

**Title:** Waste to Wealth: Comprehensive Solutions towards Circular Economy and Sustainability

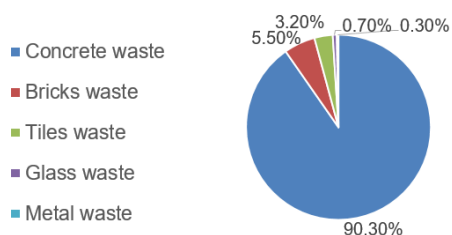
**Duration:** September 2023 to March 2026

**Objectives:**

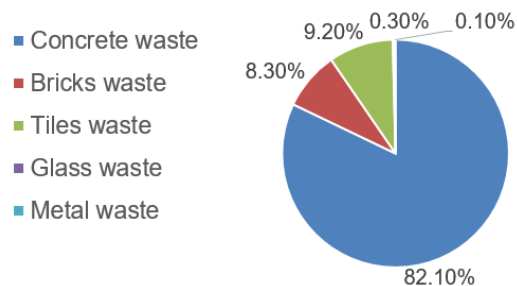
- To study on the quality of C&D waste, characterization of C&D waste, treatment of Recycled Concrete Aggregates (RCA), concrete mix design using RCA, etc. towards structural & non-structural applications

**Progress Highlights:**

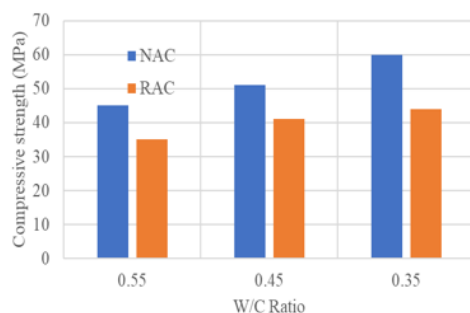
- ❖ Investigation towards the evaluation of physical, engineering and other properties/characteristics of recycled aggregate (RA) collected from a C&D processing plant, Chennai. RA is a mixture of different materials such as concrete waste, brick waste, tiles, glass, and a small amount of metals
- ❖ Due to the limited availability of information, reliable estimation of C&D waste is a difficult task, however, preliminary estimate indicate that Chennai city is being generated over 3.75 million tonnes (37.5 lakh tonnes) of C&D waste in the year 2023
- ❖ Particle size distribution shows more presence of coarser particles (above 600  $\mu\text{m}$ ) in recycled fine aggregate. Fineness modulus of RA of size 10mm and 20mm are 5.8 and 6.9, respectively, whereas these values for NA are 6.4 and 7.2, respectively
- ❖ The water absorption of RA of size 10mm and 20mm are 6.42 and 7.96 times more when compared with NA (0.53% and 0.55%), respectively
- ❖ Concrete mix proportions with three different water to cement ratios (w/c) viz., 0.55, 0.45 and 0.35 were used for both control/conventional concrete (using natural/crushed stone aggregate) and recycled aggregate concrete (RAC) (replacing crushed stone coarse aggregate with 100% recycled coarse aggregate).
- ❖ Concrete with RAs have lower compressive strengths when compared to that of the corresponding control concrete. The percentage reduction in RAC at 28 days are 21.9%, 18.4% and 26.6% when compared to that of corresponding control concrete for w/c ratios 0.55, 0.45 and 0.35, respectively. Nevertheless, compressive strengths up to 40MPa can be made by using 100% recycled coarse aggregate. However, durability studies need to be carried out to ensure the feasibility of using RFA as a replacement for conventional aggregates in construction
- ❖ Studies are also carried out on recycled fine aggregate (RFA); compared results with river sand (RS) and M-sand (MS)). Specific gravity of RS, MS and RFA are 2.3, 2.1 and 2.3; water absorption of RS, MS and RFA are 2.6, 4.5 and 4.0; fineness modulus of RS, MS and RFA are 2.5, 2.6 and 3.7, respectively
- ❖ RFA, RS and MS mortar mixes are made for relative comparison of mechanical properties. Trials have been made with different replacement levels of RFA, viz., 20%, 40%, 60%, 80%, and 100% in MS and RS
- ❖ At early ages (3 & 7 days) the strengths for replacement levels are lower than that 100% M-sand/control mixes, however, at 28 days, the compressive strengths of mortars with different replacement levels are close to that of MS mixes. Results indicate that from the strength point of view, RFA can be used in place of conventional fine aggregate



**Composition of 10mm RA**



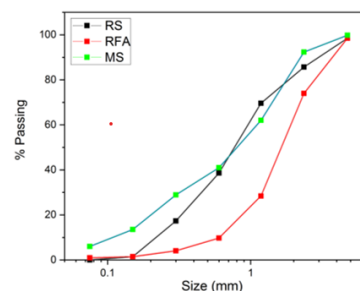
**Composition of 10mm RA**



**28-day compressive strength of RAC**



**Failure pattern of RAC cylinder**



**Particle size distribution of RFA**

#### Future Programme:

- Mechanical and durability parameters of recycled aggregate concrete/mortar
- Product development for field application/Initiation for demo building construction

#### PI and Co-PI

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*Date: September 2024*