FRC thin walled structures: opportunities and threats

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ABSTRACT

FRC thin walled structures represent a challenge for the future of prefabricated structures.
The interest for this topic is connected to the design of very light thin-webbed SFRC precast roof elements. These structures usually are longitudinally prestressed in the bottom chords, where the steel is protected also by fire attacks, and can be conventionally reinforced only at the end, in the diffusion zones close to the supports. The diffused transverse reinforcement, traditionally made of welded steel fabric, is substituted by steel fiber reinforcement. The structure is designed to fail in longitudinal bending, but snow loads, acting as distributed loads on the top surface and as concentrated loads linearly distributed along the top chords that support suitable translucid elements, induce a transverse bending moment and an axial tensile force due to the inclination of the two wings. When a HPFRC is used, a signicant residual strength after cracking, when subjected to uniaxial tension is available. Textiles can be coupled to steel fibers to stabilize crack propagation, but for fiber amount not exceeding 1,5% by volume, the peak behaviour in uniaxial tension is not significantly changed by steel fibers addition, while the post-peak behaviour grows linearly with fiber amount. A suitable fibre orientation can improve the tensile behaviour along the flow direction, but in any case this improvement is always associated to a significant strength loss in the cast crosswise direction: orthotropy must be described by a proper identification. Bending behaviour, taking advantage of linear distribution of strain in the section, presents larger thoughness. The paper considers the effect of fibre orientation on size-effect, both in tension and in compression, and on bending as well as a proper identification of the mechanical parameters in order to predict a reasonable load bearing capacity, when a compact cross section or a composite layered structure are used.