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Durability performance of high-performance concrete made with recycled aggregates, fly ash and densified silica fume

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Abstract: This study intends to analyse the effects of the incorporation of recycled aggregates (RA) and densified silica fume (SF) on the durability of high performance concrete (HPC). Considering that the mortar adhered to the RA strongly influences the behaviour of the concrete made with it, the source of these aggregates was restricted to precast mixes with target compressive strengths of 75 MPa and subjected to a primary plus a secondary crushing process. With regard to SF, a certified commercial product was used, which was incorporated in the concrete as an additional material to cement. The experimental campaign included the production of 12 types of concrete, which were evaluated by means of water absorption by immersion, water absorption by capillarity, resistance to carbonation, resistance to chloride penetration and permeability to oxygen tests. The results show that it is possible to produce HPC with significant quantities of fine and coarse recycled aggregates (FRA and CRA) as replacement of traditional fine and coarse natural aggregates (FNA and CNA). Ultimately, considering the properties analysed, it seems possible to produce HPC without incorporating natural aggregates (NA). The incorporation of densified silica fume contributed to an increase of concrete's performance through the use of a mixing process developed by the authors that minimized the previously endured dispersion difficulties associated with this product.

Keywords: Fine recycled aggregates, coarse recycled aggregates, silica fume, high performance concrete, durability.

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