Sustainable Civil Infrastructures

Suman Saha
Sabyasachi Biswas *Editors*

Innovations for Sustainable and Resilient Infrastructure

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Enhancing Soil Stability Using Plastic Waste Strips and Waste Brick Powder: A Sustainable Approach to Soil Stabilization

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Abstract. The utilization of plastic waste strips and waste brick powder in soil stabilization offers a sustainable solution for enhancing soil strength characteristics while addressing waste management challenges. Conventional soil improvement materials like cement, lime, and fly ash release harmful by-products, including carbon dioxide and heavy metals, which contribute to environmental pollution. This research explores the feasibility of using plastic waste strips and brick powder, sourced from construction debris, for soil stabilization. Sixteen sets of stabilized soil samples were prepared using four distinct blends of plastic waste strips (PWS) (0.15%, 0.3%, 0.45%, and 0.60% by weight of dry soil) and waste brick powder (BP) (10%, 15%, 20%, and 25% by weight of dry soil). Discarded plastic bottles and waste bricks from construction debris were utilized as additives. The study analyzed the changes in strength and compaction characteristics resulting from the integration of plastic waste strips and brick powder into the soil. Comprehensive laboratory tests, including specific gravity, particle distribution, Atterberg limits, moisture content, standard Proctor compaction, unconfined compression test, California bearing ratio test, and direct shear test, were conducted. The results showed a significant enhancement in soil strength characteristics with the addition of plastic waste strips and waste brick powder. An unconfined compressive strength of 124.68 kPa was achieved with a 0.3% PWS and 25% BP mix, while a soaked California bearing ratio value of 5.96% was obtained with a 0.60% PWS and 25% BP mix. In summary, incorporating these waste materials led to substantial enhancements in the soil's engineering properties. This study promotes sustainable practices by using waste materials in civil engineering, which minimizes environmental pollution and improves soil quality.

Keywords: Soil Stabilization · Plastic Waste · Brick Powder · Unconfined compressive strength · California Bearing Ratio · Waste Management

1 Introduction

Soil formation, or paedogenesis, is a complex process shaped by environmental factors, geographic location, and historical influences. This dynamic process involves biogeochemical activities that contribute to the creation and destruction of order (anisotropy)

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