DESIGN CODES

Since the mechanical properties of GFRP fibreglass rebar differ from those of steel, design engineers should consider requirements and recommendations stated in published design and construction guides when using GFRP fibreglass rebar in structural applications.

Some important differences between steel and GFRP fibreglass rebar should be considered when designing concrete members/structures using fibreglass rebar

- Direct substitution of GFRP fibreglass rebar with steel rebar may not be possible in some cases due to differences in mechanical characteristics and surface configurations.
- Since GFRP rebar has a lower modulus of elasticity than steel rebars, the design in most cases may be governed by serviceability limit state (SLS) rather than ultimate limit state (ULS).
- The design codes provide a maximum limit for the stress in the GFRP bars under sustained load

Australian How-To

In Australia Engineers design with Tuf Bar, following specific material codes developed for GFRP reinforcing, CSA S 806-12 (R2015), whilst taking into account the minimal Australian requirements of AS codes such as AS1170, AS3600, AS 5100, etc., coupled with the performance requirements and verification methods as described in the NCC 2019 Vol 1.

NSW Intelligent Transport Systems – Traffic Systems Technical Guidance TSI-TG-009

Talk to us on how.

International Material Standards Applied in Australia

Material standards and compliance is the first and most important consideration when using any materials, the same applies for internal GFRP bars used to reinforce concrete structures.

Third-party verification must be provided to prove compliance.

Canada Material Standard

- CAN/CSA-S807-19 “Specification for Fibre-Reinforced Polymers”, Canadian Standards Association.

USA Material Standard

- ASTM D7957 (2017) “Standard Specification for Solid Round Glass Fiber Reinforced Polymer Bars for Concrete Reinforcement”, American Society for Testing and Materials (ASTM International), West Conshohocken, PA, USA

Canada Design.

- CAN/CSA-S806-12 (R2017) “Design and Construction of Building Components with Fibre-Reinforced Polymers” Canadian Standards Association
- CAN/CSA-S6-14 (2014) “Canadian Highway Bridge Design Code” Section 16: Fibre Reinforced Structures, Canadian Standards Association

Through IMTReC – Centre for Structural Innovation and Monitoring Technologies Inc. (formerly known as Canadian Network of Centers of Excellence on Intelligent Sensing for Innovative Structures, ISIS Canada Resource Centre), the following design guides are available:

- Manual No. 3 “Reinforcing Concrete Structures with Fibre Reinforced Polymers (FRPs)”, Prof Brahim Benmokrane
- Manual No. 4 “Strengthening Reinforced Concrete Structures with Externally-Bonded Fibre Reinforced Polymers (FRPs)”, Dr. Kenneth Neale
- Manual No. 5 “Prestressing Concrete Structures with FRPs” Dr. Ivan Campbell

USA Design

- ACI 440.1R-15 (2015) “Guide for the Design and Construction of Structural Concrete Reinforced with Fiber-Reinforced Polymer Bars”, ACI Committee 440, American Concrete Institute
- ACI 440.3R-12 (2012) “Guide Test Methods for Fiber-Reinforced Polymers (FRPs) for Reinforcing or Strengthening Concrete Structures” ACI Committee 440, American Concrete Institute
- ACI 440.4R-04 (Reapproved 2011) “Prestressing Concrete Structures with FRP Tendons” ACI Committee 440, American Concrete Institute
- ACI 440R-07 (2007) “Report on Fiber-Reinforced Polymer (FRP) Reinforcement for Concrete Structures,” ACI Committee 440, American Concrete Institute
- ACI 440.5-08 (2008) “Specification for Construction with Fiber-Reinforced Polymer Reinforcing Bar”, ACI Committee 440, American Concrete Institute
- AASHTO GFRP-1 (2009) “AASHTO LRFD Bridge Design Guide Specifications for GFRP-Reinforced Concrete Bridge Decks and Traffic Railings”, American Association of State Highway and Transportation Officials