

Institution of Structural Engineers Research Award 2012

Project title: Structural aspects of novel rail track concrete systems containing recycled waste materials

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Other researcher(s): Two PhD students – to be advised

Aims of research:

A rail track system incorporating prestressed concrete sleepers laid on stone ballast is widely used throughout the UK rail network. There are, however, limitations associated with the use of both sleepers and ballast. First, the steel tendons in sleepers are susceptible to corrosion especially in coastal areas. Second, ballast requires periodic maintenance and, in the case of high speed trains, causes damage to rail and wheels. Hence, the aim of this project is to engineer corrosion-free sleepers and ballast-less track systems that require low maintenance. Central to this work is the use of waste tyre particles and recycled concrete aggregates to increase sustainability credentials and reduce construction costs.

The objectives of this research are:

- 1) to study the behaviour of prestressed concrete sleepers incorporating non-corrosive fibre reinforced polymer tendons and waste tyre particles; and
- 2) to characterise the performance of ballast-less slabs incorporating waste tyre particles and recycled concrete aggregates.

Benefits to structural engineering:

This work could lead to the development of more sustainable rail track concrete components with improved performance and low maintenance cost. Results from this study would be of interest to Network Rail, London Underground Limited, and companies involved in the production of concrete systems for rail track such as CEMEX. The method has high sustainability credentials as it could provide a means for disposal of waste rubber tyres. Moreover, this study could eventually lead to the establishment of design guidelines for the use of recycled waste in concrete. This would be of direct relevance to practising engineers and designers. While the design guidelines will initially focus on concrete sleepers and track slabs, its scope could be extended to encompass other structural members, e.g. columns, beams, and foundations.

Proposed finish date: September 2014