UNIVERSITI TEKNOLOGI MARA

FLEXURAL PERFORMANCE OF STEEL FIBRE REINFORCED CONCRETE (SFRC) ONE-WAY RIBBED SLAB

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ABSTRACT

The application of steel fibre (SF) is seen as an alternative material to be used in the ribbed slab. This study was performed to investigate the behaviour of SF as the main material in steel fibre reinforced concrete (SFRC) ribbed slab, omitting the conventional reinforcements. Firstly, material strength properties test was conducted which consist of compressive, splitting, flexural and elasticity. Five equivalent samples of ribbed slabs were then prepared where dimension remain same for all except variations in the rib depth of 100, 125 and 150mm and also to the concrete mix with one sample having plain concrete (PC) mix while other samples with SF mix. BRC was only included for PC and one SF ribbed slab, while the remaining are fully reinforced with SF only. All the ribbed slabs were tested under four-point bending using load-displacement control. On the material strength properties test, PC specimen showed higher strength except for splitting tensile strength where the SF specimen achieved 12.83% higher. For beam flexural strength test, SF specimen gave better post-peak behaviour compare to plain specimen despite having lower flexural strength. From the experimental testing, the SFRC ribbed slab with 125mm rib depth showed 23.70% higher load capacity than NC100(BRC). The slabs deflected more at soffit of the topping with SF150 showing 84.26% higher deflection than SF 100(BRC). In terms of variations of rib depth, SF125 achieved similar ultimate load as SF100 while slab SF150 gave the lowest strength capacity. All the cracks formed near the midspans, initiated from the bottom of the external ribs, which later propagated toward the topping and middle ribs of the slabs. For strain distribution across the depth, the neutral axes were found to be near the theoretical lines. From the Finite Element Analysis (FEA) findings, NC100(BRC) shows 17.46% higher load compared to experimental work. All slabs also achieved similar maximum stress values which were concentrated at the midspan of rib soffits. Displacements were similar to experimental values with SF150 showing the highest value and more concentrated contour along the mid-span. The FEA predicted crack patterns that initiated at the soffit of middle rib and scattered around the midspan. In conclusion, the 125mm rib depth gave an optimized design with its ability to carry higher loading at lower displacement value.

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Fadhillah Abdul Rahman
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