

An Analytical Research on Sustainable Use of Demolished Waste Material in Highway Construction

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Abstract: *The long-term viability of recycling demolition debris for use in highway building is the focus of this research, addressing the critical need for environmentally responsible practices in the construction industry. Through comprehensive laboratory testing, field trials, and comparative analyses, the research evaluated the physical, chemical, and mechanical properties of recycled aggregates derived from demolished waste, as well as the performance of recycled aggregate concrete (RAC) in highway applications. The study found that while RAC exhibited slightly lower mechanical properties compared to conventional concrete, it offered significant environmental benefits, including reduced energy consumption, lower CO₂ emissions, and conservation of natural resources. Economic analysis revealed potential cost savings, particularly in large-scale projects. The optimal use of recycled aggregates was determined to be around 50% replacement of natural aggregates, balancing performance and sustainability. Insights gained from this study will help shape regulations and standards for the environmentally responsible recycling of construction debris in highway building projects, which will benefit the construction sector, lawmakers, and sustainability initiatives. Future research directions and practical implementation recommendations are proposed to further advance the field*

Keywords: Recycled aggregates, demolished waste, sustainable construction, highway engineering, recycled aggregate concrete (RAC), environmental impact, circular economy, construction and demolition waste, concrete properties, sustainable infrastructure.