

# **EXPERIMENTAL INVESTIGATION ON PARTIAL REPLACEMENT OF SAND WITH BRICK DUST, STONE DUST, AND RECYCLED FINE AGGREGATE IN GEOPOLYMER CONCRETE**

**A Major Project Report Submitted to Civil Engineering Department**

**for**

**Partial Fulfilment of the Requirement for Award of Degree of  
Bachelor of Technology in Civil Engineering**

**By**

**MANISH SAHU**

**(20102031)**

**ANURAG YADAV**

**(20102010)**

**AMAN PRABHAKAR**

**(20102006)**

**Under the Guidance of**

**Dr M. Chakradhara Rao**

**Professor**



**DEPARTMENT OF CIVIL ENGINEERING**

**SCHOOL OF STUDIES OF ENGINEERING AND TECHNOLOGY**

**GURU GHASIDAS VISHWAVIDHYALAYA**

**(A Central University Established by the Central University Act 2009 No. 25 of 2009)**

**2023-24**



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**CERTIFICATE**

This is to Certify that the Major project report entitled **“Experimental Investigation on Partial Replacement of Sand by Brick Dust, Stone Dust, and Recycled Fine Aggregate in Geo-Polymer Concrete”** submitted by **MANISH SAHU, ANURAG YADAV, and AMAN PRABHAKAR**, B. Tech VIII Semester, in partial fulfilment of the requirements of the award of degree of Bachelor of Technology in Civil Engineering, School of Studies of Engineering and Technology, Guru Ghasidas Vishwavidyalaya Bilaspur is accorded to the student's own work, carried out by them in the Department of Civil Engineering during the session 2023-24 under my supervision and guidance.

  
08/05/24

**Dr. M Chakradhara Rao**

**GUIDE**

  
08/05/24 08/05/24

**Examiners**

  
08/05/24

**Dr. Ashish Kumar Parashar**

**Head**

**Department of Civil Engineering**

  
Department of Civil Engineering  
Guru Ghasidas Vishwavidyalaya, Bilaspur (C.G.)

# ABSTRACT

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Global warming is a threatening issue in recent times and the cement industry also contributes to CO<sub>2</sub> emission. This necessitates the alternative construction materials to lessen the carbon emission, and to attain the sustainable development. One such is the geopolymer concrete, a concrete formed by organic/inorganic materials using alkaline activation solution which is made of aluminosilicates. Moreover, it also consumes waste material/by-product and preserves significant natural resources to produce geopolymer concrete in order to meet global infrastructure developments. During the last two decades the construction industry has been produced huge quantity of waste, which creates lot of adverse impact not only on the solid waste management, but also on the environment. The European Union alone produces 320–380 million tonnes of construction and demolition waste (C&DW) annually. On the other hand, the construction industry facing severe crunch of aggregates due to depletion of natural resources, particularly the conservation of rivers. Therefore, in these circumstances the waste materials such as stone dust, brick dust and construction waste provide an alternative solution for the construction industry so that the waste converts to wealth.

The Objective of present project is to study the properties of low calcium fly ash-based geopolymer concrete (GPC) made with 20%,30%,40% replacement of natural fine aggregate with brick dust (BD), stone dust (SD) and recycled fine aggregate (RFA) under oven curing & ambient temperature curing. M25 grade concrete was considered for all concrete mixes and it was designed as per IS 10262-2019 guidelines. Two groups of concrete mixes were prepared. Group 1 consists of GPC made with 100% fly ash cured at 90 °C oven temperature for 24 hrs and Group 2 consists of GPC made with 85% fly ash and 15% lime cured under ambient temperature. In all the mixes the alkali solution of 12 Molar NaOH, and ratio of NaOH and Na<sub>2</sub>SiO<sub>3</sub> was adopted as 1:1.5 in this work. In each group, the natural fine aggregate was partially replaced with 20%, 30%, 40% SD, BD, and RFA separately. Further for comparison a control concrete mix was also prepared. A total of 20 concrete mixes were prepared. For all the mixes, the properties viz: workability, compressive strength, split tensile strength, ultrasonic pulse velocity (UPV), water absorption, density, Sorptivity, acid (chloride) attack were studied. From the experimental results it can be concluded that the replacement of natural fine aggregate by 30% stone dust had shown better performance than the replacement of natural fine aggregate by BD and RFA in all the mixes.

**Keywords:** Natural Fine Aggregate (NFA), Recycled Fine Aggregate (RFA), Brick Dust (BD), Stone Dust (SD), Geopolymer concrete (GPC), Ultrasonic Pulse Velocity (UPV).