ABSTRACT

This research is concerned with the strength, deflection, ductility and durability investigation of a new innovative construction material named as Tyre Rubber Aggregate Concrete (TRAC). TRAC is a concrete made of partial replacement of waste tyre rubber aggregates for natural aggregates. Rubber aggregates are obtained by reduction of scrap tyres to aggregate sizes using mechanical grinding or by chiseling in to required dimensions.

An experimental investigation is carried out to identify the potential of incorporating rubber aggregates as a partial replacement of fine and coarse aggregate in the concrete using weigh batching method. Numerous tests are conducted on fresh and hardened state of TRAC such as workability, compressive strength, split tensile strength and flexural strength. The results showed that the compressive strength decreases, when the percentage of replacement of rubber aggregate increases. Slump showed no significant changes in TRAC. Further, the study proved that 6% replacement of rubber aggregates are optimal and safest replacement accordance with the clean high performance of TRAC in all the mechanical properties. Consequently the tests on TRAC beams of 6% rubber aggregate replacement are conducted and results indicated that all the beams are failed in pure bending region and gives deflection almost equal to the conventional beam with the influences of the ultimate moment. Based on the observations during testing, the beams failed in pure flexural compression failure mode. Ductility factor of TRAC beam also showed its better performance compared to conventional concrete.
The impact study suggested that the TRAC which was simultaneously replaced with fine and coarse rubber aggregate (6% replacement) proves better resistance against impact and provides better ductility characteristics.

Durability tests were conducted in order to check the weight loss/gain in the adverse environments such as acids, sulphates and chlorides. The durability study is also suggested that the TRAC is highly durable than the conventional concrete because the voids of concrete is filled with inert and fine rubber particles and reduces the permeability, hence increases the resistance against severe attacks.

The potential use of rubber aggregate in hollow blocks is also studied and the results proved that, up to 15% rubber crumbs and 5% rubber chips can be used as a fine and coarse aggregates in rubber based hollow blocks as per IS specifications.

In addition to this, an innovative attempt is made to discover the new potential use of waste tyre rubber. An extensive research has been carried out to investigate the use of waste tyre rubber strips as tension reinforcement in under reinforced beams. Pure bending tests were carried out and results showed that the rubber reinforced concrete exhibits better ductile behaviour for lesser ultimate load than that of conventional concrete. The developed analytical equation for service load and deflection for TRAC and TRRC are also very much appropriate to the measured values and proves better agreement with the test result. Hence it is suggested to use this TRAC and
TRRC composite for lintel beams, floor slabs and ribs were load carrying capacity is not a major governing factor in the design.