## TECHNICAL BULLETIN FC-2

# TUF-STRAND SF SLAB ON GROUND DESIGN FOR TEMPERATURE & SHRINKAGE CRACK CONTROL

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The design of a concrete slab on ground is typically performed by a registered professional. However, when the design has been determined that a certain concrete thickness is adequate to resist all loading conditions applied to a slab on ground system, it is possible to calculate a fiber-reinforced concrete (FRC) dosage directly from the specified temperature and shrinkage steel reinforcement with the FRC system acting as an equal or better reinforcing option under the same loading conditions. The use of fibers in this type of slab on ground system can be, and have been, successfully implemented to the point where a more durable and economical floor system has been achieved.

For slab on ground projects where distributed steel has been specified for the control of temperature and shrinkage cracking, the use of TUF-STRAND SF may be warranted and calculated to provide an equivalent capacity as the originally specified steel. This assumes several conditions such as the existing reinforcing having been correctly placed in the top third of the concrete slab, that the steel is not required to support structural loading and that all other concrete placement and finishing practices have been properly applied.

The appropriate dosage of TUF-STRAND SF can be determined using the preformance of the fiber as measured using ASTM C1609, Flexural Toughness of Fiber-Reinforced Concrete. The performance of the fiber in this standardized test measures the amount of post crack tensile strength available in the concrete by a specific fiber dosage and mix design. This residual strength value can then be compared to the performance of the conventual steel reinforcement when used for temperature and shrinkage crack control. Once the required flexural residual strength has been established, the appropriate dosage of fiber can be determined by converting the residual strength to a tensile capacity provided for by the steel reinforcing as determined in accordance with ACI 544.4R, Guide to Design to Fiber Reinforced Concrete.

Performance of conventional reinforcing:

$$f_{st} = \frac{\varphi_s * A_s * F_y}{b * h}$$

Working stress provided by steel (assuming steel does not yield):

$$f_{ws} = 0.667 * f_{st}$$

FRC flexural residual strength conversion per ACI 544.4R:

$$f_{e3} = \frac{f_{ws}}{0.37}$$

*Example solutions on Page 2.*

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# EXAMPLE SOLUTION

**Example Solution:** Slab on Grade project is currently using a single layer of WWR 4x4 W4.0xW4.0 reinforcing placed near the top of a 6" thick slab. Concrete strength is 4000 psi. Steel reinforcing strength is Imperial Grade 70 – 70,000 psi.

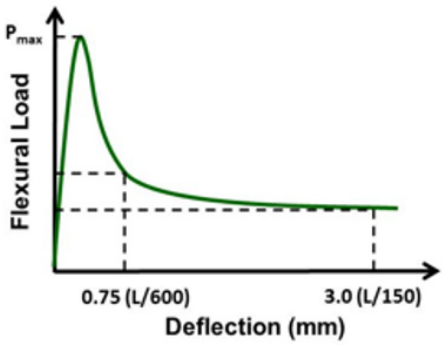
$$f_{st} = \frac{0.9 * 0.12 \frac{in^2}{ft} * 70000\ psi}{12\ in * 6\ in} = 105\ psi$$

$$f_{ws} = 0.667 * 105 = 70\ psi$$

**Therefore:**

$$f_{e3} = \frac{70\ psi}{0.37} = 189\ psi$$

Fiber dosage must provide a flexural residual strength ($f_{e3}$) capacity of 189 psi (1.3 MPa) as measured by ASTM C1609. For TUF-STRAND SF, this will be approximately 5 lbs/yd³ (3 kg/m³).




Schematics of a typical C1609 test result

The Euclid Chemical Company has mobile based calculators to provide easy conversions of single layer conventional reinforcing to appropriate dosage rates of TUF-STRAND SF. The calculators can be found at www.tufstrand.com or can be found in the app store as "**Euco FiberCalc**". An advanced analysis can also be performed for the complete design of a slab on ground system using fiber-reinforced concrete. For more information, please contact Euclid Chemical.