Influence of Subgrade Soil Stabilization Using Demolished Waste Concrete on Pavement Surface

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Abstract — In summation, utilizing DWC for subgrade soil stabilization emerges as an avant-garde and sustainable approach in pavement engineering, presenting an eco-friendly strategy for repurposing construction waste and thus, forging a sustainable pathway for future urban development. The value of CBR increased from 100.8% to 316.7% and then decreased by 174.9% for different percentages of Demolished Concrete Waste used in the soil sample in unsoaked conditions. The value of CBR increased from 109.24% to 298.96% and then decreased by 251.72% for different percentages of Demolished Concrete Waste used in the soil sample in 4 days-soaked condition. At 40% of Demolished Concrete Waste used in concrete, more economical results are provided because the CBR value is optimum.

Keywords: Subgrade Soil, Stabilization, Demolished Waste Concrete (DWC), Pavement Surface, CBR Test, Compaction Test

I. Introduction

The construction industry is undeniably one of the cornerstones of modern civilization, facilitating the establishment of infrastructural facilities that support the myriad facets of human life. However, as cities expand and infrastructure continues to develop, the industry faces two primary challenges the need for improved construction methodologies and the mounting problem of construction and post-consumer waste. Addressing these challenges in tandem by leveraging waste materials for construction purposes is both an innovative and sustainable approach.

Subgrade soil stabilization stands out as an essential process in road construction, setting the foundation for the road structure. It involves enhancing the physical properties of the soils used in the foundation layer of roads, thereby ensuring the overall stability and longevity of the road. Traditionally, materials like lime, cement, and fly ash have been employed for this purpose. However, the search for more sustainable and economical alternatives is now more relevant than ever, given the increased rate of infrastructure development and the associated environmental concerns.

A. Demolished Waste Concrete:

Every year, vast amounts of concrete structures are demolished, resulting in enormous quantities of waste concrete. While some of this is recycled into aggregate for new concrete or used as fill materials, a significant portion ends up in landfills, contributing to land degradation and other environmental issues. The untapped potential of this waste material as a component in soil stabilization is worth exploring, especially considering its inherent strength and durability characteristics.

II. Objectives of Study

Based on the detailed literature review, the objectives of the present work are as follows:-

- To study the change in geotechnical properties of the BC soil by stabilizing it with a demolished Concrete Aggregate.
- To study the quantitative changes in geotechnical properties of BC soil with different mixing percentages of demolished Concrete Aggregate.
- To suggest an optimum percentage of mixing of demolished Concrete Aggregate that can be used with locally available BC soil to get the best results.

III. Results

A. The Liquid Limit Using Hypo Sludge Content:

Liquid Limit Test	48
Plastic Limit	28.89
Plasticity Index	19.11

B. The Optimum Moisture Content Using Demolished Concrete Waste Content.

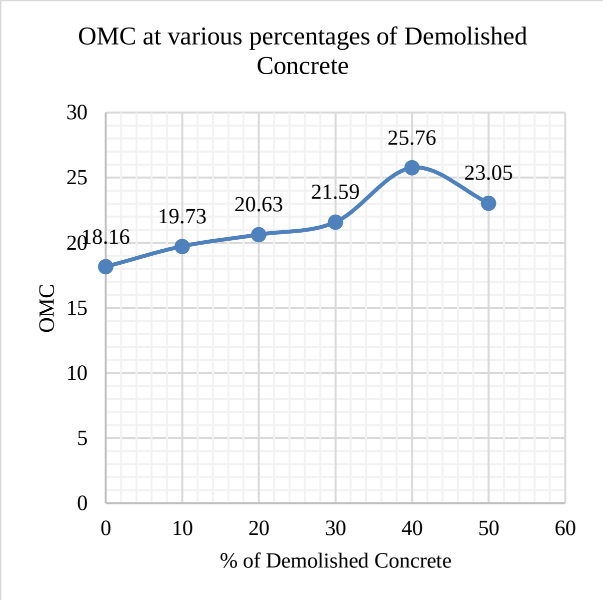

Fig. 1: Variation of Optimum Moisture Content (OMC) with Demolished Concrete Waste Content

C. The Maximum Dry Density (MDD) Using Demolished Concrete Waste.

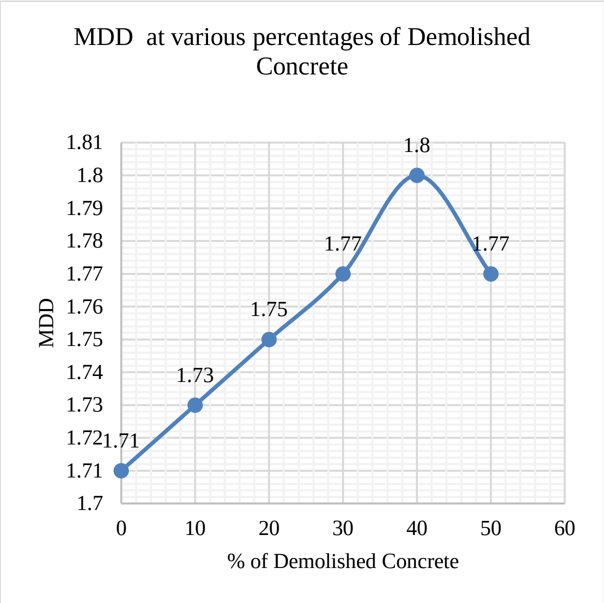

Fig. 2: Variation of Maximum Dry Density (MDD) with Demolished Concrete Waste content

D. Unsoaked CBR Test Result:

The California bearing ratio values of the untreated soil and of Demolished Concrete Waste content

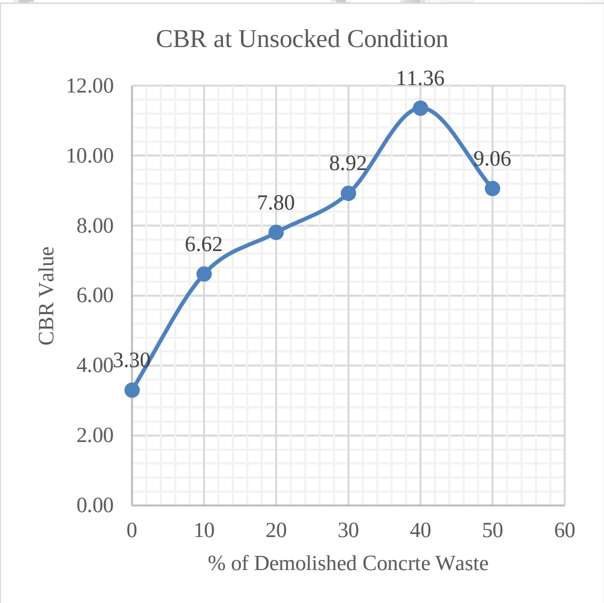

Fig. 3 Un-Soaked CBR test result using Demolished Concrete Waste

E. 4-Day Socked CBR Test Result:

The California bearing ratio values of the untreated soil and of Demolished Concrete Waste content

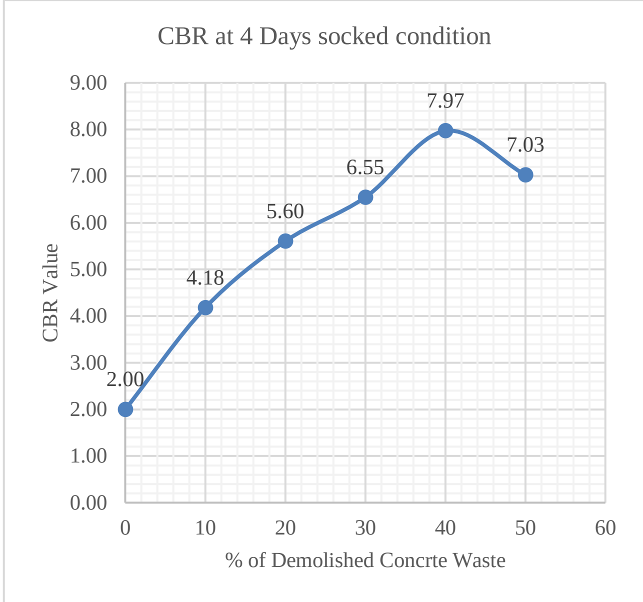

Fig. 4: 4-Days Soaked CBR test result using Demolished Concrete Waste

IV. CONCLUSION:

Based on the results obtained and comparisons made in the present study, the following conclusions can be drawn:

- The liquid limit of the soil is 48%, the plastic limit of soil is 18.89% and the plasticity index of soil is 19.11%.
- The value of OMC increased from 8.65% to 41.85% and then decreased by 26.93% for different percentages of Demolished Concrete Waste used in the soil sample.
- The value of MDD increased from 1.17% to 5.26% and then decreased by 3.51% for different percentages of Demolished Concrete Waste used in the soil sample in 4 days-soaked condition.
- The value of CBR increased from 100.8% to 316.7% and then decreased by 174.9% for different percentages of Demolished Concrete Waste used in the soil sample in unsoaked conditions.
- The value of CBR increased from 109.24% to 298.96% and then decreased by 251.72% for different percentages of Demolished Concrete Waste used in the soil sample in 4 days-soaked condition.
- At 40% of Demolished Concrete Waste used in concrete, more economical results are provided because the CBR value is optimum.

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