The present investigation has been carried out to study the performance of quaternary blended Hybrid Fiber Reinforced Concrete by using locally available materials. Incorporation of multiple blending Supplementary Cementitious Materials (SCMs) in concrete are growing in the construction industry due to economical and environmental benefits, and enhanced concrete properties. However, the concrete made with SCMs is not promising when subjected to short-time impact and dynamic load. Unreinforced concrete has low tensile strength and low strain capacity at fracture. Under impact loading, plain concrete fails suddenly in a brittle manner.

To overcome this weakness, fibers are added in concrete to improve the mechanical properties. Steel, carbon, and polypropylene fibers are generally used in concrete. However, when the fibers are added as a hybrid having two or more combinations, the hybrid composites exhibit more attractive engineering properties in comparison with the addition of a single type of fiber in the composites. Fiber hybridization in multiple blending Portland cement concrete is becoming important due to environmental and structural considerations. In this investigation, a quaternary mix is proposed as the control mix in which Ordinary Portland Cement is partially replaced with Fly Ash, Rice Husk Ash and Lime stone Powder by weight of cement. Steel, carbon, and polypropylene fibers have been added in mono and hybrid form in the quaternary blended concrete mix. The twenty six different proportions of fiber addition in the concrete mix including control concrete have been investigated.

The experimental investigation has been divided into three phases. In the first phase, mechanical properties such as compressive strength, splitting tensile strength, flexural strength and impact resistance of mono and hybrid fiber reinforced quaternary blended concrete have been investigated at the age of 28, 56 and 90 days. Based on the investigation, the optimum combination has
been identified in each hybrid fiber combinations. Mathematical models are
developed using statistical methods to predict the various strength and compared
with the experimental results. In the second phase, the durability properties such
as water absorption, sorptivity, acid resistance, sulphate resistance and chloride
permeability of quaternary blended concrete with optimum mono and hybrid
fibers have been investigated. In the third phase, the flexural behaviour of the
quaternary blended concrete beams with mono and hybrid fibers has been
investigated.

From this experimental investigation, it is found that the compressive
strength, splitting tensile strength, flexural strength and impact resistance of
quaternary blended concrete are enhanced with the addition of fibers in hybrid
form. The statistical models developed using MINITAB software has predicted
the strengths in a convincing manner.

Durability properties of quaternary blended concrete has been
significantly improved by adding steel, carbon and fibrillated Polypropylene
fiber in hybrid form. In the flexural behaviour of beams, a better positive
synergy effect has been observed in the steel-carbon-Polypropylene hybrid mix.
The experimental results of the beams are compared with the analytical flexural
strength models and the results are in good agreement. Thus, it is concluded that
the mechanical and durability properties of quaternary blended concrete can be
significantly improved by adding steel, carbon and fibrillated Polypropylene
fiber in hybrid form.