

# MasterFiber<sup>®</sup> MAC 360 FF Hybrid Fiber for Composite Steel Floor Deck-Slabs

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## Background

The American National Standards Institute / Steel Deck Institute (ANSI/SDI) C-2017 Standard for Composite Steel Floor Deck-Slabs permits the use of synthetic macrofibers as one of three options for reinforcement to control cracking due to temperature and shrinkage stresses in steel floor deck-slabs (composite metal decks). The specific provision for synthetic macrofibers is given in Section 2.4.B.15.a.3 of the standard and is provided below for reference purposes.

“Concrete specified in accordance with ASTM C1116, Type III, containing macrosynthetic fibers meeting the criteria of ASTM D7508 at a dosage rate determined by the fiber manufacturer for the application, but not less than 4 lb./cu yd (2.4 kg/m<sup>3</sup>).”

A wide range of synthetic macrofibers from different manufacturers and suppliers have been used very successfully in fiber-reinforced concrete for composite metal decks.

These fibers have different architecture, dimensions and physical characteristics, and, consequently, do not necessarily provide the same post-crack flexural performance in concrete. However, the ANSI/SDI provisions for use of fibers, both steel and synthetic, as temperature and shrinkage reinforcement are prescriptive and do not take into consideration the actual post-crack flexural performance of a given fiber product.

Recognizing this fact, some specifiers have permitted the use of certain fiber products, both steel and synthetic, at dosages different from the prescriptive dosages given in Section 2.4.B.15 of the ANSI/SDI C-2017 standard.

This technical bulletin has been developed to provide guidance to specifiers on the use of MasterFiber MAC 360 FF hybrid fiber from The Master Builders Solutions in fiber-reinforced concrete for composite metal decks.

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## The Product

MasterFiber MAC 360 FF hybrid fiber is a high-performance fiber product for use as temperature and shrinkage (secondary) reinforcement and, specifically, to provide optimum finishing performance in hard-troweled concrete applications. As a hybrid fiber, it reinforces plastic concrete to minimize plastic shrinkage and settlement cracking, while effectively enhancing the post-crack flexural toughness of hardened concrete. More importantly, MasterFiber MAC 360 FF hybrid fiber has been engineered to provide post-crack flexural performance equivalent to, if not better than,

that provided by most commercially-available synthetic macrofibers, at equal dosages. Consequently, the product's unique blended architecture offers an industry-best overall performance in both post-crack performance and finishability. MasterFiber MAC 360 FF hybrid fiber is classified by Underwriters Laboratories Inc. for use at a maximum rate of 5.0 lb/yd<sup>3</sup> (3.0 kg/m<sup>3</sup>) of concrete in the following fire rated assemblies: UL D700, D800 and D900 Series Designs.

### Post-Crack Flexural Performance

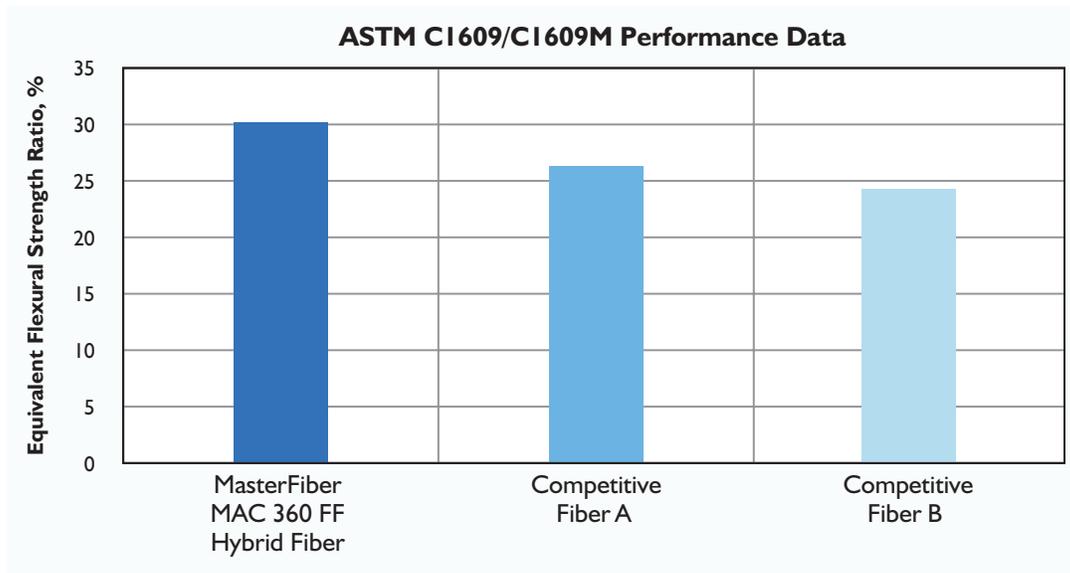
The post-crack flexural performance of MasterFiber MAC 360 FF hybrid fiber at a dosage of 4 lb/yd<sup>3</sup> Technical Bulletin (2.4 kg/m<sup>3</sup>) was determined from a comprehensive independent third-party evaluation performed at TEC Services, Lawrenceville, GA. The testing was performed in accordance with ASTM C1609/C1609M, "Test Method for Flexural Performance of Fiber-Reinforced Concrete (Using Beam with Third-Point Loading)," using roller supports meeting the requirements of ASTM C1812-15, "Standard Practice for Design of Journal Bearing Supports to be Used in Fiber-Reinforced Concrete Beam Tests."

The average equivalent flexural strength ratio,  $R_{T,150}^{150}$  (or  $R_{e3}$ ), obtained from the testing is shown in Figure 1. For reference purposes, equivalent flexural strength ratios for fiber-reinforced concretes made with other commercially-available synthetic macrofibers are also shown in Figure 1. The competitive data were obtained from ASTM C1609/C1609M data reported by the respective suppliers as shown in Appendix A (Figure A1 and A2).

The data shows that at equivalent dosages of 4 lb/yd<sup>3</sup> (2.4 kg/m<sup>3</sup>), MasterFiber MAC 360 FF hybrid fiber provides a post-crack flexural performance that is either greater than or at least comparable to that provided by competitive synthetic macrofibers typically used in fiber-reinforced concretes for composite metal decks.

### Dosage Recommendation

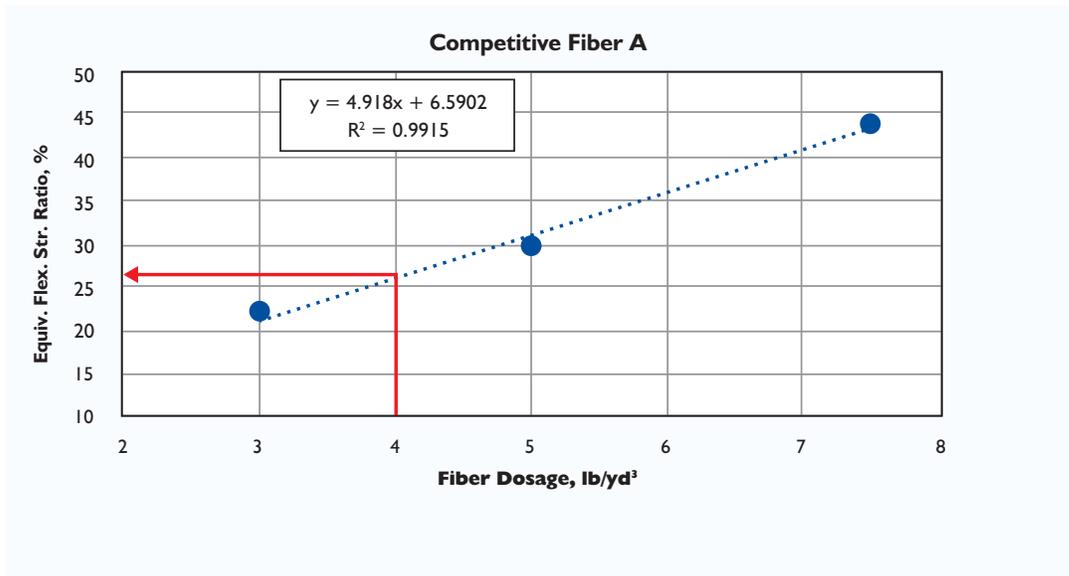
On the basis of equivalent post-crack flexural performance, The Master Builders Solutions recommends the specification of 4 lb/yd<sup>3</sup> (2.4 kg/m<sup>3</sup>) of MasterFiber MAC 360 FF hybrid fiber for use in fiber-reinforced concrete for composite metal decks.



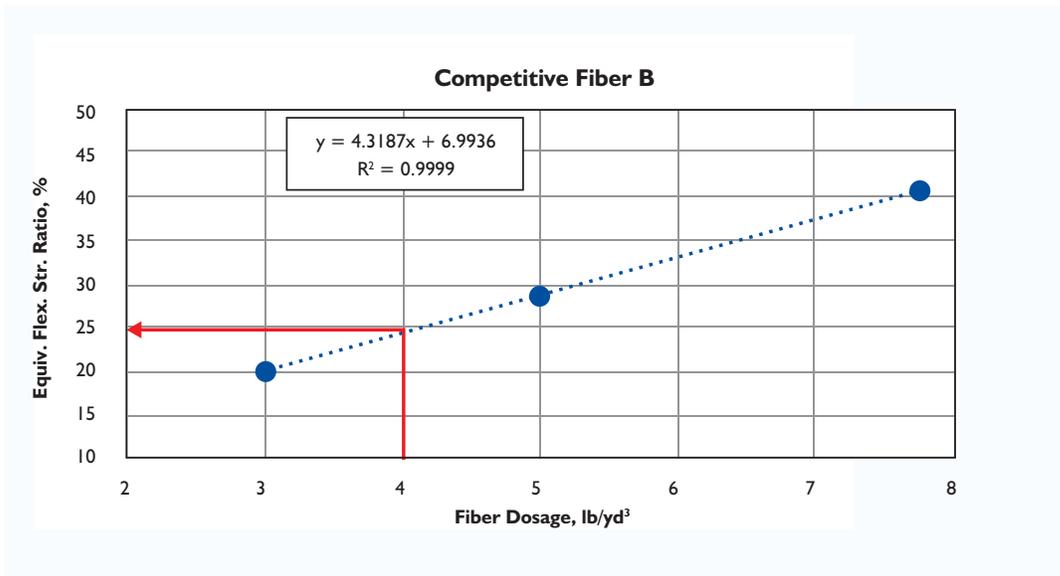
**Figure 1.** Equivalent Flexural Strength Ratio for MasterFiber MAC 360 FF Hybrid Fiber and Competitive Synthetic Macrofibers at a Dosage of 4 lb/yd<sup>3</sup> (2.4 kg/m<sup>3</sup>)

## Appendix A

(Competitive Data Plots)



**Figure A1.** Equivalent Flexural Strength Ratio for TUF-STRAND SF Fiber  
 (Source: TUF-STRAND SF datasheet, Rev. 11.14; The Euclid Chemical Company – see Appendix B)



**Figure A2.** Equivalent Flexural Strength Ratio for STRUX 90/40 Fiber  
 (Source: STRUX 90/40 bulletin, 11/07; Grace Concrete Products – see Appendix B)

## Appendix B

(Supporting Documents\*)

\*Contact Master Builders Solutions Technical Support at (800) 628-9990 for additional support documentation.

### About Master Builders Solutions

Master Builders Solutions is a leading global manufacturer of concrete admixtures, as well as other sustainable solutions for the construction industry, focussed on delivering its vision: **Inspiring people to build better**. Master Builders Solutions provides value-added technology and market-leading R&D capabilities to improve the performance of

construction materials and to enable the reduction of CO2 emissions in the production of concrete. Founded in 1909, Master Builders Solutions has ca. 1600 employees operating 35 production sites globally, supporting their customers in mastering their building challenges of today – for a decarbonised future.

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