

ENGINEERING REPORT No. 17

Load Carrying Capacity Comparison Fibermesh® 650 vs. Welded Wire Fabric

OVERVIEW – The following full-scale study compares 6x6 – W2.9xW2.9 welded wire fabric to Fibermesh 650 with e3® patented* technology, a graded alloy polymer macro-synthetic fiber used for concrete secondary reinforcement. Fibermesh 650 is manufactured to an optimum gradation and highly oriented to result in increased interfacial bonding and flexural toughness, provides impact, abrasion and shatter resistance, as well as drying shrinkage and temperature crack control.



PURPOSE OF THE REPORT – This test was conducted to compare the load carrying capacity performance of two slabs-on-grade using rubber pads to simulate a soil subgrade. For this test, one slab was reinforced with Fibermesh 650 at 3 lbs/yd³ (1.8 kg/m³) and the other slab was reinforced with 6x6 – W2.9xW2.9 welded wire fabric.

NOTE: This test was conducted at the University of British Columbia under the supervision of Nemkumar Banthia, Ph.D., P.Eng., F.ACI, Professor of Civil Engineering and Distinguished University Scholar. Results apply only to Fibermesh 650 manufactured and engineered by Propex Concrete Systems Corp.

*Covered by US Patent # 5628822, 5456752

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Introduction

Slab-on-grade construction is used in many applications such as parking areas, commercial/ industrial floors, pavements and driveways. These slab-on-grade structures are supported on a prepared elastic foundation and commonly are subjected to static and dynamic loads. In order to adequately perform, these slabs should be able to resist intrinsic cracking forces and support the loading conditions that may be required. Unlike traditional steel reinforcement such as welded wire fabric and light rebar, fiber reinforced concrete (FRC) has greatly improved resistance to shrinkage crack formation. FRC offers post-crack toughness and serves to redistribute forces in the event of cracking.

Fabrication of the Test Slabs

Two 8' x 8' x 4" (2.5 m x 2.5 m x 0.1 m) slabs were tested. One slab was reinforced with Fibermesh® 650 at a rate of 3 lbs/yd³ (1.8 kg/m³). The second slab was reinforced with 6x6 – W2.9xW2.9 welded wire fabric on 6" (152.4 mm) center-to-center spacing in both directions with the mesh located in the upper third of the slab according to ACI recommendations.

Mix Design

Ready mix concrete with an average compressive strength of 5,076 psi (35 MPa) was used in this test. For material characterization, cylinders were tested for compressive strength in accordance with ASTM C39. Table 1 Concrete Properties shows average compressive strength values for each slab.

Table 1. Concrete Properties

Slab No.	Type of Reinforcement	Average Compressive Strength PSI (MPa)
1	Fibermesh® 650	4946 PSI (34.1 MPa)
2	Welded Wire Fabric	5221 PSI (36.0 MPa)

Testing of the Slabs

The slabs were tested under a central concentrated load applied through a 100 mm x 100 mm steel plate. The sub-base consisted of sheets stacked on top of each other with a total thickness of 100 mm. The modulus of the sub-grade reaction was 0.025 N/mm³. Load was applied using a 448 kN (100,000 lbs) capacity hydraulic jack. The loading arm was lowered at constant displacement rate of 0.25

mm/min. The load was measured by a load cell and the deformation of the slab was measured using three Linear Variable Displacement Transducers (LVDTs) at different locations. The load and deflection readings were stored directly on a data logging system connected to a computer.



Figure 1. FRC Slab Crack Pattern

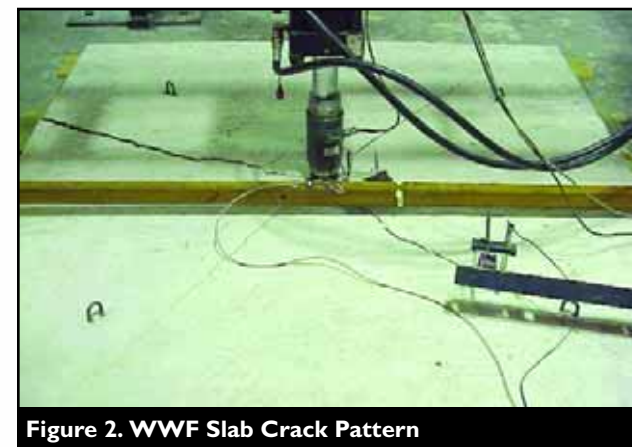


Figure 2. WWF Slab Crack Pattern

Summary of Test Results

On the slab reinforced with Fibermesh 650, a circular plug formed at the center of the slab initially then continued with diagonal cracks to the edge of the slab as the load increased (see Figure 1). Eventually the slab failed due to a combination of shear and bending stresses. The slab reinforced with the welded wire fabric failed with a slightly different crack pattern (see Figure 2). The failure in the welded wire mesh reinforced slab started with cracks located at the 4 corners. The cracks initiated from the bottom side of the slab through the slab thickness without the circular plug indicating less redistribution of the concentrated load.

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As shown in the load displacement curves in Figure 3, the Fibermesh® 650 reinforced slab carried a greater ultimate load. The peak load carried by the Fibermesh 650 slab was approximately 160 k/N and the peak load carried by the welded wire fabric reinforced slab was approximately 150 k/N. Figure 3 also shows the peak load carried by the Fibermesh 650 reinforced slab occurred at a lower displacement indicating a stiffer response.

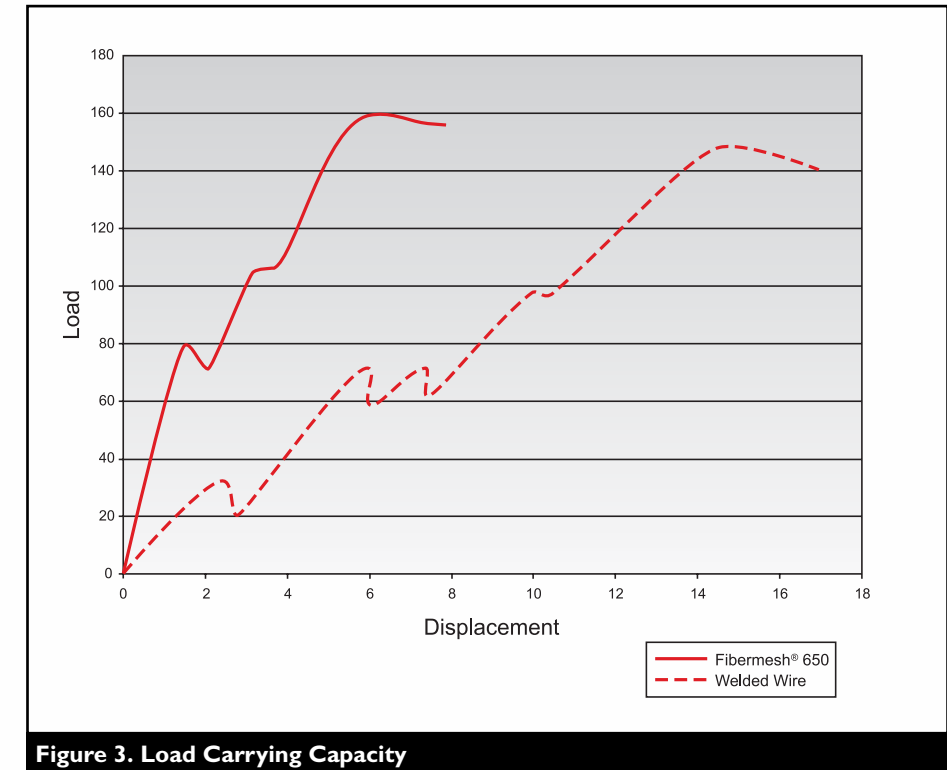


Figure 3. Load Carrying Capacity

CONCLUSIONS

- Fibermesh 650 fiber reinforced concrete was shown to support a greater ultimate load carrying capacity when compared to 6x6-W2.9xW2.9 welded wire fabric reinforced concrete.
- The slab reinforced with Fibermesh 650 displayed lower deflections at a given load
- This test program shows that fiber reinforced concrete (FRC) is an ideal material when used as secondary reinforcement in slab-on-grade applications. In addition to superior load carrying capacity, FRC offers improved plastic shrinkage and plastic settlement crack control, increased impact, abrasion and shatter resistance, lowered water migration which are benefits that traditional steel reinforcement does not offer.

