

# TRACK TO THE FUTURE (T2F): three interlinked Research Challenges

**TRACK4LIFE:** low-maintenance, long-life track systems with optimised material use, through

- ▶ developing and demonstrating new track forms or components and promising interventions
- ▶ developing an understanding of the relationships between the key measurable parameters of track stiffness and track settlement, and the key performance parameter of geometrical standard deviation
- ▶ extending the life of ballast by reducing or eliminating the factors leading to its degradation.

**DESIGNER CROSSINGS AND TRANSITIONS:** crossings and transitions that optimise the behaviour of the vehicles traversing them, thereby minimising damage.

**NOISE-LESS TRACK:** an integrated approach to designing a low-noise, low-vibration track consistent with reduced whole life costs and maintenance needs.

TRACK TO THE FUTURE (T2F) is a major five-year, £8.5M research programme, funded by EPSRC and the Universities of Southampton, Birmingham, Huddersfield and Nottingham, with support from major industry partners. Its aim and vision is to support the development of railway track systems that are efficient in terms of embodied carbon, materials use and cost; robust in requiring little maintenance; and unintrusive in producing little noise.

Fully-funded PhD studentships are being offered in support of the aims and objectives of T2F. Each project will be based at one of the participating universities, but at least one member of the supervisory team will be drawn from one of the other universities with the expectation that the student will spend some time (normally a few weeks or months) at the second institution.

TRACK to the future

## Get on board

Funded Phd Studentships In Railway  
Track System Research



Cover photo: Paul Bigland

**EPSRC**  
Pioneering research  
and skills

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UNIVERSITY OF  
**Southampton**

UNIVERSITY OF  
**BIRMINGHAM**

University of  
**HUDDERSFIELD**  
Institute of Railway Research

The University of  
**Nottingham**  
UNITED KINGDOM · CHINA · MALAYSIA





The projects will be supervised by internationally recognised academics, including:

**William Powrie, FEng**

Professor of Geotechnical Engineering and Dean of Engineering and the Environment, Southampton

**Simon Iwnicki**

Professor of Railway Engineering and Director of the Institute of Railway Research, Huddersfield

**David Thompson**

Professor in Railway Noise and Vibration, Southampton

**Antonis Zervos**

Associate Professor in Geomechanics, Southampton

**Clive Roberts**

Professor of Railway Systems, Birmingham, and Director of the Birmingham Centre for Railway Research and Education

**Glenn McDowell**

Professor of Geomechanics and Head of Department of Civil Engineering, Nottingham

**John Preston**

Professor of Rail Transport and Head of the Transport Research Group, Southampton

**More information?**

Contact Rod Anderson on +44 (0)23 8059 3960, or email at [railresearch@soton.ac.uk](mailto:railresearch@soton.ac.uk)

Find out about the Track to the Future programme at [www.t2f.org.uk](http://www.t2f.org.uk)

There are links for more details about these opportunities on the T2F website at <http://t2f.org.uk/research-studentships/>, including how to apply and contacts for an informal discussion about any of the projects.

**MECHANICAL PROPERTIES OF RE-USED BALLAST**

*Based at Southampton*

This project will build on previous work to investigate deterioration of railway ballast. You will undertake experimental lab tests on scaled and full size ballast, field studies on the railway and numerical discrete element method modelling. Your results will be incorporated into integrated models for improved track performance prediction and maintenance planning.

**FIBRE REINFORCEMENT FOR RAILWAY BALLAST**

*Based at Southampton*

Recent studies have focused on the use of polymeric fibres (narrow strips) for reinforcing railway ballast. This project will focus on the properties of the fibres, particularly on their mechanical response (isolated and in contact with ballast). By understanding the role of fibre material, you will contribute to the development of guidelines for optimal design of fibre reinforced ballast.

**GROUND SUPPORT AND MODELLING THROUGH S&C AND TRANSITIONS**

*Two studentships, based at Huddersfield and Southampton*

We are investigating innovative measures to prevent some of the most significant degradation modes of switches and crossings (S&C) and other transitions in railway tracks, potentially leading to substantial cost savings. Two PhD opportunities, working in close collaboration, are associated with this research challenge.

A project at Huddersfield will analyse the dynamic behaviour of a complete turnout, taking into account the train-track interaction. It will develop a numerical model of the track system and integrate it with commercial railway vehicle dynamics simulation software (e.g. Simpack and VI-Rail) and use measurements from T2F sites for validating the model's predictions. The model will be used to assess mitigation measures and innovations emerging from the T2F project.

An associated project at Southampton will focus on using field and laboratory test data to develop improved ways of specifying and representing support stiffnesses for S&C and other problematic transitions. Your results will be included in the models run at Huddersfield.

**A WHOLE LIFE CARBON MODEL FOR RAILWAY TRACK SYSTEM INTERVENTIONS**

*Based at Southampton*

This project will develop a carbon emissions model for railway track systems, covering the whole life of infrastructure. It will be capable of modelling the impacts of a wide range of track system interventions, including the full range of engineering solutions developed during Track to the Future. The model will have a high degree of spatial transferability, which will allow it to be used to generate results for any part of the UK rail network.

**NOISE AND VIBRATION MITIGATION AT SWITCHES & CROSSINGS**

*Based at Southampton*

This project will extend existing computer models of the dynamics of vehicles running through switches and crossings. The results from these models will then be used together with acoustic models to determine noise generation, and with advanced models of vibration to determine the vibration transmitted through the ground. The project will consider the effects of changes in switch geometry on the noise and vibration generated in different situations. You will have the opportunity for experimental work to support the research.

**INTEGRATING TRAIN AND TRACKSIDE MONITORING**

*Based at Birmingham*

Various data are available from sensors mounted on trains running on track, and from sensors mounted on the rails or the track more generally. This project will consider whether combining data from train-borne and lineside sensors is able to provide useful information that is not available from one data set or the other alone. It is likely to involve instrumenting plain track, a set of points (S&C) and a transition, and vehicles running over them. You will create models or use existing models to simulate interactions of interest. Your data and analyses will inform the T2F project, in particular in relation to switch and crossing design and monitoring.

**NOVEL FORMS OF RAILWAY TRACK**

*Based at Nottingham*

This project will investigate the potential for novel sleeper shapes to improve track robustness and reduce maintenance needs.

This project, in tandem with a similar project at Southampton, will involve testing sleeper/ballast bed performance over millions of loading cycles in a purpose-built test rig; numerical discrete element method modelling; and dynamic finite element analyses. There will also be the opportunity to help specify and become involved in field testing of novel track forms and interventions, through the EU-funded Shift2Rail programme. Your results will be incorporated into integrated T2F models.