Experimental Investigation on Porous Concrete for Sustainable Drainage Systems

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Urban flooding caused by unpredictable high-intensity rainstorm events due to insufficient drainage infrastructure has become a major problem nowadays. Urbanization and climate changes in urban cities have made drainage systems overflow, which results in urban floods. Introducing a sustainable urban drainage system is an effective solution to control urban floods. Furthermore, it will control downstream flooding and it will reduce the deterioration of river water quality. Porous concrete drainages can be a good alternative in urban areas as they can infiltrate excess runoff into the soil. In many countries, construction debris has become a severe environmental issue. So, it is an environmentally friendly approach to reuse or recycle construction wastes for the manufacturing of porous concrete. Porous concrete has already been used to create pavements, parking lots, cover slabs etc. However, limited studies have been conducted in investigating different mix designs for porous concrete and permeabilities. This study investigated the material and hydraulic properties of porous concrete with recycled aggregate based on eight mix designs. The first four mix designs involve variations in the weight of coarse aggregates with a size range of 12.5 - 25 mm without fine aggregate. The remaining three mix designs incorporate different ratios of fine aggregates at 10%, 20%, and 30%. The eighth mix design is constructed using recycled construction waste materials. When the coarse aggregate percentages changed from 15% to 75%, infiltration rates increased from 339.3 cm/hr to 1138 cm/hr per/hr and the seven-day compressive strength varied from 14.3 MPa to 12.1 MPa. When fine aggregates were introduced from 10% to 30%, the compressive strength increased from 16.5 MPa to 18.21 MPa and the infiltration rates decreased from 1524 cm/hr to 812.8 cm/hr. Test with construction waste yielded 16.28 MPa strength and 3550 cm/hr infiltration after 28 days showing its potential to be used in urban areas.

Keywords: Sustainable drainage systems, Porous concrete, Infiltration rate

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