

Performance of Polypropylene Fibre Reinforced Concrete

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Abstract: The paper deals with the effects of addition of various proportions of polypropylene fibers on the properties of High strength concrete (M30 and M40 mixes). An experimental program was carried out to explore its effects on compressive, tensile, flexural strength under different curing condition. The main aim of the investigation program is to study the effect of Polypropylene fiber mix by varying content such as 0%, 0.5%, 1%, 1.5% & 2% and finding the optimum Polypropylene fibre content. The concrete specimens were tested at different age level for mechanical properties of concrete, namely, cube compressive strength, split tensile strength, flexural strength. A detailed study was carried out for curing conditions. Half of the concrete specimens were left exposed to the surrounding to cure by themselves and the remaining half were cured in a curing tank. Initially the concrete specimen's shows appreciable strength for irregular curing but as the days advances the curing specimens gave satisfactory strength. A notable increase in the compressive, tensile and flexural strength was observed. However, further investigations were highly recommended and should be carried out to understand more mechanical properties of fibre reinforced concrete.

Keywords: Different curing condition, High strength concrete, mechanical properties of concrete, polypropylene fibers

I. Introduction

Polypropylene fibers are hydrophobic, that is they do not absorb water. Therefore, when placed in a concrete matrix they need only be mixed long enough to insure dispersion in the concrete mixture. The mixing time of fibrillated or tape fibers should be kept to a minimum to avoid possible shredding of the fibers. The type of polypropylene fiber recommended by manufacturers for paving applications is the collated fibrillated fiber. The length of fiber recommended is normally tied to the nominal maximum size of aggregate in the mixture. Manufacturers recommend that the length of the fiber be greater than twice the diameter of the aggregate. This would be consistent with past experiences with steel fibers and also with current theories on fiber dispersion and bonding". The manufacturers of fibrillated fibers recommend their products for the following purposes in paving: to reduce plastic shrinkage and permeability, to increase impact resistance, abrasion resistance, fatigue, and cohesiveness (for use in slip forming and on steep inclines), and to provide a cost effective replacement for welded wire fabric (WWF). However, they do not recommend specifying fibers for the control of cracking from external stresses, increased structural strength, slab thickness reduction, joint spacing reduction, or replacement of structural steel reinforcement. Monofilament fibers, according to fiber manufacturers, only provide control of cracking caused by shrinkage and thermal stresses occurring at early ages. These fibers provide no post-crack benefit and are used only for shrinkage cracking and not to provide improvements to other engineering properties.

The amount of polypropylene fibers recommended by most manufacturers for use in paving mixtures and most other mixtures is 0.1 percent by volume of concrete (0.889 to 0.949 kg per cubic meter). Researchers have experimented with fiber volumes up to 7.0 percent. Fiber volumes greater than 2.0 percent normally involve the use of continuous fibers, which are not usually considered for paving applications due to constructability problems. Fiber volumes up to 0.5 percent can be used without major adjustments to the mixture proportions. As volume levels approach 0.5 percent, air-entraining and water-reducing admixtures are required.

1.1 Literature Review

Review of work done by various researchers discusses the mechanism of fibre-matrix interaction, where various models are used to compute the bonding between the fibres and cement matrix. As the bonding of fibre and the matrix plays a major role in the composite behavior. Furthermore, this chapter also presents a review of literature relevant to the investigation and tests done for fibre reinforced concrete in general with a prominence of civil engineering application.

Fiber reinforced concrete was successfully used in variety of engineering applications, because of its satisfactory and outstanding performance in the industry and construction field. However, most of the engineers and researchers have thought that how and why the fibers perform so successfully. So, to recognize the usage of fibers in concrete, in these last four decades, most of the research was done on mechanical behavior of fiber reinforced concrete and the fibers itself.

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hydration process decreasing the shrinkage and increasing the tensile strength It indicates the innovative findings and establishes prediction models on early age internal relative humidity autogenous shrinkage tensile creep of modern concrete considering water to cement ratio curing temperature etc reveals the variation law and mechanism of early age cracking resistance of modern concrete with different kinds of fibers supplementary cementitious materials chemical admixtures and internal curing agents under circumferential or uniaxial restrained condition It is designed as a reference work for professionals or practitioners and a textbook for undergraduates or postgraduates

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