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Geosynthetic Reinforcement for the Protection of Buried Pipes beneath Pavements

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Abstract

Traffic loading can produce a semi shock on the trench involved with pipe and tent to damage the lifelines buried in the soil and also permanent settlements may happen. This study describes the construction and testing of 13 trenches containing buried uPVC pipes as typically installed beneath roads for drainage purposes. Both surface settlement of the trench top and deflection of the pipe at the trench base were monitored. Many of the installations were reinforced at the top with a geosynthetic reinforcement to evaluate their potential in limiting deflection of the trench surface and of limiting the compression of the pipe in the trench. The planar reinforcement was the best material tested as far as surface settlement was considered. However, its ability to protect the pipe from straining wasn't so well developed under repeated loading, even though it worked well under initial loading. Geocells also had potential but it was more demanding as regards compaction installation.

Keywords: Buried pipe, Settlement, Plate loading test, Repeated loading, Geosynthetic.

1. INTRODUCTION

Lightweight, polymeric pipes – e.g. drainage pipes – are commonly installed in trenches which, once backfilled, are then over-trafficked by construction plant and, later by service traffic. Such pipes must be placed deep enough, and under well compacted trench backfill, in order that the stresses imposed by the traffic have been spread to such a low level that the load imposed on the pipe is insufficient to cause any damage.

Appropriate geosynthetic reinforcement of soil, trench backfill or granular pavement construction over the pipe seems likely to have the possibility of reducing the stress imposed on the pipe. If this is the case then it is likely that the pipe could be placed at shallower depth, or less high specification backfill could be used. In both cases the use of the geosynthetic reinforcement might then give economic benefits to the constructor.

To investigate this possibility a number of full-scale installations were made in a test pit at the University of Nottingham and subjected to repeated plate loading tests to establish the behaviour of pipes in trenches underneath reinforced and unreinforced construction layers.

3. EXPERIMENTAL ARRANGEMENTS

Figure 1 is a schematic of the installations employed for the testing showing the soil, geotextile reinforcement, standard unplasticized PVC (uPVC) drainage pipe (external diameter approximately 16cm and internal diameter approximately 15.1cm) and loading area.