# SDI Alkali-Resistant Glass Fiber Scrim (mesh)

## SCRIMS AND THEIR USE IN GFRC

**Scrims**

Scrims are a structured form of glassfiber reinforcement in which the strands are continuous and are laid down in two directions at 90°. Figure 1. shows the structure of the two primary scrims produced by NEG.

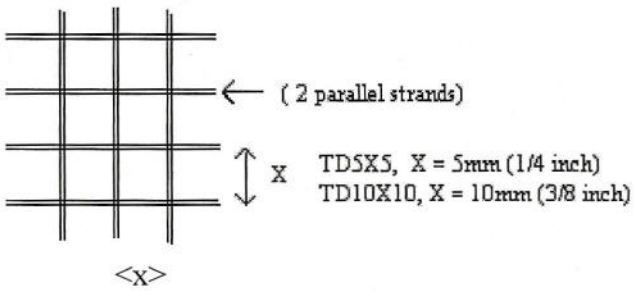


Figure 1.- Typical Scrim Construction

Because cement and sand mixes have relatively coarse particle sizes, there has to be sufficient open area in the scrim construction to allow the matrix to freely penetrate it and allow full wet-out of the fibers, without causing separation of the solids and the water. This means that the construction of the scrim has to have an opening of at least 0.25 inch.

The open construction of scrim means that they cannot be woven but rather the strands in one direction are laid across the strands going in the other direction and then an adhesive is applied which bonds the whole scrim together. The amount of adhesive is kept to the minimum necessary to provide sufficient scrim integrity ( i.e. won't pull apart easily) while still allowing good bond between the glassfibers and the cement matrix.

**Scrim as a Reinforcement**

The bi-directional construction of scrim offers a means of more efficient reinforcement (higher flexural strength for a given fiber content ) than is obtained from randomly dispersed chopped strands. Because of this it can often be used cost effectively to enhance the flexural properties of GFRC composites based on chopped strands.

In particular, the flexural strengths of composites with glassfiber contents lower than the usual 5% spray-up, such as premix, can be increased significantly by incorporating layers of scrim in the surface of the composite.

**Test Composites**

To demonstrate this effect a test program was initiated at Washington University in St. Louis by NEGA and Molloy & Associates, in which several premix composites were made with a variety of glassfiber contents and differing amounts of scrim. Table (1) lists the various composites tested.

Two types of scrim were tested , TD5X5 and TD10X10. Both scrims have two parallel strands of glassfiber placed as shown in Figure 1. TD5X5 (0.48 oz/ft$^2$) is the heavier scrim, having strands every 5mm (1/4 inch) compared to every 10 mm (3/8 inch) for TD10X10 (0.26 oz/ft$^2$).

Figure 2 illustrates the basic test panel. It consisted of a 1/2 inch layer of premix with 0,1, or 2 layers of scrim in each face. Also tested were panels which had a 1/2 inch of aggregate face mix ( 1/4 inch maximum aggregate size) on one side.

Table 1 gives the various panel configurations that were tested and Table 2 gives the mix formulations for both the premix and the face mix.

The premix only panels were made by first laying a thin mist coat on the form and then, if required, 1 or 2 layers of scrim were laid in the mist coat. The 1/2 inch layer of premix was placed on top of the layers of scrim and vibrated. The vibration levels and compacts the premix and also causes the cement to flow into the scrim, so "wetting" it out and imbedding it into the face of the premix. For panels C-H, additional layers of scrim were laid on top of the premix and rolled lightly to imbed them into the premix.

For the face mix panels the 1/2 inch thick aggregate face mix was first placed in the form, followed by 1 or 2 layers of scrim, followed by the 1/2 inch layer of premix, followed by the final layers of scrim for panels K and L. The panel was vibrated during placing of the face mix and the premix. The layer(s) of scrim in face mix panels I and J were laid immediately behind the face mix only. In panels K and L one of the layers of scrim was immediately behind the face mix and the other layer was in the exposed face of the premix.

Table 1 summarizes the test results. The MOR for the basic premix with 3% glass content was 1760 psi.

***The tests show that the addition of scrim in the tension face significantly increased the MOR of all composites.***

***Each layer of TD5X5 increased MOR by at least 600psi.***

***The MOR of 3% premix with two layers of TD5X5 in the tension face was comparable to 5% spray-up composite at over 3000psi. Also the strain to failure was comparable to spray-up composite.***

TD10X10 also afforded an increase in MOR of at least 300psi per layer of scrim.

Scrim placed in the compression face does not affect strengths.

The results of the tests on 0.5% premix were interesting, in that the addition of one layer of scrim provided strengths comparable to 3% premix and two layers provided strengths approaching those of spray-up composite. However, it should be noted that the 0.5% composite has a more brittle characteristic than the 3% composite, which suggests that it may be more susceptible to cracking due to shrinkage or temperature stresses.

The tests on panels with a face mix showed that there is a definite benefit derived from placing at least one layer of scrim immediately behind the face mix. The scrim provides reinforcement for the face mix so that it will only micro-crack when stressed in tension and wide cracks will not form prior to panel failure. (The fact that the MOR for panels with face mixes tested in tension is smaller than for panels without face mix is due to the fact that the panel thickness used in the MOR calculation is 1 inch for face mix panels and 1/2 inch for panels without face mix).