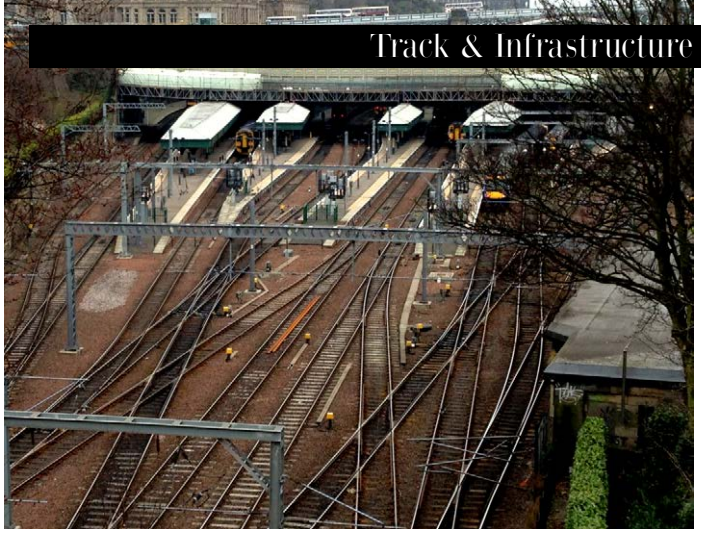
TRACK TO THE FUTURE



Professor William Powrie, dean of engineering and the environment at the University of Southampton and a member of the steering group for the 2012 Rail Technical Strategy, discusses a new research project that aims to discover the scientific knowledge and develop the analytical tools to design long-life, low-noise railway track systems that are economical to install, require minimal maintenance, and optimise environmental performance.

The UK Engineering and Physical Sciences Research Council (EPSRC) recently announced a major new Programme Grant awarded to the universities of Southampton, Birmingham, Huddersfield and Nottingham. The value of the award from EPSRC is £5m, with a further £3.5m in cash and in kind from collaborating industry partners including Network Rail and from the universities for postgraduate studentships associated with the research programme.

The programme, known as Track to the Future (T2F), will run for five years from June 2015. It will build on some of the promising outputs from the current research programme TRACK21, but will also address some of the completely new questions being asked as we push expectations of railway infrastructure performance to the limit.

Given the significant investment planned by Network Rail and other infrastructure operators, the scope for cost savings and improved environmental performance through better track system design and longevity is substantial.

Track is being more intensively used as the frequency and speed of trains continue to increase. The time available for maintenance is decreasing and pressure is growing to reduce cost and environmental impacts, including noise and vibration. At the same time, climate change is imposing new pressures on old infrastructure, sometimes with well-publicised impacts on exposed coastal railways and vulnerable earthworks.

The key research challenges that T2F will address are to develop low-maintenance, long life track systems with optimised material use; to design crossings and transitions so as to optimise vehicle behaviour through them and hence maximise resistance to damage; and to develop an integrated approach to designing a low-noise, low-vibration track.

Research into long-life track systems will follow three main strands. The first is to develop and demonstrate new track forms or components, taking forward promising interventions identified in TRACK21 such as under-sleeper pads and random fibre ballast reinforcement. The second is to understand the relationships between the key measurable parameters of track stiffness and track settlement, and the key performance parameter of geometrical standard deviation. The third is to extend ballast life by reducing or eliminating factors that lead to degradation, looking at the feasibility of design for the degraded state and developing options for re-use rather than downcycling or disposal.

Recent research into crossings and transitions has started to quantify the highly complex interactions between switch and crossing geometry, sub-base support, wheel profile and vehicle dynamics, including the potential benefits of varying the support stiffness through the crossing or transition. The challenge now is to develop and combine these new understandings with the potential of modern manufacturing methods to provide a tuned variation in geometry and materials properties, to improve vehicle/crossing interaction and thereby reduce damage.

The third challenge to be tackled is noise and vibration. Track is the main source of railway rolling noise and has a key role in vibration transmission into the ground. Design, however, is usually driven by other concerns with the implications for noise and vibration considered as secondary. T2F will develop and demonstrate an integrated approach to designing a low-noise, low-vibration track consistent with reduced whole life costs and maintenance needs.

The programme will be carried out in collaboration with industry, with advice and input through an Industry Steering Group chaired by Andy Doherty (Network Rail, and a member of RTM's editorial board) and comprising representatives of infrastructure operators, the rail industry supply chain, and regulatory, government and quasi-autonomous bodies. The research will be reviewed for quality and international relevance by an international scientific panel with members from Australia, the USA and Europe.

The programme will benefit from parallel and complementary research activities, including Strategic University Partnerships between Network Rail and the universities of Southampton, Birmingham and Nottingham, and between RSSB and Huddersfield; engagement of the university partners in FutureRailway and Shift2Rail; other publicly-funded railway infrastructure research; wider research in complementary disciplines such as geotechnical materials and climate change; and facilities in the new National Infrastructure Laboratory on the Southampton Boldrewood Innovation Campus, as part of the UK Collaboratorium for Research in Infrastructure and Cities (UK-CRIC).

One of the Research Council's independent reviewers described the vision for this programme as ambitious and adventurous, commenting that if only parts of it can be achieved it will be transformative. The rail industry will gain a better scientific understanding to refine the design of track maintenance, refurbishment and new build. The prize is not slightly reduced costs or marginally longer life but greatly extended maintenance intervals and transformational reductions in whole life costs.

FOR MORE INFORMATION

W: www.t2f.org.uk