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(57) Abstract :
6. ABSTRACT The objective of this invention is to reduce the amount of concrete debris generated by construction and deconstruction waste that is sent to landfills and causes environmental disruptions. Both construction waste, such as recycled aggregate, and industrial waste, such as manufactured sand (M-sand), were utilised in this for the production of concrete. The majority of higher grade M30 and M35 concrete structures were severely impacted by industrial fires and sudden explosions. A select few concrete mixtures were chosen with full replacement of M-sand in place of river sand and partial replacement of recycled aggregates. As a substitute for coarse aggregate, two ratios of 40% and 60% recycled aggregates were chosen. Nano-silica was added to PPC cement, which was used as a binder material. M30 with 0% crushed aggregate, M30 with 40% recycled aggregate, M30 with 60% recycled aggregate, M35 with 0% crushed aggregate, M35 with 60% recycled aggregate, M35 with 40% recycled aggregate, and M35 with 60% recycled aggregate were the six proportions listed. This study examines the mechanical and thermal characteristics of concrete made with recycled aggregates when it is exposed to high temperatures at 300°C and 400°C for exposure times of 1 hour, 2 hours, 3 hours, and 4 hours. Applications of recycled aggregates, manufactured sand, PPC cement, and 1.5% nano-silica were used to enhance the thermal properties of concrete. SEM and XRDA were also used for micro-structure analysis in order to quickly study the characteristics of concrete. By adding 1.5% of Nano-silica to the binder, concrete gains additional properties to lower the void ratio while also becoming denser and performing better when exposed to temperature changes. In comparison to 0% replacement, 40% and 60% replacement of recycled aggregate with crushed aggregate demonstrated a good achievement in both the mechanical and thermal properties of concrete. When concrete with crushed aggregate is exposed to temperatures of 300°C and 400°C, the compressive strength increases at 300°C, the C-S-H gel in the cement breaks down, and no difference in colour change is seen. For both replacements, concrete made with recycled aggregate exhibited the same behaviour. Strength began to decline after 300 °C due to the lack of gel after 400 °C. By carrying out the experiment with recycled aggregate, the mechanical and thermal properties of concrete have increased by 60% and can now be used for slabs and beams. M-sand and PPC cement had demonstrated strong performance in terms of durability.

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