

DESIGN AND PERFORMANCE OF SLOPE DRAINAGE IN TRANSPORT EARTHWORKS

ABSTRACT Transportation slopes across the UK are increasingly vulnerable to climate change and more frequent extreme weather. In recent years, slope failures have made national headlines due to the disruption they cause to vital transport links and the high costs of repair and reinstatement. Many embankments in the UK's transport infrastructure are built with compacted clay soils, which deteriorate over time through shrinking and swelling, caused by the fluctuation of weather cycles and soils' repeated wetting and drying. With precipitation events expected to become more intense and frequent, the stability of these slopes is under growing threat.

Drainage plays a key role in maintaining slope stability. Effective solutions must consider the slope as a whole; its composition, existing signs of instability, and how water moves through features like desiccation cracks. The method of installation and ongoing maintenance may influence how effectively a drainage system supports slope stability, particularly in relation to water movement and retention within the soil profile.

This project will monitor the performance of three full-scale drainage trenches with different material compositions at the BIONICS embankment. Soil behaviour will be tracked over time using a combination of laboratory testing and field observations. In parallel, a study of legacy drainage systems will provide insight into long-term performance under real world conditions. Together, these investigations will build a clearer picture of how drainage affects slope resilience. By combining lab analysis, field-scale monitoring, and real world case studies, this research aims to identify practical, climate-resilient drainage strategies for UK transport infrastructure. The findings will support better design and maintenance practices, helping to reduce the risk of slope failures and improve the reliability of major transport networks.