

University of Macau

Abstract

An Experimental Study of Thermal Conductivity of Rubber
Tire Concrete (RTC)

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Scrap tire generation is always trending up in Macao as in everywhere of the world. Such a large amount of scrap tire in Macao results in a lot of environmental problems, especially in view of the limited landfill space in Macao. And due to the low thermal conductivity of rubber tire particles, it would be very promising to use scrap tire particles as part of aggregates in concrete mixture for thermal insulation in construction projects. The objective of this study is to investigate the mechanical properties, including slump, density, compressive strength, and thermal conductivity of rubber tire concrete (RTC) based on the laboratory tests. The thermal conductivity of RTC is measured by ISOMET test and heat flow meter (HFM) test according to ASTM C518 standard.

Results showed that the mechanical properties of concrete decreased considerably with the increasing amount of tire content regardless of replacing coarse or fine aggregates by coarse tire chips (size of particles within 10 – 20 mm) or fine tire chips (size of particles \leq 5mm) respectively. In addition, it was demonstrated that scrap tire particles used as proportion of aggregates reduced the thermal conductivity of normal concrete, and the result from the comparison between ISOMET test and HFM test showed that the thermal conductivity from ISOMET test was in good agreement with HFM test and ISOMET test was as good as HFM test. Tire content to total concrete mixing ratio (T/T ratio) of greater than 16.8% (by volume) for coarse and

fine tire chip concrete was not practical due to consideration for workability, and the optimal ratios for mixing RTC were between 4.2% to 8.4% of T/T ratio, due to satisfaction of the minimum strength criterion in concrete roof structure and maintaining the workability, as well as improving the thermal property (thermal conductivity) of conventional normal concrete used in construction.

Finally, the estimation showed that the disposal and environmental problems are possible to be solved if RTC can be used as a construction material in current Macao's project.