NON-WOVEN TEXTILE REINFORCED COMPOSITE CONCRETE

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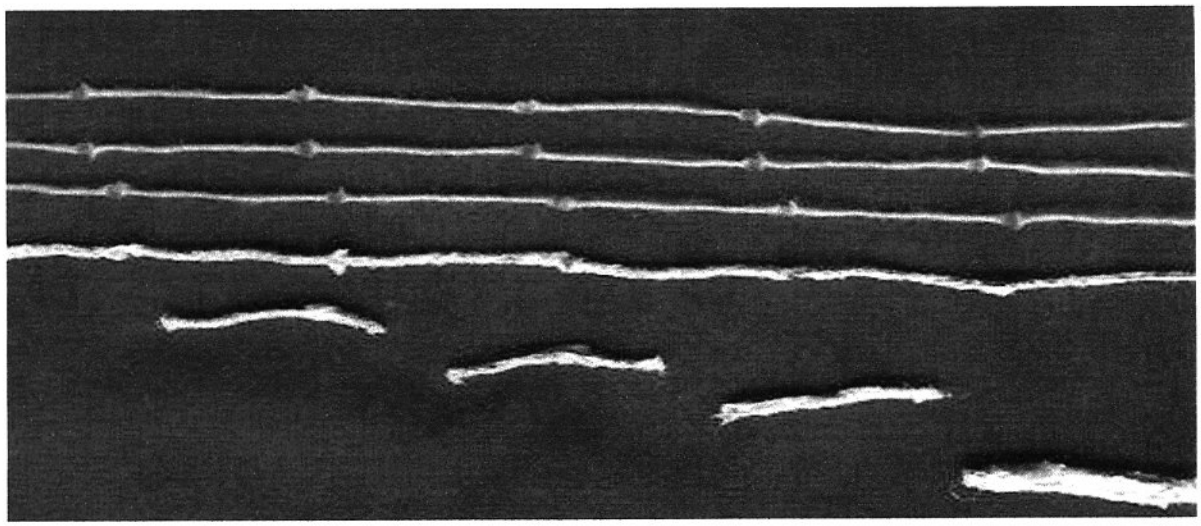
1. Introduction

The incorporation of woven fabrics in concrete has been known for some time (Hill et al and Schütt et al). This paper describes the incorporation of non-woven textiles in concrete. Non woven textile reinforced composite concrete is a method that allows a high volume fraction of fibres to be reached in hydraulic matrices, for example cement slurries or gypsum plaster, by avoiding the need for mixing. Pre-weakened strands are dip coated with the chosen matrix, the excess material removed by pulling the strand through a die, which is then broken off at the pre-determined fibre length. Pre-coated fibres can be moulded into porous or dense products.

2. Preparation of the non-woven fabric

A special machine has been designed and developed to pre-weaken strands of fabric. These strands can be pre-coated and broken off as fibres ready for moulding – illustrated below.



At the top, three pre-weakened strands, below them one that has been coated with a cement mix, three fibres broken off from such a strand. To the right a bundle of fibres, aligned & bonded together, as they can be randomly aligned in a mould.

These strands can be used at the nozzle for shot-creating, offer an alternative to chopper gun spraying. It is also possible to create a fluffy surface by spinning fibres around the strands. For example e-glass can be spun together with polypropylene fibres, which holds the glass fibres together, when notched to create a weakness. The glass gets fragmented and encapsulated in melted polypropylene fibres, which forms a sheath on the surface of the glass fibres. This would obviously result in a perfect bond between the fibres and the concrete. The bond is further enhanced by the notching process, which creates a fish tail and moulded from glass and filled with polypropylene. The fish tail ends act as an anchor in the same way as hooked steel fibres. As the fibres are corded a certain percentage of the fibres will have short ends, these will branch out to enhance the fibre to fibre bond.

3. Applications (Examples)

3.1 Drinking trough

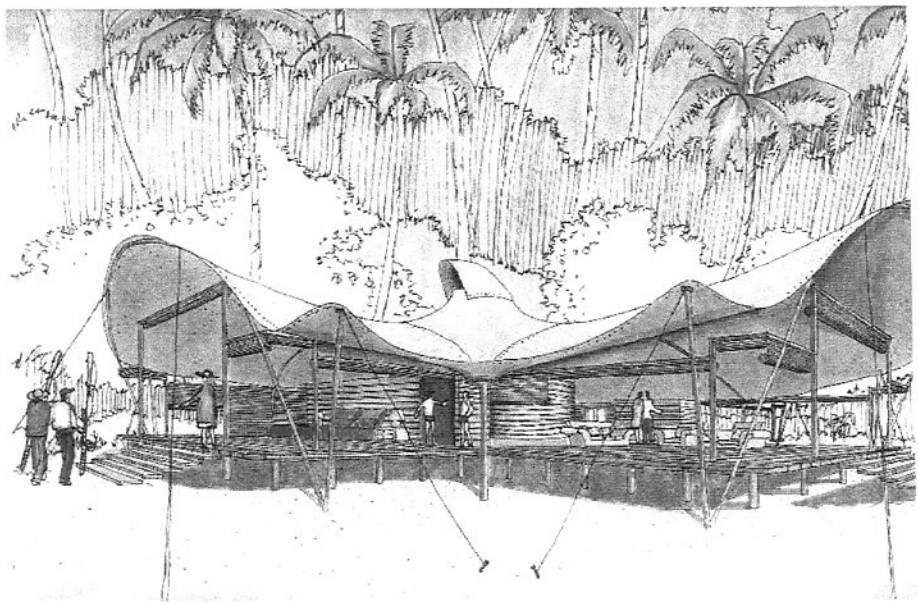
An agricultural drinking trough (length two meters) has been designed for use on farms in South Africa. The top edge is flanged and the bottom also has a flange, which can be recessed into the ground below the turf level.

3.2 Snap-off concrete poles

Motor car accidents on freeways lined with concrete lighting poles or standard street lighting poles can be fatal if a pole is hit. Using a "clever" design, the pole can be made to snap-off at a pre-determined height (say 1.5 m) on impact. The design will result in the pole falling clear of the can. The whip-lash will have the top section flip over the car. With an added design pull-out, connections could be made at the break-off point in order to cut off the electricity and therefore some save the driver from being electrocuted.

3.3 Light weight roof structures

Because of the ability to incorporate high volume fractions of fibres in to the composite, it is possible to develop long span light-weight structures, which can be used for roofing purposes. The example given below is a roof made out of textile concrete in the Seychelles. This text-like structure covers an area of 250 m2.



4. Summary

This abstract has given a brief account of the method for using non-woven textiles in concrete. The fibre strands can be made with any type of fibre ranging from glass, Kevlar, polyethylene, carbon or polypropylene, etc. The core can be designed to take large tensile loads and the sheath can be spun around the strands to form a very good bond between the matrix and the fibre. The sheath consists of fluffed polypropylene or other fibre types. The strands can be pre-weakened or notched if required or used without notching. Selected applications have been presented with notched and continuous fibre strands in order to demonstrate the potential of this invention.

5. References

Hill, B.J., Mc Ilhagger, R. and Harper, C.M. (1995), *The Effect of Internal Structural Changes on the Properties of Multi-layer Fabrics Composite Reinforcement.* Polymers and Polymer Composites, 3,2: 105-115.
Schütt, K., Rostasy, F.S. and Scheibe, M. (1997), *Textile Tendans for Pre-stressed Concrete*, Techtextil – Symposium Paper no. 419.