ABSTRACT

The development of Self Compacting Concrete (SCC) is described by the Concrete Society and Building Research Establishment (BRE) as a quiet revolution in the construction industry resulting in massive usage of SCC worldwide. Incorporation of fibres has further enhanced the strength and durability of the properties of SCC. The fibres include steel, nylon, poly-propylene, glass, Carbon and so on. Further, hybridization of different types of fibres proved to be more effective. Hybridization of fibres means using a combination of two or more different types of fibres.

In the earlier days, wall panels were mostly used for environmental protection ignoring its structural capacity. But in the recent years, reinforced concrete walls have been used as integral part of structural system to resist lateral and seismic loads and they gained popularity in the construction of multistoreyed buildings. It is observed that not much work has been done on the behaviour of fibre reinforced SCC walls as structural members.

In the present work which is both experimental and analytical, the behaviour of fibre reinforced self compacting concrete wall panels has been studied. Model wall panels of size 1500 × 1000 × 75mm thick were cast using Glass Fibres, Steel Fibres and Hybrid Fibres (combination of Glass and Steel Fibres) with and without minimum reinforcement. Model wall panels were subjected to axial, eccentric
and flexural loads. The experimental ultimate load carrying capacity values were compared with theoretical analysis developed, based on principles of structural mechanics.

The present project consists of two phases. In the first phase, SCC mix of M30 grade was developed without fibres and with Glass, Steel and Hybrid Fibres. The mechanical properties like compressive strength, tensile strength and Stress-Strain behaviour were studied. The Stress-Strain behaviour was studied further in confined and unconfined states. From the Stress-Strain behaviour, properties like Secant Modulus, Initial Tangent Modulus, Ductility Factors, Plasticity Ratios, Toughness, Strength enhancement ratios were determined. The applicability of mathematical models like Desayi, Saenz and Mansur was probed using the data obtained from the above studies. In the second phase, the experimental results obtained by testing wall panels were analyzed using principles of structural mechanics for predicting the critical loads. Further, using model analysis techniques, the critical loads were predicted for prototype wall panels of size 3000 × 1500 × 150mm and 3000 × 1500 × 200 mm.

Detailed studies have revealed that the Hybrid Fibre Self Compacting Concrete made with a combination of high dispersion Glass Fibres and Steel Fibres displays better performance. The investigations, results and analysis are presented in different chapters.