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Evaluation of Flexural Cracking Width of Steel Fibre Reinforced Concrete Beams

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Abstract : Excessively wide cracks are harmful to the serviceability of reinforced concrete (RC) beams and may lead to durability problems in the longer term. They also reduce the rigidity of RC sections, rendering the tensile concrete ineffective structurally. To reduce the negative effects of cracks, steel fibers are added to concrete mixes in the same manner as aggregates. In the present work, steel fibers reinforced concrete (SFRC) beams, made of normal strength and high strength concretes, were tested in a four-point bending test using a digital image correlation technique. The beams had different volume fractions of fibres and different aspect ratios (fiber length/fiber diameter). The evaluation of flexural cracking widths was determined using Gom-Aramis software. The experimental crack widths were compared with theoretical values predicted by the technical document of Rilem TC 162-TDF. The model proposed in this document seems to be the only one that considers the efficiency of steel fibres in restraining the crack widths. However, the model of Rilem takes into account only the aspect ratio of steel fibres to predict the crack width of SFRC beams. It has been reported in several pieces of research that the contribution of steel fibres to the limitation of flexural cracking widths is based on three essential parameters namely, the volume fraction, the orientation and the aspect ratio of fibres. Referring to the literature on the flexural cracking behavior of SFRC beams and the experimental observations of the present work, a correction of the Rilem model by the introduction of these parameters in the formula is proposed. The crack widths predicted by the new empirical model were compared with the experimental results and assessed against other test data on SFRC beams taken from the literature. The modified Rilem model gives better results and is found more satisfactory in predicting the crack widths of fibres concrete.

Keywords : stee fibres, reinforced concrete, flexural cracking, tensile strength, crack width
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