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Experimental Study on Fibre Reinforced Pervious Concrete

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Abstract: This project deals with the improvement oftheproperties of pervious concretepavementby adding fiber (polypropylenepolymer) reinforcementasadmixture. Pervious concrete is aspecialtype of concrete with a high porosityofabout 15% to 30% and used forconcrete flatworkapplications by this property runoff from the site can be reduced and ground water recharge can be done effectively. The mechanical properties of conventional pervious concrete and polymer fiber reinforced pervious concrete were analysed by compressive strengthtest,split tensile strength test, flexuralstrengthtest, density and void ratio, infiltrationtest. A detailed cost analysis between pervious concrete and fibre reinforced pervious concrete is done. 37%,42% and 52% of increase in compressive strength, tensile strength and flexural strength respectively is achieved in fibre reinforced pervious concrete than the normal pervious concrete. Even though the cost of fibre reinforced pervious concrete is 18% higher than normal pervious concrete, fibre reinforced pervious concrete is preferred because it achieves large improvement in properties.

General

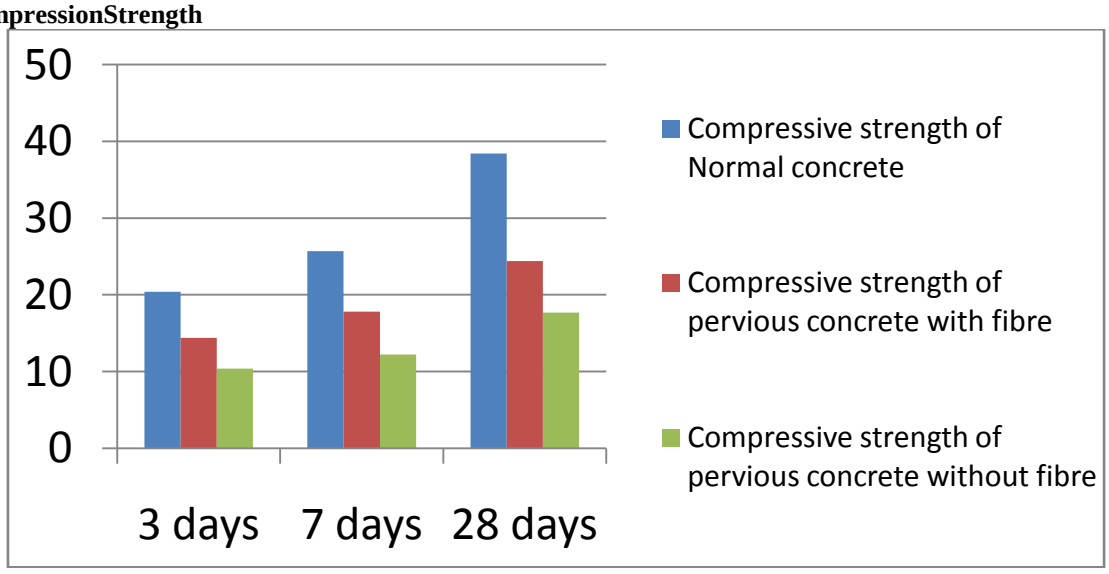
Pervious concrete pavement is an excellent and efficient method to face important environment issues. By reducing surface and storm water runoff it increases ground water recharge. By this technique land can be used efficiently by reducing retention ponds and storm water runoff management devices. By doing so the overall pervious concrete can reduce overall project budget on first copy basis. While pervious concrete can be used for a surprising number of applications, its primary use is in pavement. This project focuses on the pavement applications of the material, which also has been referred to as porous concrete, permeable concrete, no-fines concrete, gap-graded concrete, and enhanced-porosity concrete.

Mixratio

By testing various trial mixes, the mixratiofor M30 grade pervious concrete is confirmed as 1: 0.3: 5.5 cement,fineaggregate, coarse aggregaterespectively,w/c ratio 0.4. 1.5% of recron3$_s$ polypropylene polymer fibrereinforcement and 1% superplasticizer are added in weight of cement forbetterresult in properties of perviousconcrete.

Testsconducted

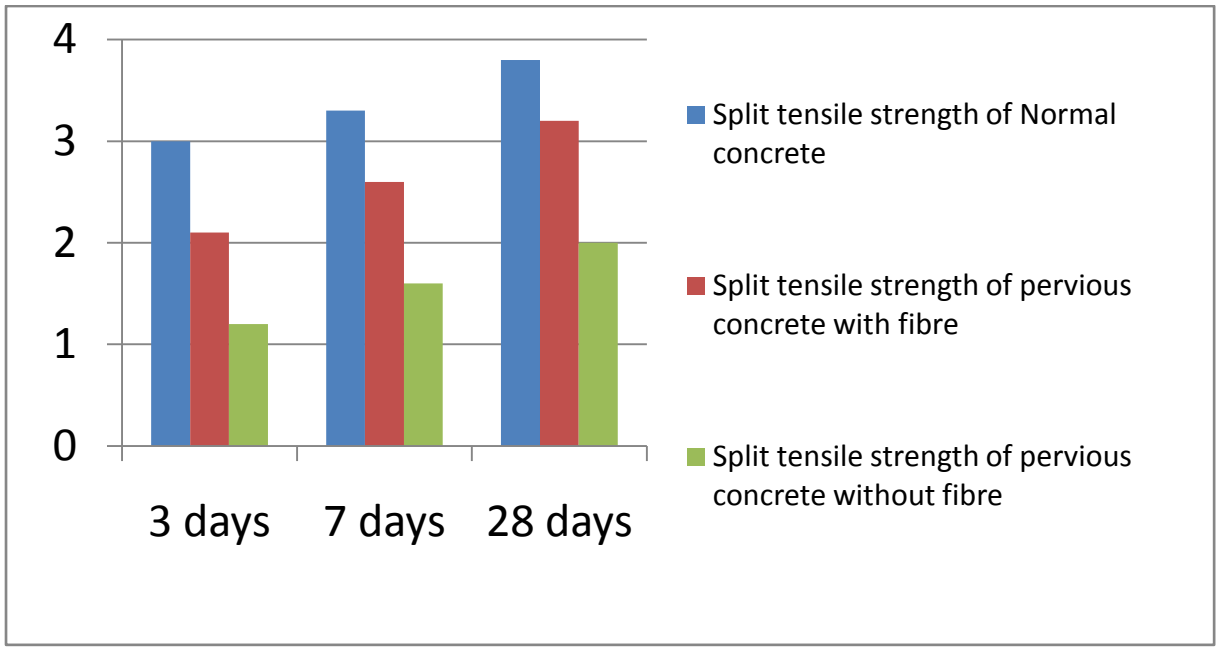
CompressionStrength



Compressive strength of normalconcretein 28 days is 38.4 Mpa,Compressivestrength of pervious concretewithoutfibre in 28 days is 17.7 MpaandCompressive strength ofperviousconcrete with fibre in 28 days is 24.4Mpa.

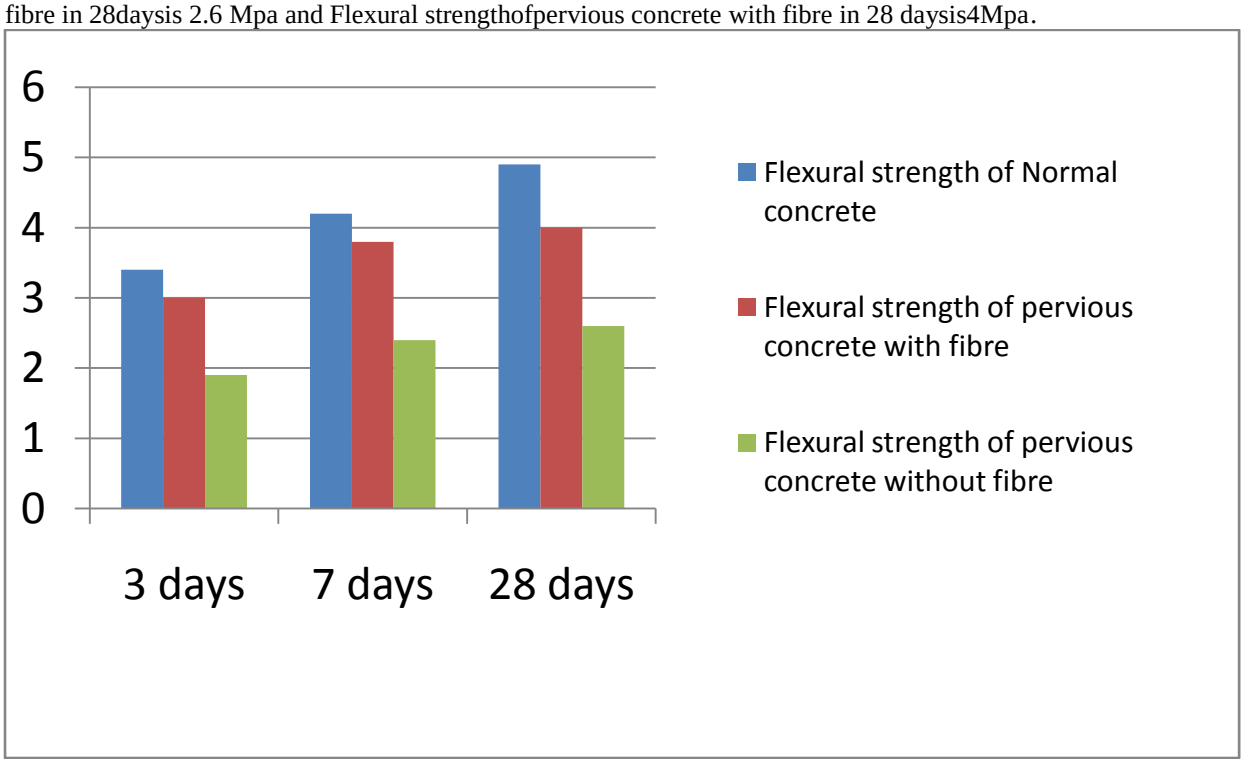
Split TensileTest

Split tensile strength of normal concretein 28 days is 3.8 Mpa, splittensilestrength of pervious concretewithoutfibre in 28 days is 2.1 Mpa andsplittensile strength of pervious concretewithfibre in 28 days is 3.2Mpa.



FlexuralStrength

Flexural strength of normal concrete in28days is 4.9 Mpa, Flexural strengthofpervious concrete without fibre in 28daysis 2.6 Mpa and Flexural strengthofpervious concrete with fibre in 28 daysis4Mpa.



Density and VoidRatio

Density of normal concrete (T) is2400Kg/m^3, Density of pervious concretewithfibre (D1) is 1790 Kg/$m^3$and Densityofpervious concrete without fibre (D2)is1785Kg/m^3.

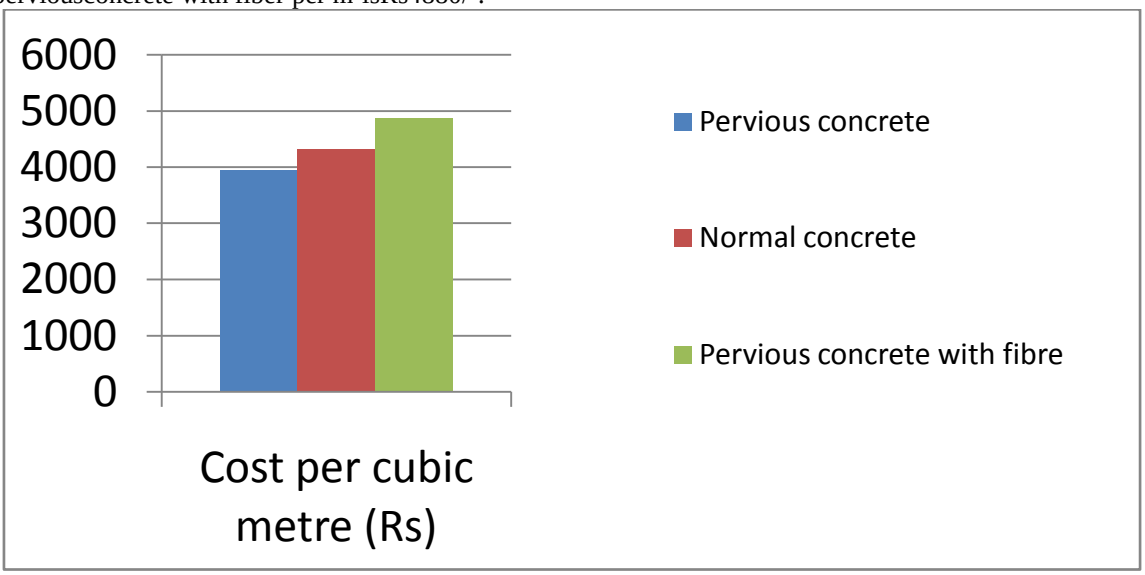
Void content of pervious concretewithfibre (U1) is 25% and Void contentofpervious concrete without fibre (U2)is26%.

Infiltration Test onPerviousConcrete(I)

Infiltration rate of perviousconcretewithout fibre is 602.6 inches/hourandinfiltration rate of pervious concretewithfibre is 557.5inches/hour.

Costcomparison

The cost of normal concrete per m^3isRs4320/-, cost of pervious concreteperm^3isRs3940/-and cost ofperviousconcrete with fiber per m^3isRs4880/-.



Results and Discussion

- Compressive strength ofperviousconcrete with fibre is 24.4 Mpa andforpervious concrete without fibre is17.7Mpa, which is 37% of increaseincompressivestrength.
- Split tensile strength ofperviousconcrete with fibre is 3.2 Mpa andforpervious concrete without fibre is2.1Mpa, which is 42% of increaseintensilestrength.
- Flexural strength of perviousconcretewithfibreis4Mpaandforperviousconcrete without fibre is 2.6Mpa,which is 52% increasing inflexuralstrength.
- The density of perviousconcretelies between its range 1600 kg/m^3to2000kg/m^3.
- The target void content of theperviousconcrete mix design was20%therefore it achieves the targetedvoidcontent.
- The minimum infiltration rateofpervious concrete should be 480inches/hourtherefore it achieves thetargetedinfiltrationrate.
- Due to the presence of fibermaterialsin pervious concrete, the rateofinfiltration(I) reduced only up to7.5%.
- By comparing the cost ofnormalconcrete, pervious concreteandpervious concrete with fibre,thepervious concrete is 10% cheaperthanthe normalconcrete.
- While the pervious concrete withfibreis 18% costlier than theperviousconcrete without fibre. Though thecostof pervious concrete with fibre ishigh,it achieves greater improvementinproperties.