Innovative Utilization of Recycled Concrete Aggregate (RCA) Stabilized with Class C Fly Ash Derived from Rice Husk Ash as a Sustainable Alternative for Sub-Base Course

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Abstract:

The increasing number of construction activities significantly intensifies the scarcity of natural aggregates, while the rising volume of construction and agricultural waste further amplifies the need for sustainable alternatives in pavement construction. This study explores the potential of utilizing Recycled Concrete Aggregate (RCA) stabilized with rice husk ash (RHA) as sustainable alternative sub-base material in compliance with DPWH item 200 specifications. Thus, this study evaluated the physical and mechanical performance of five sub-base mixtures: conventional mix, RCA control mix, and three stabilized RCA mixes utilizing 5%, 10%, and 15% RHA. Modified Proctor test results revealed maximum dry density (MDD) increased from 2118 kg/m3 (conventional) to 2158 kg/m3 for the 5% RHA-stabilized mix, demonstrating improvement on particle packing and cementitious bonding. Subsequently, optimum moisture content (OMC) exhibited gradual increase with higher RHA content, reflecting the higher water demand of RHA. The CBR results demonstrated a clear improvement in load-bearing capacity, with the 5% RHA-stabilized mix attaining the highest soaked CBR value of 36.2%, exceeding those of both the conventional and control mixtures. Moreover, the findings confirm that RCA stabilized with 5% RHA meets and exceeds the DPWH minimum requirements for sub-base materials, exhibiting optimal performance that balances durability and compaction efficiency. Conclusively, results show that RCA stabilized with an optimal RHA content improves load-bearing capacity while maintaining acceptable compaction characteristics. Moreover, this study recommended that recycled coarse aggregate stabilized with Class C fly ash derived from rice husk ash be initially implemented in pilot-scale sub-base applications to validate field performance prior to large-scale adoption.