Quantitative analysis of the influence of synthetic fibres on plastic shrinkage cracking using digital image correlation - DTU Orbit (14/08/2019)

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The plastic shrinkage cracking behaviour of restrained mortar overlays on a concrete substrate was studied with the aim of quantifying the influence of commercially available polypropylene (PP) fibres and recycled polyethylene (R-PE) fibres obtained from discarded fishing nets. The use of R-PE fibres was investigated with a view to creating a more eco-friendly construction material. The plastic shrinkage behaviour was evaluated on the basis of a non-contact 2D digital image correlation (DIC) technique that enables the automated detection of surface displacements and strains with high precision. Based on the DIC data, the degree of surface cracking was quantitatively analysed using a MATLAB post-processing procedure and presented in detailed histograms showing the crack width distribution of the entire specimen surface. Using this data, the effect of fibre reinforcement on crack control was objectively quantified and evaluated. The results indicate that while the addition of 2.0% of R-PE is effective in controlling shrinkage cracking in the mortars, the commercial PP fibres perform better even at volume fractions as low as 0.1%. These findings show that the recycled fibres can be used to reduce plastic shrinkage cracking behaviour compared to unreinforced materials, while a waste material is being reused, though, a much larger volume fraction of R-PE fibres than of commercially available PP fibres is necessary to achieve a similar effect.

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