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**Equating steel and synthetic fibre concrete post crack performance to BS EN 14651:2005+A1:2007**

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**ABSTRACT**

Establishing toughness performance in concrete using steel fibres is well understood and design guides are available to assist with this process. What is less readily understood is the use of Type 2 synthetic fibres to provide toughness. This problem is exacerbated by the wide range of synthetic fibres available, with each different fibre providing different structural/material properties. This paper examines the relative pull out values of two single fibre types, being steel and Type 2 synthetic fibres. The pull out test results have informed the doses of fibre additions to beams which have been used to equate near equal toughness performance for each fibre type. The results show that synthetic Type 2 fibres when used at a prescribed additional volume can provide equal toughness to steel fibre concrete. The residual loads analysed at crack mouth opening displacements were examined and conclusions were drawn. It was noted, using mean values, that a steel fibre dose of  $30 \text{ kg/m}^3$  provided sufficient post crack residual flexural strength to exceed the minimum requirements of BS EN 14651:2005+A1:2007. A synthetic fibre dose of  $7.44 \text{ kg/m}^3$  also complied with the BS minimum requirements, albeit at a lower load transfer in the early stages of post crack performance, however the synthetic fibres performed equally as well as steel fibres at crack mouth opening displacement (CMOD) 3 and 4.

**Key words:** Steel fibres, synthetic fibres, toughness, beam, load, residual strength.