

Eco-Friendly Ground Improvement for Sustainable and Resilient Civil Infrastructure

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Abstract

Soils described as problematic—soft, erodible, or loose—present significant challenges for civil infrastructure due to their high compressibility, low bearing capacity, and susceptibility to collapse. Various civil infrastructure, such as Foundations, roads, railways, embankments, mining corridors, and coastal assets, built on such ground are all vulnerable to these issues. To prevent excessive post-construction settlement and the resulting structural damage, effective ground improvement before construction is essential. Chemical stabilisation using grouts such as lime or Portland cement has long been the standard approach, but it carries high environmental costs, including high carbon emissions and potential toxicity. This Plenary Lecture introduces a more sustainable alternative: bio-cementation, an emerging technique that uses biological processes involving bacteria to improve soil properties. Covering the underlying mechanisms, recent developments, and applications, the lecture positions bio-cementation as a transformative step toward greener, more sustainable, and more resilient ground improvement practices.