

**EPSRC**Engineering and Physical Sciences  
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# Full-Scale Laboratory Testing of Slab Track and Ballasted Track on Two Embankment Systems

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## Summary

This project was funded by the UK Engineering and Physical Sciences Research Council (EPSRC) under Grant Numbers EP/N009207/1 with industry support from Tensar and Max-Bögl. This collaborative research, with Leeds University and the University of Dundee, aims at lowering the costs of railway tracks construction using preformed systems. It investigates the immediate and long-term settlement behaviour of conventional and Geosynthetically Reinforced Soil with Retaining Wall (GRS-RW) systems subject to cyclic loading for two track forms: a concrete slab track and a ballasted track. First, a three-sleeper concrete slab section is constructed at full-scale under controlled laboratory conditions, followed by a ballasted track. Both are supported by a 1.2m deep subgrade and a frost protection layer in accordance with railway design standards. Two different axle load magnitudes are applied statically, and then cyclically/dynamically, using 6 actuators to replicate moving train axle loads.

## Conclusions highlight

- ✓ The ballasted track shows more settlement when compared to the concrete slab track, under the same loading conditions, even though the ballasted track was tested at a slightly higher compacted state due to the concrete slab track test being conducted first.
- ✓ For both track forms, it is observed that the slab track performs significantly better in terms of elastic and plastic deformation.
- ✓ Pressure cells show that for GRS-RW the stress levels on the wall remain negligibly small during loading, demonstrating the positive stabilisation effect of the geosynthetic material.

## Publications

Čebašek TM, Esen AF, Woodward PK, Laghrouche O, Connolly DP. Full scale laboratory testing of ballast and concrete slab tracks under phased cyclic loading. *Transportation Geotechnics*. 2018 Dec 1;17:33-40. <https://doi.org/10.1016/j.trgeo.2018.08.003>

Sainz-Aja J, Pombo J, Tholken D, Carrascal I, Polanco J, Ferreno D, Casado J, Diego S, Perez A, Abdala Filho JE, Esen A. Dynamic calibration of slab track models for railway applications using full-scale

testing. Computers & Structures. 2020 Feb 1;228:106180.  
<https://doi.org/10.1016/j.compstruc.2019.106180>