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"SOIL STABILIZATION WITH C&D WASTE"

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ABSTRACT

Soil stabilization is a vital process in geotechnical engineering aimed at improving the strength, durability, and load-bearing capacity of weak or unstable soils to make them suitable for construction. This study focuses on enhancing soil properties through stabilization techniques using both conventional materials and sustainable alternatives. Various laboratory tests—including determination of maximum dry density, liquid limit, plastic limit, water content, and field density—were conducted to evaluate the engineering characteristics of the soil. Special emphasis was placed on the use of Construction and Demolition (C&D) waste as a stabilizing material. The incorporation of C&D waste not only improved the compaction and strength of the soil but also reduced its plasticity and moisture sensitivity. This approach contributes to sustainable construction practices by minimizing waste disposal, conserving natural resources, and reducing environmental pollution. The results demonstrate that soil stabilization using recycled materials like C&D waste is an effective, economical, and eco-friendly method for improving subgrade performance and supporting sustainable infrastructure development.

Key Words: *soil stabilization, load bearing capacity, C&D waste, recycled material, sustainability.*

I. INTRODUCTION

Soil stabilization is a process used to improve the engineering properties of soil, such as its strength, durability, and load-bearing capacity. It involves modifying the natural soil to enhance its performance under various conditions, making it suitable for construction purposes like roads, airfields, foundations, and embankments.

In many areas, natural soils may not possess adequate strength or stability to support structures. Factors such as high moisture content, poor gradation, or excessive compressibility can make soil unsuitable for construction. To overcome these issues, stabilization techniques are applied by either mechanical means (e.g., compaction or mixing different soil types) or by using chemical additives such as lime, cement, fly ash, bitumen, or even recycled materials like Construction and Demolition (C&D) waste.

II. LITERATURE REVIEW

Previous studies conducted by various researchers have shown that waste concrete and recycled concrete aggregate (RCA) can effectively improve weak soil properties. Arulrajah et al. (2019) reported significant improvement in CBR values using recycled aggregates in pavement subgrades. Mohammadinia et al. (2019) observed reduced plasticity and better compaction characteristics in clay soils stabilized with RCA. Jitsangiam et al. (2015) found that recycled concrete possesses self-cementing properties which increase soil strength. Dewanda et al. (2023) demonstrated improvement in black cotton soil behavior using waste concrete aggregate. Several researchers also concluded that the use of C&D waste

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reduces environmental pollution, minimizes landfill disposal, and supports sustainable construction practices. These studies confirm that waste concrete is an economical and eco-friendly material for soil stabilization applications.

III. METHEDOLOGY

Soil Collection

- Representative soil samples were collected from the project location.
- Organic matter, roots, and unwanted materials were removed before testing.

C&D Waste Collection

The following construction waste materials were collected:

- Recycled Concrete Aggregate (RCA)
- Crushed brick/brick powder
  - Cement mortar waste
  - Ceramic/tile waste
  - Recycled fine aggregate

IV. RESULT ANALYSIS & DISCUSSION

The present study focused on the stabilization of soil using waste concrete obtained from construction and demolition (C&D) waste. Various laboratory tests were conducted to evaluate the engineering properties of natural soil and stabilized soil mixes containing different percentages of waste concrete aggregate (RCA). The experimental investigation showed significant improvement in soil properties after the addition of waste concrete.

- The Maximum Dry Density (MDD) increased gradually with the increase in waste concrete content up to 30%, while the Optimum Moisture Content (OMC) decreased. This indicates that the granular nature of recycled concrete aggregate improved soil compaction characteristics and reduced the water requirement for compaction. The highest MDD value was obtained at 30% replacement, which was considered the optimum mix proportion.
- The Liquid Limit and Plasticity Index of soil decreased continuously with the addition of waste concrete. Reduction in plasticity indicates that the stabilized soil became less expansive and more stable under varying moisture conditions. The decrease in plasticity also improves the workability of soil during field compaction and construction activities.
- The California Bearing Ratio (CBR) values showed considerable improvement after stabilization. The CBR increased from about 3.2% for natural soil to approximately 12.6% at 30% waste concrete addition. This improvement demonstrates the enhanced load-bearing capacity of the stabilized soil, making it suitable for pavement subgrade and road construction applications.
- Field density results also confirmed better compaction and higher dry density values for stabilized soil. The addition of.

V. CONCLUSION

Soil stabilization using waste concrete is an effective and sustainable method for improving weak soil properties. In this study, different percentages of waste concrete were mixed with natural soil and various laboratory tests such as Maximum Dry Density (MDD), Optimum Moisture Content (OMC), Liquid Limit, Plastic Limit, Plasticity Index, CBR, moisture content, and field density tests were performed.

The results showed that the addition of waste concrete significantly improved the engineering behavior of soil. The Maximum Dry Density and CBR values increased, while the Optimum Moisture Content and Plasticity Index decreased. This indicates better compaction, higher load-bearing capacity, and reduced swelling characteristics of the stabilized soil.

Among all the mixes, the optimum performance was observed at approximately 30% replacement of soil with waste

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concrete. At this percentage, the soil exhibited maximum strength, improved stability, and better field performance. The stabilized soil also required less moisture for compaction and showed reduced settlement and deformation. The implementation work confirmed that waste concrete can be successfully used in field applications such as road subgrade construction, embankments, backfilling, and pavement works. Proper mixing and compaction produced a dense and stable soil layer.

In addition to technical benefits, the use of waste concrete provides environmental and economic advantages. It helps in recycling construction and demolition waste, reduces landfill disposal problems, conserves natural resources, and lowers construction costs. Therefore, waste concrete can be considered an economical, eco-friendly, and sustainable material for soil stabilization in civil engineering projects.

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