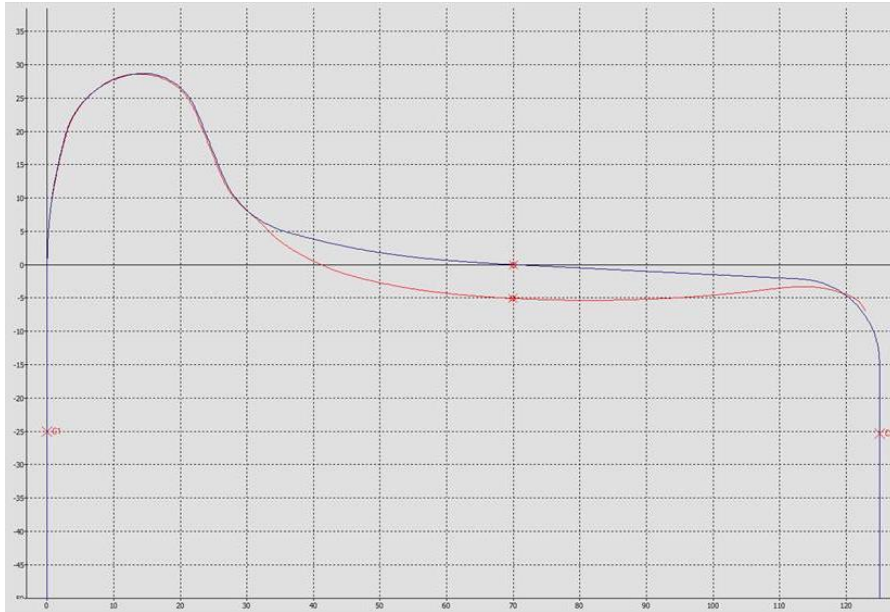
Mayor of London

Transport for London

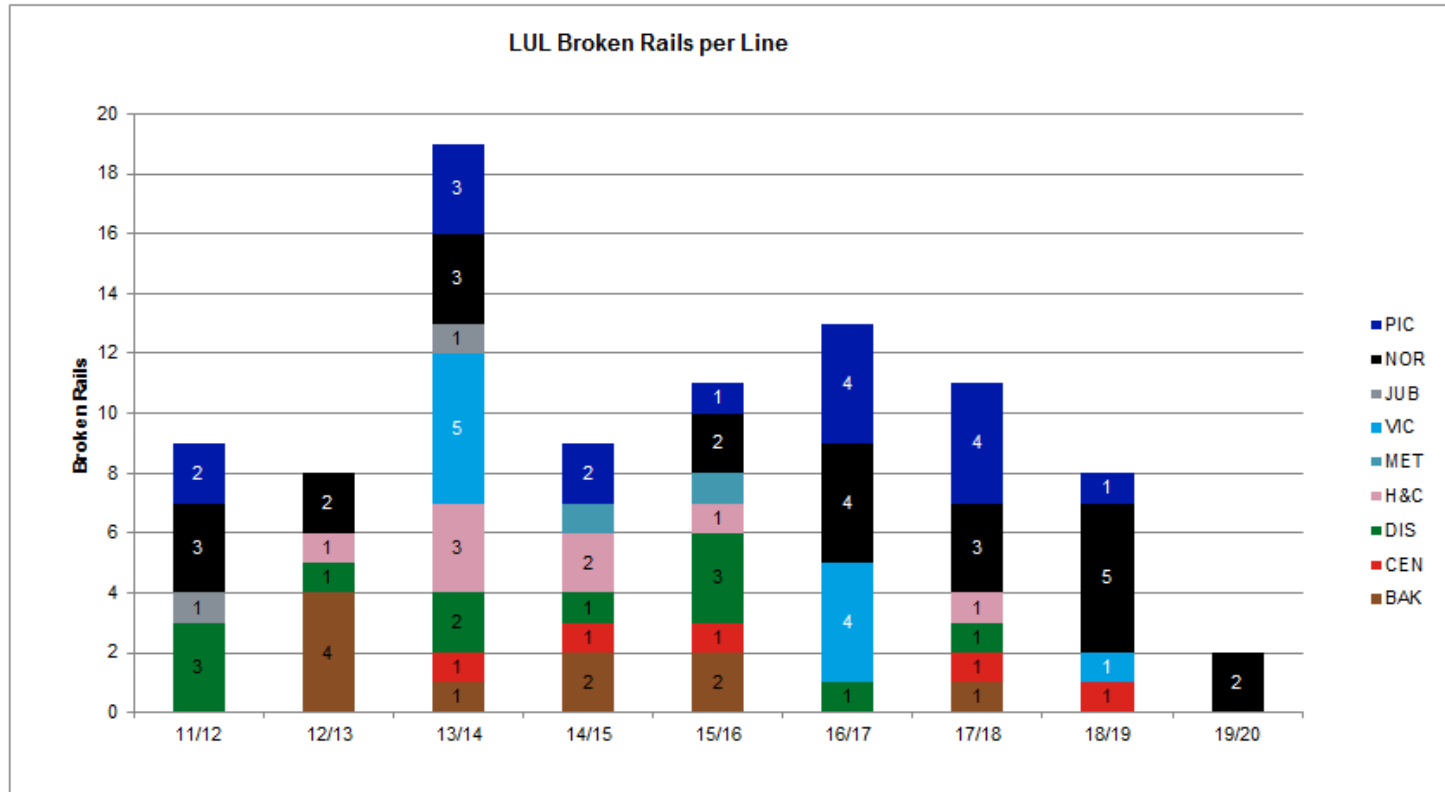
FREE THE NIGHT



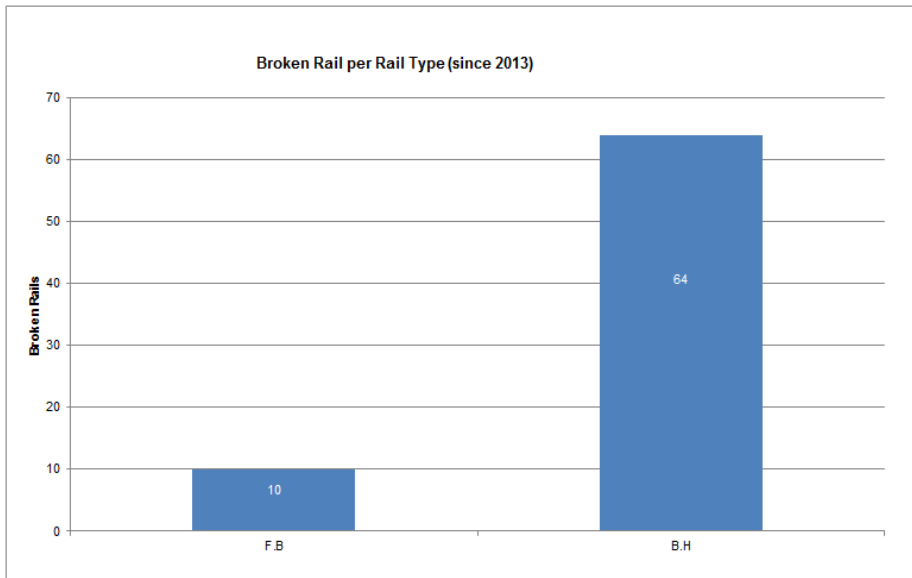
Wheel Failure Mode



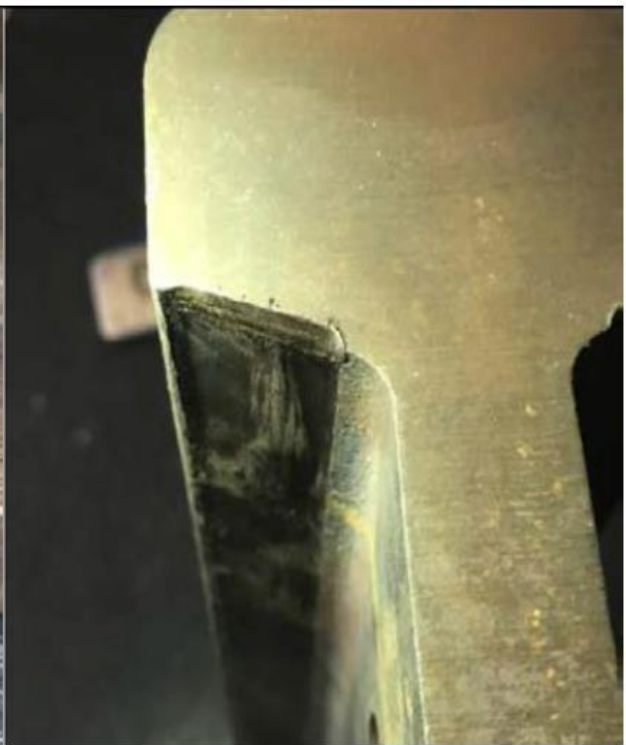
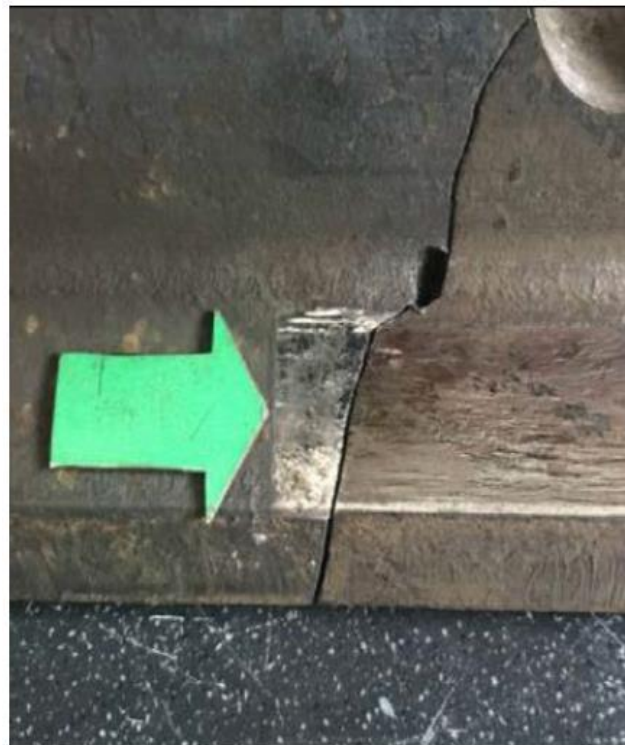
Broken Rails



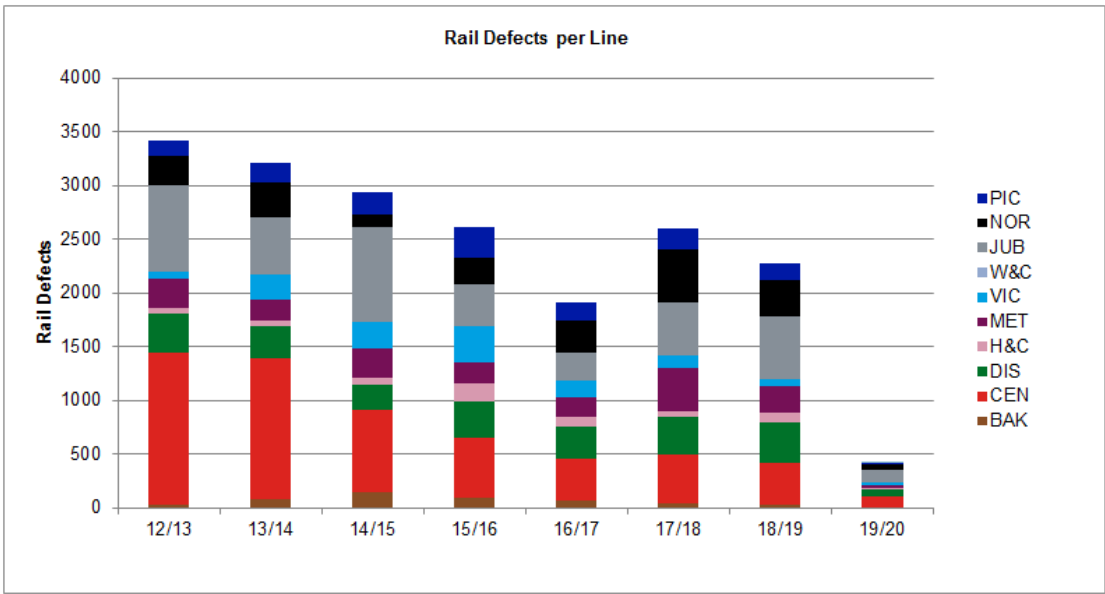
Broken Rails by Type



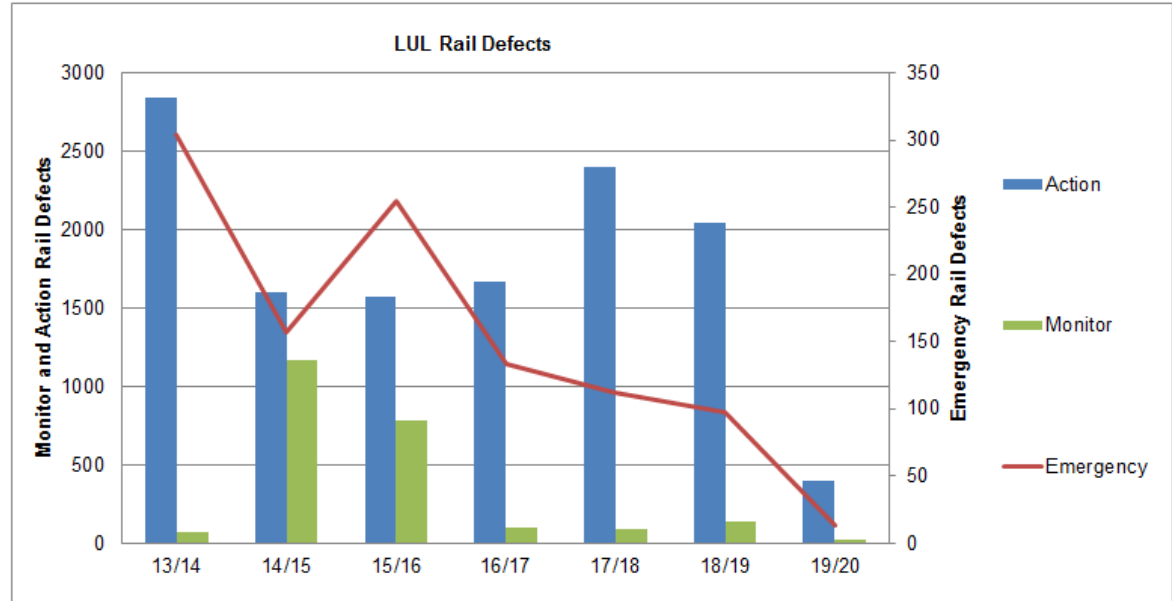
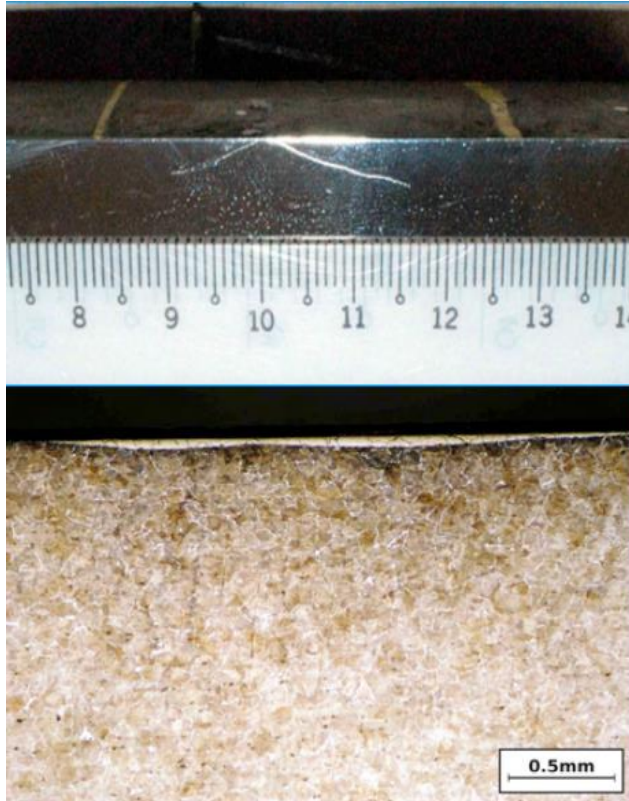
Fishplate Fretting



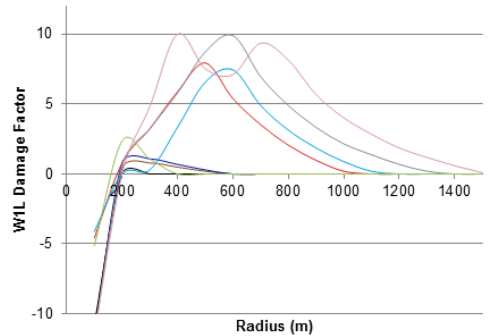
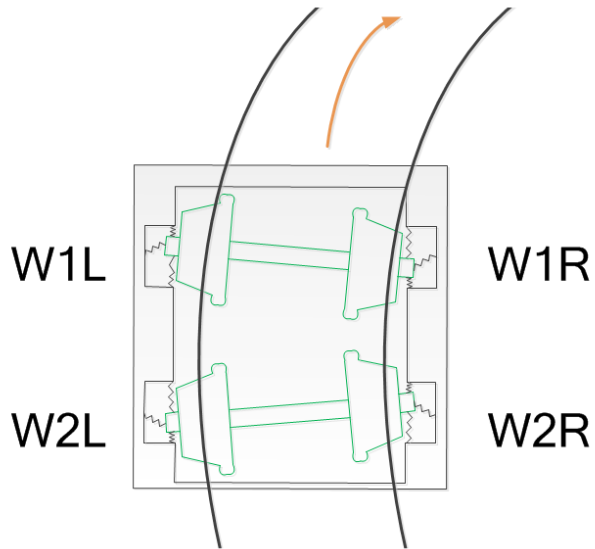
Rail Defects



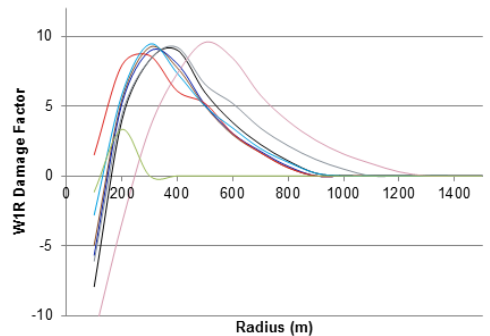
Squat Type Defects



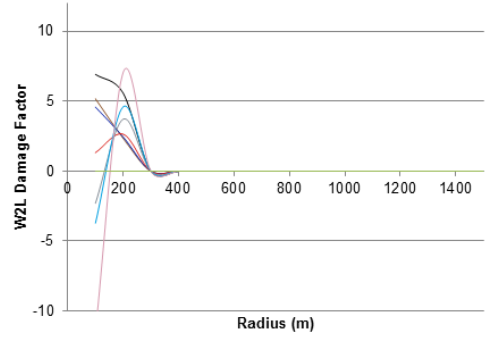
Rolling Contact Fatigue: Predicting



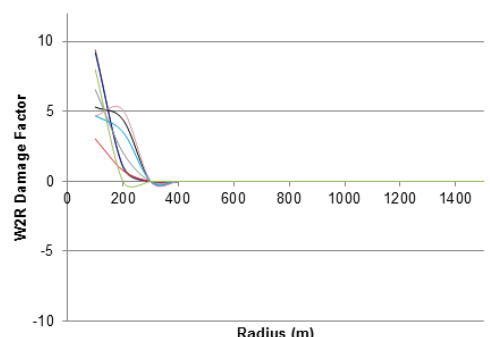
- 72
- 73
- 92
- 95
- 96
- 9
- S
- DTUP



- 72
- 73
- 92
- 95
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- S
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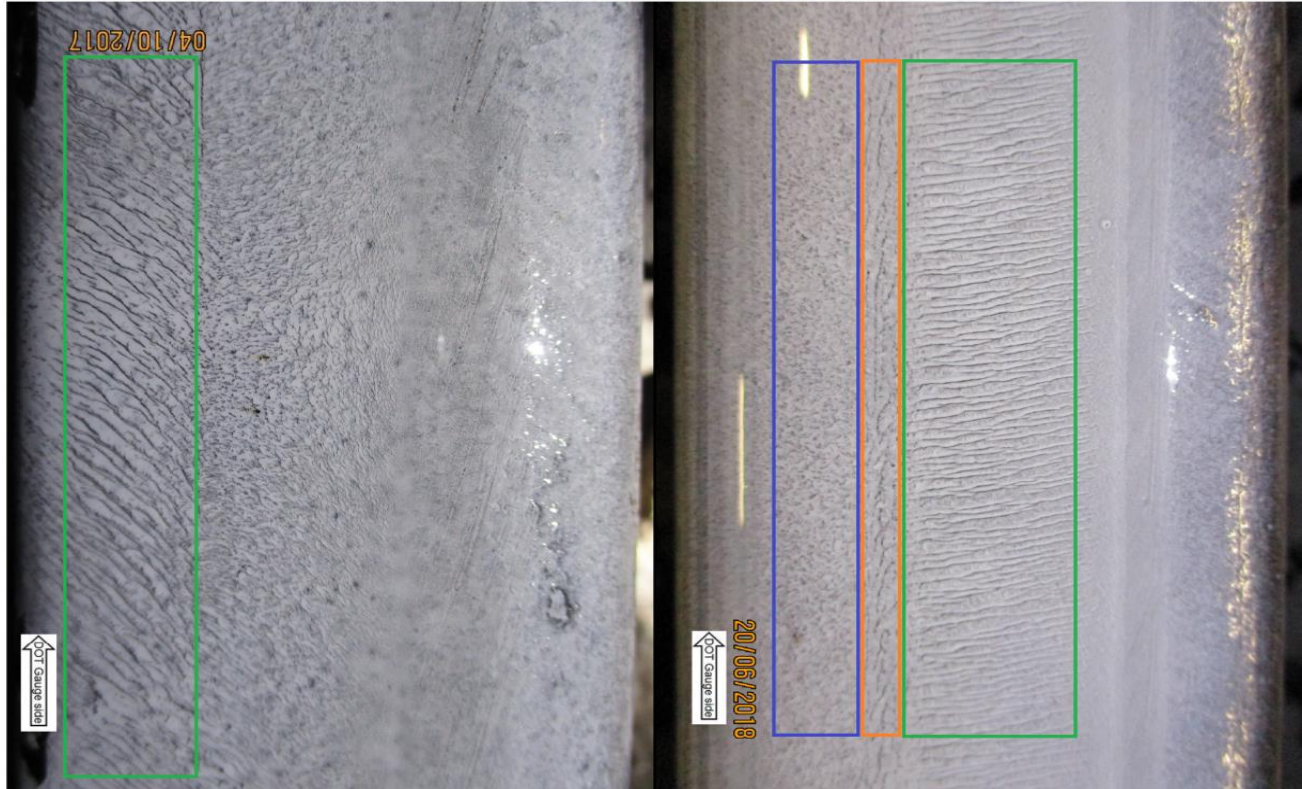
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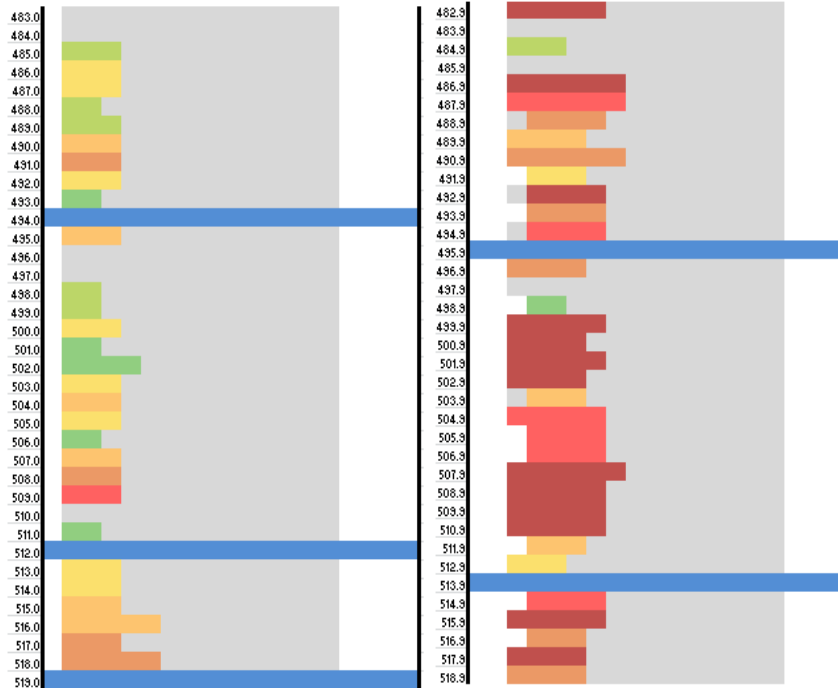
Rolling Contact Fatigue: Predicting



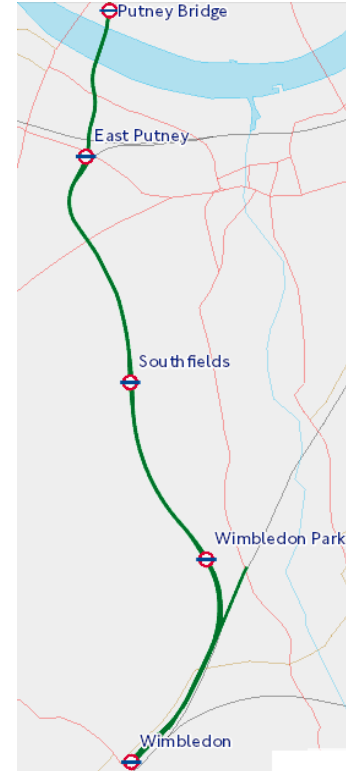
Rolling Contact Fatigue: Measuring



Rolling Contact Fatigue: Measuring



300m Radius Curve, 56MGT Interval



Grinding Strategy



- 2 x 8-Stone Machines
- Engineering Hours
- 3 Drivers:
 - Squat Type Defects
 - RCF
 - Corrugation



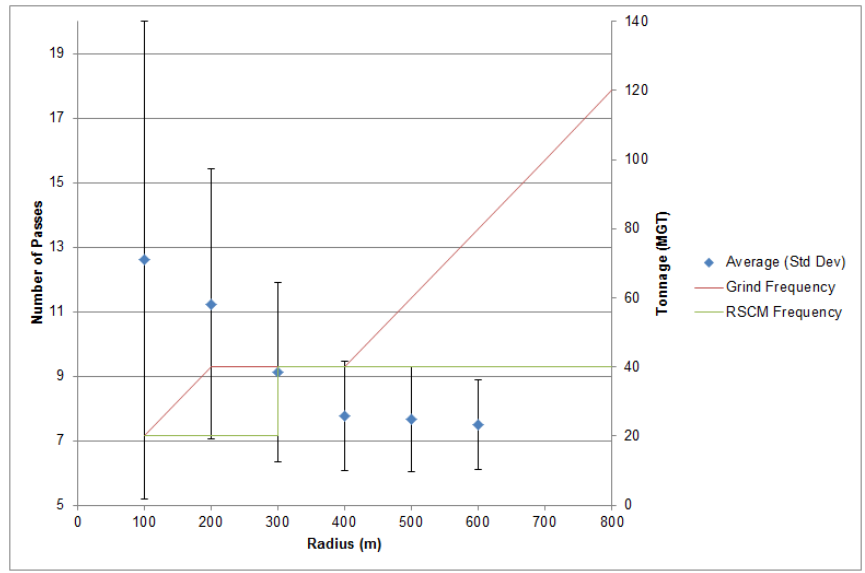
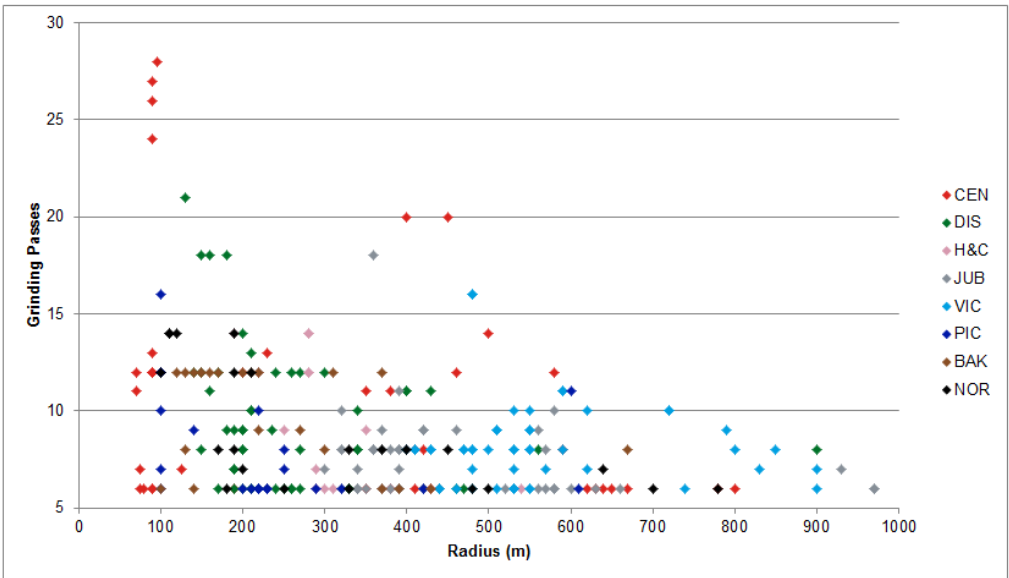
Grinding Strategy: Squat Type Defects



- Reduction in closures for renewals
- May 2019: 52 hour Pilot Heavy Maintenance Closure
- 2 x Grinders, 1 x Tamper
- 32km Squat Grinding
- £3/m v £40/m in engineering hours
- 5 years of 'pencilled in' maintenance closures every 2 years for Squat Type Defect Prevention



Grinding Strategy: RCF



Grinding Strategy: Corrugation



- Deep Tube
- NTF415 Sleepers
- Speeds c. 50kph
- Radius 350 – 450m
- Pin to Pin Corrugation

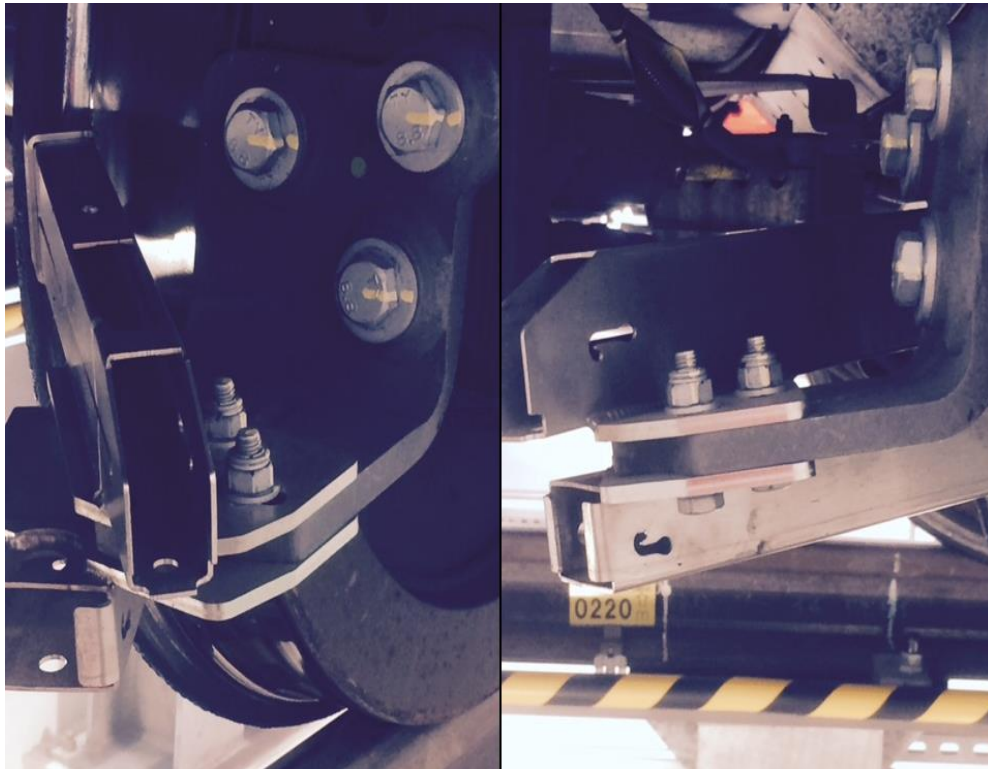
Adhesion Management: TOR



Adhesion Management: Gauge



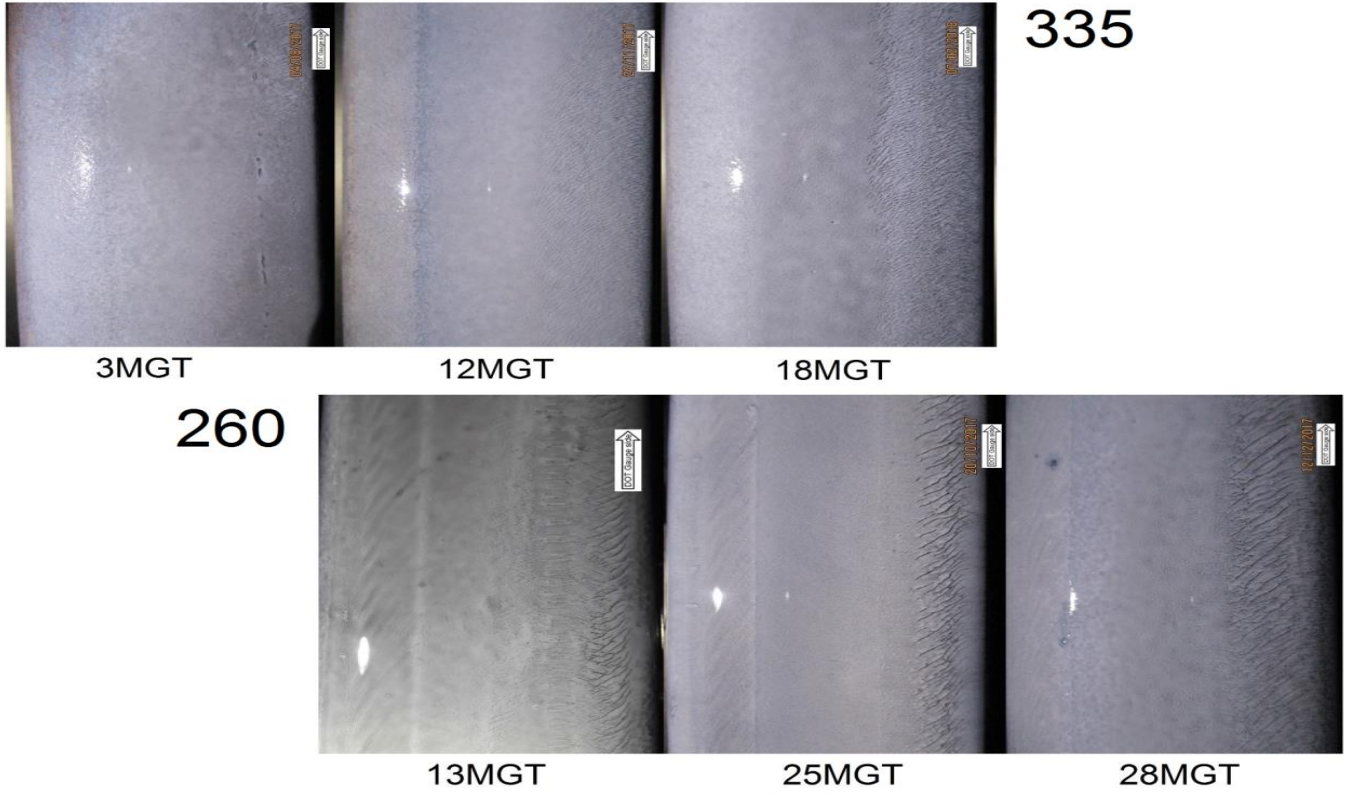
Adhesion Management: On Board



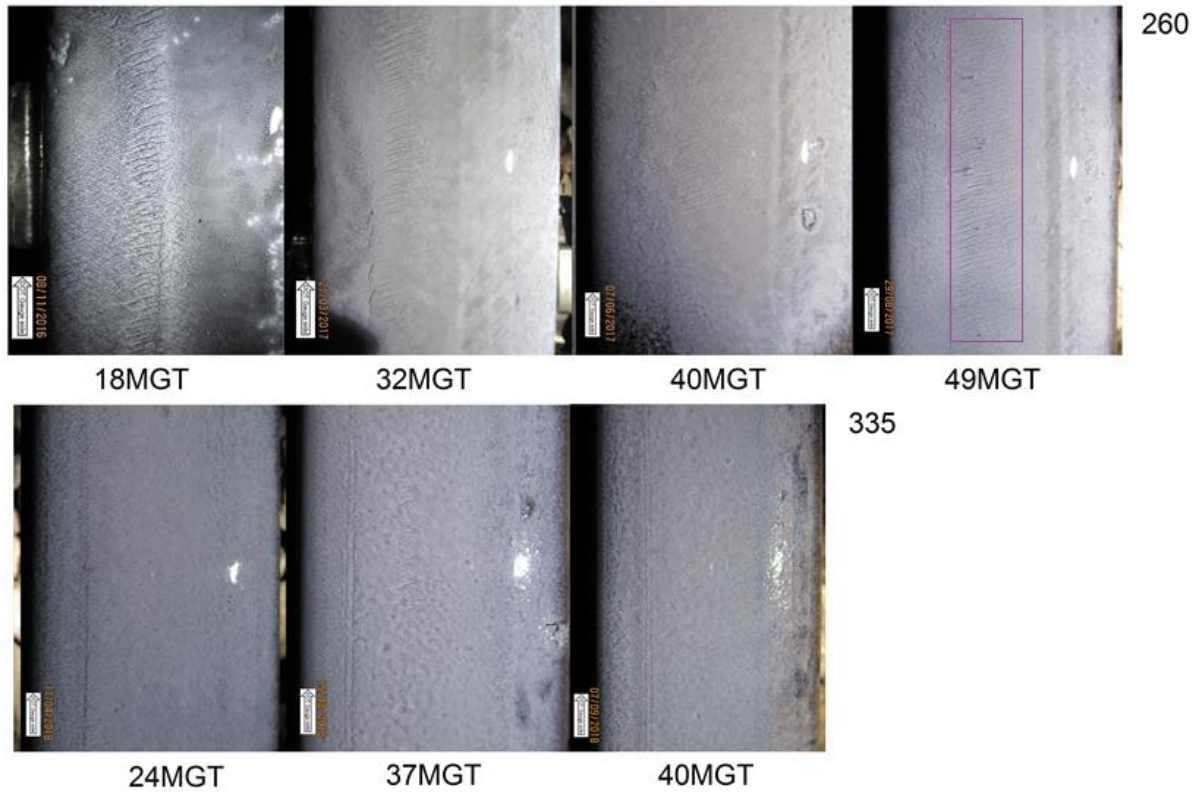
- Flange Contact @ c.600m
- Sub 200m radius curves require grease
- On Board does not protect switches
- Savings of between 20 & 40% maintenance costs with removal of track based systems



Premium Rail Steels: 400m Radius



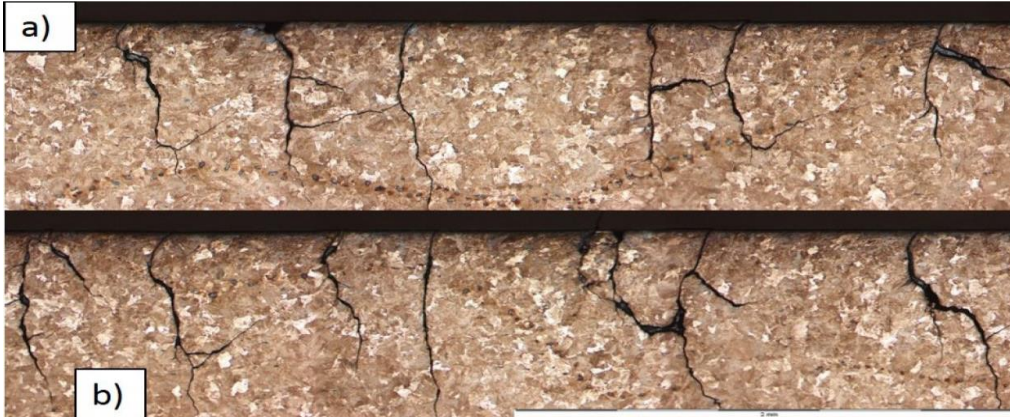
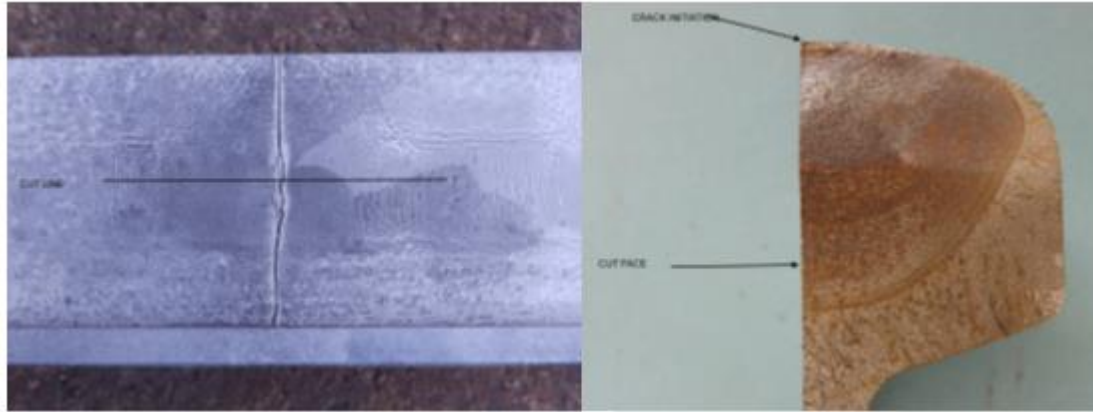
Premium Rail Steels: 180m Radius



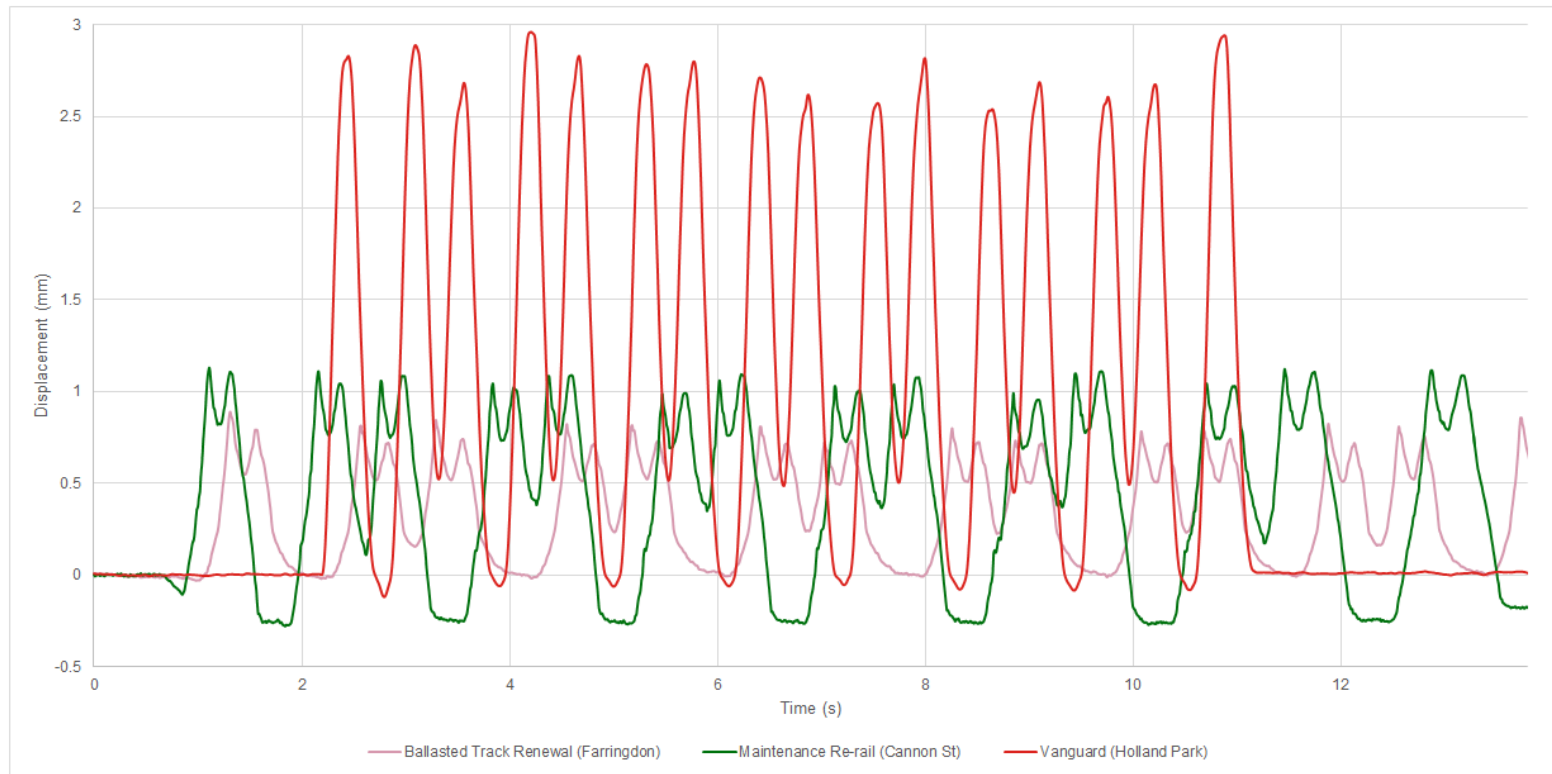
Premium Rail Steel Failures



Premium Rail Steel Failures



Premium Rail Steels: Deflection



Future Proofing



Conclusions

- Wheel Turning in mileage and Rail Grinding in tonnage allows future planning
- Removal of bullhead rail priority as although DTUP reduces wheel rail forces the increased axle load highest risk for broken rails, 17:1 risk.
- Squat type defects dominant but low risk and grinding in closures has shown the cost reductions possible
- Grinding for RCF/Corrugation probably still engineering hours based but re-introduction of miller should improve productivity
- Adhesion rationalisation programme will continue to reduce costs of maintenance between 20 & 40%
- Premium rail strategy still very much under development

