Overview of the Materials used to Increase the Strength of Concrete

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Abstract— Concrete, a strong, durable material composed of cement, aggregate and water, is the most used building material in the world. Concrete has an ultimate load bearing capacity under compression but the material is weak in tension. The use of supplementary cementations material in the production of concrete can result in measure saving of energy and cost. It also helps to improve strength, durability, impermeability and chemical reaction of concrete. However, the cracks in the concrete form a major problem which affects the durability of the structures. To increase the strength and durability of the structure either the cracks that are formed should be repaired conventionally using epoxy injection or latex treatment or by providing extra reinforcement in the structure during the design phase to ensure that the crack width stays within a permissible limit.

Key words: Fibre Reinforced Concrete, Effect of Fibre, Cost Effectiveness of FRC, Self Compacting Concrete, Properties of SCC, Advantages of SCC

I. Introduction

Cement based matrix incorporated with short discrete randomly distributed discontinuous fibers. Fiber is a small piece of reinforcing material possessing certain characteristic properties. Addition of Fibres improves significantly tensile strength of concrete, modifying the basic property of brittleness to ductile one to overcome the major drawback of concrete. It also improves other properties of concrete such as shear strength, ductility, post cracking behavior, impact resistance etc.

II. Effect of Fibers

Steel fibres helps in strength enhancement of concrete beams, Polypropylene fibres helps in strain enhancement of concrete beams and Hybrid fibres (Steel and Polypropylene fibres combined) helps in both strength and strain enhancement. Steel fibers are relatively expensive. Polypropylene fibres are better than Steel fibres in comparison of cost to benefit ratio as well as rusting Plain concrete fails suddenly once the deflection corresponding to the ultimate flexural strength is exceeded; on the other hand, fibre-reinforced concrete continue to sustain considerable loads even at deflections considerably in excess of the fracture deflection of the P.

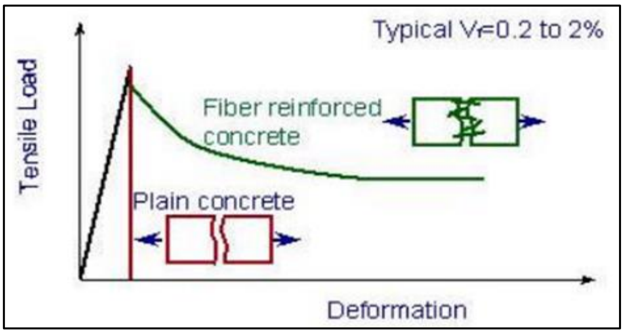

Fig. 1: Tensile Load v/s Deformation

A. Merits of Steel Fibers

- Significant improvement in tensile strength.
- Wear and tear resistance improved.
- Thinner section possible due to higher flexural strength of SFRC.
- Significant control in crack width and improves post cracking behavior
- Long service life with little or no maintenance.
- Fatigue and impact resistance improved.

III. Cost Effectiveness of FRC

It has been observed thatPolypropylene fiber is the cheapest material among all other types of fibers.Although Steel fibers having more strength compared to Polypropylene fibers but cost of Steel fiber used per m3 of concrete is comparatively very high which may reduce the effective use of SFRC in practical applications.Polypropylene fibers are better than steel fibers in comparison of cost to benefit ratio.

IV. Self Compacting Concrete

Self-compacting concrete (SCC) is an innovative concrete that does not require vibration for placing and compaction. It is able to flow under its own weight, completely filling formwork and achieving full compaction, even in the presence of congested reinforcement. The hardened concrete is dense, homogeneous and has the same engineering properties and durability as traditional vibrated concrete. Thus SCC eliminates the needs of vibration either external or internal for the compaction of the concrete without compromising its engineering properties. This concrete was first developed in Japan in late 80's to combat the deterioration of concrete quality due to lack of skilled labors, along with problems at the corners regarding the homogeneity and compaction of cast in place concrete mainly with intricate structures so as to improve the durability of concrete and structures.

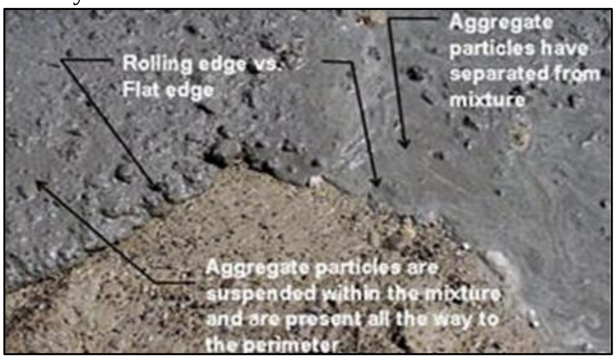

Fig. 2: Establishment of the Material

There is no standard self compacting concrete. Therefore each self-compacting concrete has to be designed for the particular structure to be constructed. However working on the parameters which affect the basic properties of self-compacting concrete such as plastic viscosity, deformability, flow ability and resistance to segregation, the fresh state. Other performances such as strength and durability should be established as for normal self-compacting concrete may be proportioned for almost any type of concrete structure.

V. PROPERTIES OF SCC

Passing ability :-Self compacting concrete must flow through tight openings such as spaces between steel reinforcing bars under its own weight. The mix must not 'block' during placement. The passing ability is the property that characterizes the ability of the SCC to pass between obstacles- gaps between reinforcement, holes, and narrow sections, without blocking.

VI. ADVANTAGES OF SCC

- SCC yields homogeneous concrete in situations where the castings are difficult due to congested reinforcement, difficult access etc.
- SCC shows a good feeling ability especially around reinforcement
- SCC is very well suited for special and technically demanding structures such as tunnel linings, as the possibility to compact the concrete is limited in the closed space between formwork and rock.
- Shows narrow variation in properties on site.
- Most suitable for concrete filled tubes (CFT) technology construction for high rise buildings.
- It ensures better quality of in-situ pile foundation.
- Eliminates problems with blood circulation leading to "white fingers" caused by compacting equipment, hence called a healthy concrete.
- SCC gives noise protection in precast industry, by introducing no restrictive measures like ear protection, marked areas, and safety instructions are necessary.

VII. CONCLUSION

The flexural and tensile strength properties were found to compare closely with those for normal concrete. Hence, concrete with mixtures of lateritic sand and quarry dust can be used for structural construction provided the proportion of lateritic sand content is kept below 50%. Both flexural and tensile strengths were found to increase with increase in laterite content. Further work is required to get data for long-term deformation characteristics and other structural properties of the experimental concrete. These include: shear strength, durability, resistance to impact, creep, etc. Also, it may be necessary to investigate the optimum contents of lateritic sand and quarry dust in relation to the structural properties of the concrete. These will assist engineers, builders and designers when using the materials for construction works.

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