

2021 BETTER CONCRETE CONFERENCE –


B2 Concurrent Session – "Non-Steel Reinforcements"

By
 Max Porter, Ph.D., PE, D. Mem. ASCE, F.ACI, F.TMS, Univ. Prof.
 Emeritus - ISU CCEE Department

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Toys – Examples

- Pass around rebars, (note the labels)
- Dowel bar,
- Dowel tie connector,
- Etc.



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Guide for the Design and Construction of Structural Concrete Reinforced with Fiber-Reinforced Polymer (FRP) Bars

Reported by ACI Committee 440

ACI 440.1R-15

Specification for Construction with Fiber-Reinforced Polymer Reinforcing Bars

Reported by ACI Committee 440

ACI 440.2R-17

Standard Specification for Solid Round Glass Fiber Reinforced Polymer Bars for Concrete Reinforcement

Designation: C7957/G7957M - 17

ACCEPTANCE CRITERIA FOR FIBER-REINFORCED POLYMER (FRP) BARS FOR INTERNAL REINFORCEMENT OF CONCRETE MEMBERS

AC454

Approved December 2020

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Workshop on Research in FRP Composites in Concrete Construction
 October 22-23, 2004 – San Francisco California

Sponsored by:

National Science Foundation

With the Support of:

ACI International & ACI Committee 440

ISIS Canada

ACI 440-D Formulated Workshop (When MP chaired)

Identification and Prioritization of research areas for FRP reinforced concrete and masonry structures

Contributed to the identification prioritization of a large agenda of needed Research.

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FRP Rebar Work & Docs

ACI 440 - Fiber-Reinforced Polymer Reinforcement:

Document	Doc Ballot by Sub	Doc Ballot by 440 Main	Resolve Negative 440 Main Ballot	Doc to ACI for TAC Review	TAC Review	440 Reply to TAC Comments Ballot	Reply to Public Comment	In Print
440-H CODE	PI-F15 PII-Su16	PI-S17 PII-S18	PI-S17 PII-S18	Fall 2021				
Bar Const. Spec	Done	Done	Done	Done	Done	Done	Pending	
440.2R Strengthening	Multiple Sections Done	Multiple Sections Done	Multiple Sections Done	Spring 2022				
440.7R Masonry	Done	Done	Done	Done	Done	Spring 2021		
Repair Const. Spec	Done	Done	Done	Done	Done	Done	Pending	
Fire TechNote	Done	Done	Done	Done	Done	Pending		
440.4R Prestress	Done	Pending						
440-J	Pending	Fall 2021						

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Big deal is the Ballot Results: "Code Requirements for Structural Concrete Reinforced with GFRP Bars and Commentary"

Subcommittee Activities of ACI 440 (12): (partial list)

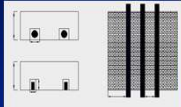
- 440-D Research Development and Applications
- 440-F FRP-Repair-Strengthening
- 440-H FRP-Reinforced Concrete
- 440-I FRP-Prestressed Concrete
- 440-J FRP Stay-in-Place Forms
- 440-K FRP-Material Characteristics
- 440-L FRP-Durability
- 440-M FRP-Repair of Masonry Str



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Published Docs by ACI 440: (Samples)

- ACI PRC-440.10-21: Fire Resistance of FRP-Strengthened Concrete Members – TechNote
- ACI PRC-440.1-15 Guide for the Design and Construction of Structural Concrete Reinforced with Fiber-Reinforced Polymer Bars
- ACI PRC-440.2-17: Guide for the Design and Construction of Externally Bonded FRP Systems for Strengthening Concrete Structures
- ACI PRC-440.3-12 Guide Test Methods for Fiber-Reinforced Polymers (FRPs) for Reinforcing or Strengthening Concrete Structures
- ACI PRC-440.4-11: Prestressing Concrete Structures with FRP Tendons
- ACI PRC-440.7-10 Guide for Design & Constr of Externally Bonded FRP Systems for Strengthening Unreinforced Masonry Structures



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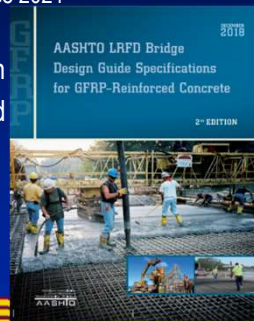
Published Docs by ACI 440: (Cont'd)

- ACI PRC-440.9-15 Guide to Accelerated Conditioning Protocols for Durability Assessment of Internal and External Fiber-Reinforced
- ACI PRC-440-07 Report on Fiber-Reinforced Polymer (FRP) Reinforcement for Concrete Structures
- ACI SPEC-440.5-08 Specification for Construction with Fiber-Reinforced Polymer Reinforcing Bars
- ACI SPEC-440.6-08(17) Specification for Carbon and Glass Fiber-Reinforced Polymer Bar Materials for Concrete Reinforcement

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Related Items and Docs

- ▣ ASCE 74 – New Standard for Load & Resistance Factor Design (LRFD) for Pultruded Fiber Reinforced Polymer (FRP) Structures
 - Patterned after the AISC for steel structures
 - Presented at the recent Pultrusion Conference 2021
 - Resolving comments from Public Ballot
- ▣ AASHTO – AASHTO LRFD Bridge Design Guide Specifications for GFRP-Reinforced Concrete, Second Edition



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Other Related Docs.

- ▣ AASHTO - AASHTO Guide Specifications for Design of Bonded FRP Systems for Repair and Strengthening of Concrete Bridge Elements (being updated)
- ▣ New Edition of TMS 402 (Bldg Code for Masonry Structures will contain provisions for FRP-Reinforced Masonry (public ballot stage)



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ACI 440 Docs in Process

- ▣ Code Requirements for Structural Concrete Reinforced with GFRP Bars and Commentary
- ▣ 440.ZR Guide for design of circular concrete-filled FRP Tubes (CFFT)
- ▣ SPEC 440.X (Construction Specification). It will be issued after the Fall convention.
- ▣ PRC-440.10-21 (TechNote on Fire Resistance of FRP Strengthening Systems), available as of this past weekend for purchase from ACI.



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Future and Innovative Items

- ▣ Innovative: precast modular-units with rapid assembly time with GFRP & BFRP reinforcement to eliminate corrosion-related maintenance and provide higher resistance to Environment conditions.
- ▣ CFRP remains high on the list for strength and other material properties.



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GFRP Bars - Cage Assembly (slide by Toni Nanni)

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Center for Integration of Composite into Infrastructure

13

Summary - Aspects of GFRP Use

<u>PROs</u>	<u>CONs</u>
<ul style="list-style-type: none"> • Reduce Corrosion • Quick installation • Light weight • Assembly time savings • Save shipping costs 	<ul style="list-style-type: none"> • Bent-shapes need to be pre-fabricated by pultruder • No on-site bending of GFRP (unless thermoplastic) • "Skin-itching" (protective clothes should be worn) • More GFRP than black steel bars are needed

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QUESTIONS?