ABSTRACT

Concrete infrastructure typically follows a linear lifecycle model which is based on the design and construction of infrastructure from virgin materials, their maintenance, repair and rehabilitation, and eventual demolition. The deteriorated materials resulting from this process then becomes construction and demolition waste (CDW). While CDW is comprised of valuable material inputs, very low proportions of this are recovered and recycled for use in new infrastructure in developing nations like South Africa.

Where concrete recovered from CDW is separated and suitably processed, recycled concrete aggregates (RCA) and recycled concrete fines (RCF) are produced. RCA can be characterised by size as natural aggregates are and, according to several national standards and technical recommendations, the coarse fraction can be used to substitute up to 50% of natural coarse aggregates in the production of structural concrete. However, the use of the fine fraction of RCA and RCF, defined as the subsieve material produced during the crushing of concrete waste, as aggregate replacement in the production in structural concrete is prohibited. This is because these materials contain high proportions of porous hardened cement paste, resulting in concrete with a higher water demand. This may negatively influence the fresh and hardened properties of concrete produced.

A potential alternative use for RCF is as a supplementary cementitious material or filler material to partially replace the Portland cement used in concrete production. This research aims to harness the physical and chemical properties of RCF and investigate the properties and performance of concrete produced with this material as a part of the binder system. Such a binder system may allow for a more efficient use of material resources in the construction industry as well as a decrease in overall carbon dioxide emissions.