

Advancing Eco-friendly Ground Improvement for Sustainable and Resilient Civil Infrastructures

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Abstract: Unstable soils, characterized by high compressibility, low bearing capacity, and susceptibility to collapse, pose major challenges and significantly constrain the construction and long-term performance of civil infrastructures such as building foundations, roads, railway tracks, dams, embankments, tunnels, etc. Effective ground improvement of such problematic soils prior to the construction of civil infrastructures is therefore critical to mitigate excessive settlement and potential bearing failures. Conventional ground improvement techniques, typically involving chemical additives such as lime and Portland cement, have proven effective but raise serious environmental and sustainability concerns due to high carbon emissions and potential toxicity. This Plenary Lecture presents an innovative and eco-friendly sustainable alternative through bio-cementation, an emerging field that harnesses biological processes to enhance soil properties. The lecture will discuss the fundamental mechanisms, recent advances, and practical applications of this technology in civil infrastructures. By minimizing dependence on chemical stabilizers, bio-based ground improvement offers a transformative pathway toward greener, more sustainable, and resilient ground improvement practices in civil infrastructure developments.