

Durability of Cast-Concrete Products Utilizing Recycled Materials

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ABSTRACT

The major aim of this investigation was to develop technology for manufacturing of cast-concrete products using fly ash, bottom ash, and used foundry sand. A total of 18 mixture proportions were developed for bricks, blocks, and paving stones using these by-products. A reference mixture without any by-product materials for each type of cast-concrete masonry product was also proportioned. For bricks and blocks, 25% and 35% of portland cement was replaced with fly ash. Bottom ash and used foundry sand were used as a partial replacement of cement at replacement levels of 25 and 35% of regular sand. Paving stones contained fly ash as a replacement of cement at the rate of replacement of 15% and 25%. All cast-concrete products were tested for compressive strength, density, absorption, freezing and thawing resistance, drying shrinkage, and abrasion resistance. Analysis of test data revealed that bricks with 25% replacement of cement with fly ash are suitable for use in both cold and warm climates. However, other brick mixtures were appropriate for building interior walls in cold regions and both interior and exterior walls in warm regions. None of paving stone mixtures including control mixtures strictly conform to the ASTM requirements. Masonry blocks with up to 25% replacement of regular sand with either bottom ash or used foundry sand could be used for building exterior walls in cold regions. The rest of the concrete mixtures for blocks could be used for building interior walls in cold regions and both interior and exterior walls in warm regions.