

Climate Change Impact on Slope Stability: A Study of Slope Drainage Design and Operation

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Abstract : The effects of climate change and increased rainfall events on UK-based infrastructure are observable, with an increasing number being reported on in the national press. The fatal derailment at Stonehaven in 2020 prompted a wider review of Network Rail-owned earthworks assets. The event was indicated by the Rail Accident Investigation Branch (RAIB) to be caused by mis-installed drainage on the adjacent cutting. The slope failure on Snake Pass (public highway A57) was reportedly caused by significant water ingress following numerous storm events and resulted in the road's closure for several months. This problem is only projected to continue with greater intensity and more prolonged rainfall events forecasted in the future. Subsequently, this project is designed to evaluate effective drainage trench design within infrastructure embankments, considering the capillary barrier phenomenon that may govern their deterioration and resultant failure. Theoretically, the differential between grain sizes of the embankment clays and gravels, customarily used in drainage trenches, would have a limiting effect on infiltration. As such, it is anticipated that the inclusion of an additional material with an intermediate grain size should improve the hydraulic conductivity across the drainage boundary. Multiple drainage designs will be studied using instrumentation within the drain and surrounding clays. Data from the real-world installation at the BIONICS embankment will be collected and compared with laboratory and Finite Element (FE) simulations. This research aims to reduce the risk of infrastructure slope failures by improving the resilience of earthwork drainage and lessening the consequential impact on transportation networks.

Keywords : earthworks, slope drainage, transportation slopes, deterioration, capillary barriers, field study

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