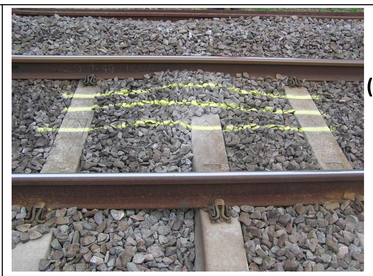
Railway Track for the 21st Century (EP/H044949/1) - £3.1 million, 2010-15. PI William Powrie

Developing a fundamental and linked understanding of the engineering, economic and environmental performance of railway track that will provide the science needed to underpin a radical overhaul in techniques for railway track design, construction and maintenance. Universities of Southampton, Nottingham and Birmingham

Rail investment in the UK and internationally is at a scale unprecedented in over a century, yet design is still based largely on empirical rules developed when train speeds, intensity of use and climate impacts were all substantially less. Significant societal and cost benefits can be gained by rational design based on sound science.

Outputs from *TRACK21* have already been embedded in the Rail Technical Strategy, a UK industry-wide, 30-year plan. New science and analytical tools have informed the European Commission's Shift²Rail research and development Joint Undertaking and industry, particularly Network Rail, is funding additional research. Find out more at www.track21.org.uk

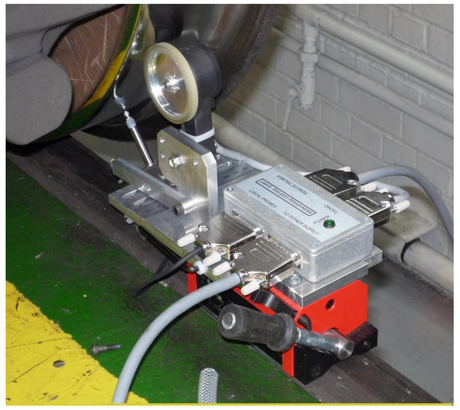


(a)

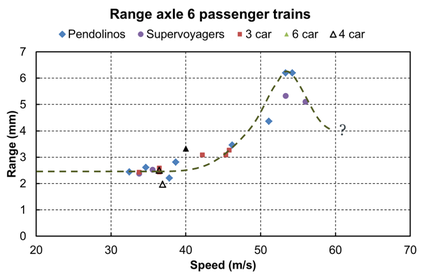
(b)

Ballast migration, where ballast moves downslope forming a heap against the low rail (a), may occur on sections of curved track after an increase in line speed. The higher curving forces from tilting trains (b) may also play a role. Field measurements and analysis have led to an understanding of the fundamental mechanisms of this behaviour and the development of more effective remediation and prevention techniques.

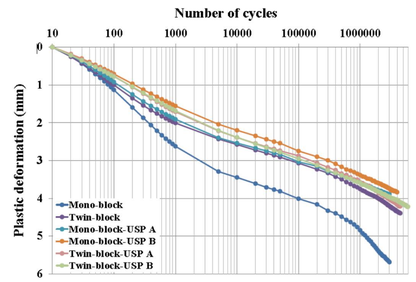
A wheel roughness measurement device has been developed that has been commercialised by Rail Measurement Ltd. The device is being used in a study of wheel flat generation with Siemens.



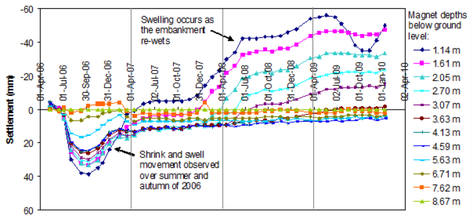
Through field testing and theoretical analysis we have shown that noise from a modern vehicle on a modern track is dominated by the track. A renewed track was 3-4 dB noisier than the track it replaced owing to the use of softer rail pads. Our rail dampers offer a potential solution for this.



Critical velocity (resonance) effects associated with low stiffness soils are being investigated through field measurements and computer models. A high speed rail working group with representatives from HS1, HS2 and Network Rail is guiding the work and ensuring the dissemination of findings directly to industry.

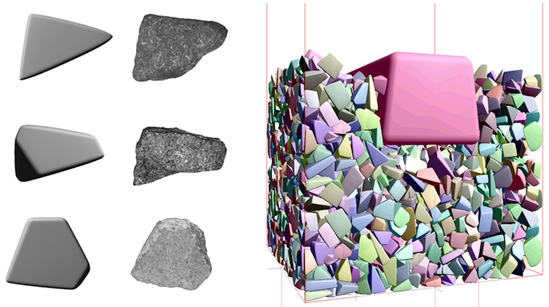


Laboratory sleeper/ballast interface tests have demonstrated the relative advantages of different sleeper shapes, under sleeper pads and random fibre reinforcement of ballast to reduce settlement. This work is informing the development of track design at HS2, London Underground Limited and Network Rail.



Vegetation can cause shrinkage and swelling of clay railway embankments, putting the track out of line and level. Site measurements have shown the extent of movements and how these may be reduced by partial vegetation clearance. This has informed vegetation management guidance and practice at Network Rail and London Underground Limited.

Piles are used to stabilize railway earthwork slopes that have failed or are in danger of slipping. Instrumentation at a number of sites has enabled us to understand the various mechanisms of behaviour and to develop improved design methods that have led to substantial cost savings.



Potential particles with ballast-like shapes and spheres with breakable asperities have been developed for discrete element method simulation of ballast behaviour under load, and compared with laboratory results. The method is being used commercially to optimise sleeper shape.

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