

Field Trial of Resin-Based Composite Materials for the Treatment of Surface Collapses Associated with Former Shallow Coal Mining

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Abstract : Effective treatment of ground instability is essential when managing the impacts associated with historic mining. A field trial was undertaken by the Coal Authority to investigate the geotechnical performance and potential use of composite materials comprising resin and fill or stone to safely treat surface collapses, such as crown-holes, associated with shallow mining. Test pits were loosely filled with various granular fill materials. The fill material was injected with commercially available silicate and polyurethane resin foam products. In situ and laboratory testing was undertaken to assess the geotechnical properties of the resultant composite materials. The test pits were subsequently excavated to assess resin permeation. Drilling and resin injection was easiest through clean limestone fill materials. Recycled building waste fill material proved difficult to inject with resin; this material is thus considered unsuitable for use in resin composites. Incomplete resin permeation in several of the test pits created irregular 'blocks' of composite. Injected resin foams significantly improve the stiffness and resistance (strength) of the un-compacted fill material. The stiffness of the treated fill material appears to be a function of the stone particle size, its associated compaction characteristics (under loose tipping) and the proportion of resin foam matrix. The type of fill material is more critical than the type of resin to the geotechnical properties of the composite materials. Resin composites can effectively support typical design imposed loads. Compared to other traditional treatment options, such as cement grouting, the use of resin composites is potentially less disruptive, particularly for sites with limited access, and thus likely to achieve significant reinstatement cost savings. The use of resin composites is considered a suitable option for the future treatment of shallow mining collapses.

Keywords : composite material, ground improvement, mining legacy, resin

Conference Title : ICSMGE 2016 : International Conference on Soil Mechanics and Geotechnical Engineering

Conference Location : Paris, France

Conference Dates : February 22-23, 2016