

**VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM**



**DHARWAD-580002**

**PROJECT REPORT ON**

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**PARTIAL REPLACEMENT OF CEMENT & SAND BY FLY ASH &  
QUARRY DUST USING PARTICLE PACKING THEORY**

**(SPONSORED BY KARNATAKA STATE COUNCIL FOR  
SCIENCE & TECHNOLOGY)**

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**UNDER THE GUIDANCE OF**

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## **ABSTRACT:**

*Particle packing deals with the problem of selecting appropriate sizes and proportions of particulate materials to obtain a compact mixture. Optimisation of the packing density of granular components of concrete has become an important factor for achieving improvements in mechanical properties of conventional concrete. Granular components of concrete, viz, aggregates and fillers occupy as high as 70 to 85% of the concrete volume. Therefore, controlling the granular mixture proportion will help to minimise the volume of void space, thereby ensuring higher strength and better workability due to improved macro-mechanical properties, Further, with the same w/c ratio, smaller amount of water and hence lesser cement paste is needed when the granular fraction is more densely packed, which in turn reduces the occurrence of weak interface between the aggregate and the cement paste thus enhancing the strength and durability of the concrete. Since high strength concretes are made with a low w/c, they require a large amount of cement in the mixing process that may cause severe creep and drying shrinkage and other associated problems.*

*Theoretical studies suggest that with better packing of the ingredients of concrete, one can achieve a higher compressive strength (up to 20 %) for the same mix composition and w/c ratio. Filler material such as quarry dust and binding powders like cement and fly ash in order to optimize the proportions of concrete mixes.*

*In this project an attempt is made to replace cement by fly ash and sand by quarry dust to enhance the density of the concrete so that both the strength and durability properties of the concrete mix are improved. The relevant tests are conducted on the ingredients such as cement, sand, coarse aggregate, fly ash and quarry dust which are collected from the places around Dharwad and Raichur Thermal Power Station. The cement and sand are replaced by the addition of fly ash and quarry dust in increments of 5% and maximum packing density was determined. Cube specimens were prepared and are tested for compressive strengths on 7 and 28 days.*

*Key words: particle packing, loose packing, vibrated packing, target strength*