

TB-0003 — STRUX® 90/40 Replaces WWF as Minimum Reinforcing for Composite Steel Floor Deck Construction

Composite metal deck is a cost-effective flooring system used in many multi-story buildings. Floors constructed of composite metal deck are typically designed such that the corrugated metal deck will support the weight of the fresh concrete and some construction loads without requiring shoring. Once the concrete gains strength the concrete and metal deck act together as a composite member. The metal deck acts as the tensile reinforcement for the slab in resistance to positive moment stresses induced by dead and live loads. Traditional design practice dictates that minimum reinforcing is required in the transverse direction to control any cracks that may occur due to temperature and shrinkage movements. This minimum requirement for reinforcing has traditionally been addressed via the use of light gauge welded wire fabric (WWF). Both SDI (Steel Deck Institute) and ANSI-ASCE 3-91 design provisions call for a cross sectional area of steel reinforcing equal to 0.00075 times the area of concrete to satisfy these minimum reinforcing requirements.

[New ANSI/SDI Code Provisions for Synthetic Macro Fibers is Suitable Alternate to WWF for both Normal and Lightweight Concrete](#)

The ANSI/SDI-C1.0 Standard for Composite Steel Floor Deck has changed (11/06) the provisions in its design code relative to minimum temperature and shrinkage reinforcing to the following:

2.4.B6 Reinforcement

Temperature and shrinkage reinforcement, consisting of welded wire fabric or reinforcing bars, shall have a minimum area of 0.00075 times the area of the concrete above the deck (per foot or meter of width), but shall not be less than the area provided by 6 x 6—W1.4 x W1.4 welded wire fabric.

Fibers shall be permitted as a suitable alternative to the welded wire fabric specified for temperature and shrinkage reinforcement. ...macro synthetic fibers "Coarse fibers" (per ASTM Subcommittee C09.42), made from virgin polyolefin, shall have an equivalent diameter between 0.016 in. (0.4 mm) and 0.05 in. (1.25 mm), having a minimum aspect ratio (length/equivalent diameter) of 50, at a minimum addition rate of 4 lbs/yd³ (2.4 kg/m³) are suitable to be used as minimum temperature and shrinkage reinforcement.

Commentary

Neither welded wire fabric or fibers will prevent cracking, however they have been shown to do a good job of crack control. The welded wire fabric must be placed near the top of the slab 3/4 to 1 in. (20 to 25 mm) cover at supports and draped toward the center of the deck span. If a welded wire fabric is used with a steel area given by the above formula, it will not be sufficient as the total negative reinforcement. If the minimum quantity of macro synthetic fibers are used for shrinkage and temperature reinforcement, they will not be sufficient as a total negative reinforcement.

Note: STRUX[®]90/40, a synthetic macro fiber made from virgin polyolefin, has an equivalent diameter of 0.43 mm and an aspect ratio of 90.



STRUX[®]90/40 fiber as marketed by GCP Applied Technologies is classified by Underwriters Laboratories Inc. for use as an alternative, or in addition to, the welded wire fabric in 1, 1 1/2 and 2 hr floor–ceiling D700, F700, D800, F800, D900 and F900 (except 909) Series Designs. Fibers to be added to the concrete mix at maximum addition rate of 5 lbs/yd³ (3.0 kg/m³).

STRUX[®] 90/40 is UL (U.S.) and ULC (Canada) Listed for Fire Ratings up to 2 Hours

In many structures, the floor system selected will require a fire rating. STRUX[®]90/40 fibers are now UL Classified as a replacement of WWF for many composite metal deck systems. To view UL and ULC Classification go online to www.ul.com, file #R13667.

STRUX[®] 90/40 Benefits—Improved Performance and Constructability

The advantages of STRUX[®]90/40 fibers over WWF for use in composite metal deck are numerous from both the engineer’s and contractor’s point of view. Synthetic macro fiber reinforced concrete results in superior performance, improved durability and higher quality slabs. Because the fibers are uniformly dispersed throughout the concrete matrix, performance is not dependent on construction practices to assure proper placement. Internal stresses within the concrete as a result of drying, temperature and plastic shrinkage are addressed at or near their point of origin and a result crack control is greatly improved. Therefore, the use of STRUX[®]90/40 provides a superior quality floor with the potential for lower in place costs and faster construction schedule.

EQUIVALENT STRUX [®] 90/40 ADDITION RATE LBS/YD ³			
Height of concrete above flutes (in.)	Recommended WWF to meet minimum area of steel per ANSI/SDI C1.0	Light weight	Normal weight
2.0	6 x 6 W1.4 x W1.4	5	4.5
2.5	6 x 6 W1.4 x W1.4	4	4
3.0	6 x 6 W1.4 x W1.4	4	4
3.5	6 x 6 W2.1 x W2.1	4	4

4.0	6 x 6 W2.1 x W2.1	4	4
4.5	6 x 6 W2.1 x W2.1	4	4
5.0	6 x 6 W2.9 x W2.9	4	4
5.5	6 x 6 W2.9 x W2.9	4	4
6.0	6 x 6 W2.9 x W2.9	4	4

Note 1: Temperature and shrinkage reinforcement consisting of WWF or reinforcing bars, shall have a minimum area of 0.00075 times the area of concrete above the deck but shall not be less than a 6 x 6 W1.4 x W1.4 (ANSI/SDI- C1.0)

Note 2: Fibers shall be permitted as a suitable alternative to welded wire fabric.... Macro synthetic fibers “Coarse fibers” (per ASTM Subcommittee C09.42), made from virgin polyolefin, shall have an equivalent diameter between 0.016 in. (0.4 mm) and 0.05 in. (1.25 mm), having a minimum aspect ratio (length/equivalent diameter) of 50, at a minimum addition rate of 4 lbs/yd³ (2.4 kg/m³) are suitable to be used as minimum temperature and shrinkage reinforcement.

Note 3: For deck and WWF configurations not covered by this table, contact your local GCP representative for STRUX® 90/40 addition rate.

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Last Updated: 2023-06-28

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