APPENDIX C
CODE CHANGE PROPOSAL
NORTH CAROLINA
BUILDING CODE COUNCIL

325North Salisbury Street, Room 5_44
Raleigh, North Carolina 27603
(919) 647-0009
carl.martin@ncdoi.gov

Petition for Rule Making Item Number _____

Granted by BCC	_____	**Adopted by BCC**	_____	**Approved by RRC**	_____
Denied by BCC	_____	**Disapproved by BCC**	_____	**Objection by RRC**	_____

PROPONENT: Kerry Sutton, PE PHONE: (734) 673-2195
REPRESENTING: American Concrete Institute (ACI)
ADDRESS: 38800 Country Club Drive
CITY: Farmington Hills STATE: Michigan ZIP: 48331
E-MAIL: Kerry.Sutton@concrete.org FAX: ( ) -

PROPONENT: Edward Deaver PHONE: (704) 608-5782
REPRESENTING: ACI Carolinas Chapter
ADDRESS: 3122 Fincher Farm Road, Ste 100, #548
CITY: Matthews STATE: North Carolina ZIP: 28105
E-MAIL: Edward.deaver@holcim.com FAX: (704) 246-4400

PROPONENT: Caroline Sutton PHONE: 704-717-9199
REPRESENTING: Carolinas Ready Mixed Concrete Association (CRMCA)
ADDRESS: PO Box 480310
CITY: Charlotte STATE: North Carolina ZIP: 28269
E-MAIL: caroline@crmca.com FAX: ( ) -

PROPONENT: Shamim Rashid-Sumar, PE FSFPE PHONE: 917-484-1960
REPRESENTING: National Ready Mixed Concrete Association (NRMCA)
ADDRESS: 66 Canal Plaza Suite 250
CITY: Alexandria STATE: Virginia ZIP: 22314
E-MAIL: ssumar@nrmca.org FAX: ( ) -

PROPONENT: Griff Shapack, PE PHONE: 980-598-9553
REPRESENTING: Simpson Strong-Tie
ADDRESS: 2524 Beechridge Rd.
CITY: Raleigh STATE: North Carolina ZIP: 27608
E-MAIL: gshapak@strongtie.com FAX: ( ) -

PROPONENT: Jay Pease, PE PHONE: 614-905-2707
REPRESENTING: Owens Corning/Infrastructure Solutions
ADDRESS: One Owens Corning Parkway
CITY: Toledo STATE: Ohio ZIP: 43659
E-MAIL: Jay.Pease@ownscorning.com FAX: ( ) -

PROPONENT: Jerzy Zemajtis, PE PHONE: (248) 848-3170
REPRESENTING: NEX: An ACI Center of Excellence for Nonmetallic Building Materials
ADDRESS: 38800 Country Club Drive
CITY: Farmington Hills STATE: Michigan ZIP: 48331
E-MAIL: Jerzy Zemajtis@nonmetallic.org FAX: ( ) -

PROPONENT: Jay Thomas PHONE: 443-271-7100
REPRESENTING: Structural Technologies
ADDRESS: 815 116th Ave
CITY: Treasure Island STATE: Florida ZIP: 33706
E-MAIL: jthomas@structuralgroup.com FAX: ( ) -

North Carolina State Building Code, Volume 2024 NC State Building Code – Section 1901

CHECK ONE: [ ] Revise section to read as follows: [ ] Delete section and substitute the following:
[X] Add new section to read as follows: [ ] Delete section without substitution:

~~LINE THROUGH MATERIAL TO BE DELETED~~ UNDERLINE MATERIAL TO BE ADDED

Please type. Continue proposal or reason on plain paper attached to this form. See reverse side for instructions.

1901.2 Plain and reinforced concrete. Structural concrete shall be designed and constructed in accordance with the requirements of this chapter and ACI 318 as amended in Section 1905 of this code. Except for the provisions of Section 1904 and 1907, the design and construction of slabs on grade shall not be governed in this chapter unless they transmit vertical *loads* or lateral forces from other parts of the structure to the soil.

Add new text as follows:

1901.2.1 Structural concrete with GFRP reinforcement. Cast-in-place structural concrete internally reinforced with glass fiber reinforced polymer (GFRP) reinforcement conforming to ASTM D7957 and designed in accordance with ACI CODE 440.11 shall be permitted where fire resistance ratings are not required and only for structures assigned to Seismic Categories A, B or C.

Exception: Concrete internally reinforced with GFRP bars shall not be permitted for concrete elements that are part of the seismic lateral force resisting system in structures assigned to Seismic Design Categories B or C.

Add new reference standard(s) as follows:

ACI
440.11-22 Building Code Requirements for Structural Concrete Reinforced with Glass Fiber-Reinforced Polymer (GFRP) Bars-Code and Commentary……1901.2.1

ASTM
D7957-17 Standard Specification for Solid Round Glass Fiber Reinforced Polymer Bars for Concrete Reinforcement……1901.2.1

Will this proposal change the cost of construction?	Decrease [ ]	Increase [ ]	No	[X]
Will this proposal increase to the cost of a dwelling by $80 or more?		Yes [ ]	No	[X]
Will this proposal affect the Local or State funds?	Local [ ]	State [ ]	No	[X]
Will this proposal cause a substantial economic impact (≥$1,000,000)?		Yes [ ]	No	[X]

- Non-Substantial – Provide an economic analysis including benefit/cost estimates.
- Substantial – The economic analysis must also include 2-alternatives, time value of money and risk analysis.
- Pursuant to §143-138(a1)(2) a cost-benefit analysis is required for all proposed amendments to the NC Energy Conservation Code. The Building Code Council shall also require same for the NC Residential Code, Chapter 11.

REASON:

Please see attached reason statement, Attachment A.

BCC CODE CHANGES

Signature: Kerry Sutton Date: 7/26/23 FORM 11/26/19

INSTRUCTIONS

Each proposed Code change request shall comply with the following policies:

Rule 1: The Original and twenty-two (22) copies of the proposed Petition for Rule-Making along with supporting documentation shall be filed with the Building Code Council Secretary. Submit one (1) electronic copy via email.

Rule 2: The filing shall be received by the first day of the month prior to the quarterly scheduled meeting date. Example: A December meeting date will require filing by November 1 prior to the meeting.

Rule 3: Each request shall be typewritten on this form and shall contain the following:
(1) The proposed rule change must be set forth in full and contain explicit reference to the affected section or sections of the Code.
(2) The request shall state the reasons for the proposed rule change with supporting documentation.
(3) The proposed rule change shall comply with the standards set forth in GS 143-138(c) and reference to the particular standards shall be set forth in the request for the amendment.
(4) The proposed rule change shall contain an economic impact analysis as required by GS 143-138(a).
(5) A proposed rule change to the NC Energy Conservation Code shall have an accompanying cost-benefit analysis as required by GS 143-138(a1)(2).

Rule 4: When a request is improperly filed or not in accordance with all the rules listed above, the BCC Secretary shall reject the submittal and notify the applicant of the proper procedure to follow.

Rule 5: Upon the proper filing of a request, the BCC Secretary shall forward one copy of said request to each council member prior to the scheduled meeting date. Persons filing proposed petitions are hereby notified of the place and time of the scheduled hearings. The BCC Secretary shall cause to be published the notice of public hearing as specified in GS 143-138(a).

Rule 6: The Council shall either Grant or Deny the proposed Petition for Rulemaking at the meeting following receipt of the proposed rule change. The Council will take no further action on items that are Denied. Granted items may be referred to Committee for review.

Rule 7: The Council will hold a public hearing on Granted items at the next quarterly scheduled meeting. The Council will take final action on Granted items at the next quarterly scheduled meeting after the public hearing.

Timeline Example

Petition received:	**February 1**
Petition Granted:	**March BCC meeting**
Notice of Hearing published:	**April NC Register**
Committee review:	**May - June**
Hearing held:	**June BCC meeting**
Final Adoption:	**September BCC meeting**
Rules Review Meeting:	**November RRC meeting**
Approved:	**December 1**

ATTACHMENT A

2021 IBC Option for ACI 440.11

Chapter 19 – Concrete

Section – 1901 General

1901.2 Plain and reinforced concrete. Structural concrete shall be designed and constructed in accordance with the requirements of this chapter and ACI 318 as amended in Section 1905 of this code. Except for the provisions of Sections 1904 and 1907, the design and construction of slabs on grade shall not be governed by this chapter unless they transmit vertical *loads* or lateral forces from other parts of the structure to the soil.

Add new text as follows:

1901.2.1 Structural concrete with GFRP reinforcement. *Cast-in-place structural concrete internally reinforced with glass fiber reinforced polymer (GFRP) reinforcement conforming to ASTM D7957 and designed in accordance with ACI CODE 440.11 shall be permitted where fire resistance ratings are not required and only for structures assigned to Seismic Design Categories A, B, or C.*

Exception: *Concrete internally reinforced with GFRP bars shall not be permitted for concrete elements that are part of the seismic lateral force resisting system in structures assigned to Seismic Design Categories B or C.*

Add new standard(s) as follows:

ACI		American Concrete Institute 38800 Country Club Drive Farmington Hills, MI 48331
Standard reference number	Title	Referenced in code section number
440.11-22	*ACI CODE-440.11-22: Building Code Requirements for Structural Concrete Reinforced with Glass Fiber-Reinforced Polymer (GFRP) Bars – Code and Commentary*	1901.2.1

ASTM		ASTM International 100 Barr Harbor Drive, PO Box C700 West Conshohocken, PA 19428
Standard reference number	Title	Referenced in code section number
D7957/D7957M-17 Reinforcement	*Standard Specification for Solid Round Glass Fiber Reinforced Polymer Bars for Concrete*	1901.2.1

Background and rationale - This proposal adds a new referenced standard: ACI CODE 440.11-22: *Structural Concrete Buildings Reinforced Internally with Fiber Reinforced Polymer (FRP) Bars – Code Requirements.* The addition of this new standard allows the design and construction of cast-in-place reinforced concrete using non-metallic reinforcement bars. The design and construction requirements contained in the standard are limited to use in structures assigned to Seismic Design Category A, B or C where fire resistance ratings are not required (Section 4.11.1). It further clarifies that GFRP bars shall not be permitted for structure elements assigned to Seismic Design Category B and C where part of seismic force-resisting systems (Section 4.4.6.5). ACI Committee 440 developed this standard to provide for public health and safety by establishing minimum requirements for strength, stability, serviceability, durability, and integrity of GFRP reinforced concrete structures.

The standard not only provides a means of establishing minimum requirements for the design and construction of GFRP reinforced concrete, but for acceptance of design and construction of GFRP reinforced concrete structures by the building officials or their designated representatives.

Due to the performance of other types of FRP reinforcement and the lack of research and testing of other types, the standard only applies to reinforced concrete structures designed and constructed with GFRP manufactured in accordance with ASTM D7957 Standard Specification for Solid Round Glass Fiber Reinforced Polymer Bars for Concrete.

GFRP reinforced concrete is especially beneficial for satisfying a demand for improved resistance to corrosion in highly corrosive environments, such as reinforced concrete exposed to water, sea water, sea air, and de-icing salts.

This standard establishes minimum requirements for GFRP reinforced concrete in a similar fashion as ACI 318 Building Code Requirements for Structural Concrete establishes minimum requirements for structural concrete reinforced with steel reinforcement. A separate standard is needed, as GFRP reinforcement behaves differently than steel reinforcement. ACI CODE 440.11 will be referenced in the 2024 International Building Code. Because of the many corrosive environments in North Carolina, acceptance of ACI CODE 440.11 prior to the review of the 2024 I-Codes can be beneficial for the health, safety, and general welfare of the public in North Carolina.

Currently GFRP is accepted for use to reinforce highway bridge decks. Acceptance is primarily in areas where saltwater is prevalent and where deicing salts are used on the roads and cause severe corrosion to conventional steel reinforcement. This proposed change provides minimum requirements for other applications where GFRP reinforced concrete is being considered, such as marine and coastal structures, parking garages, water tanks, and structures supporting MRI machines. Design reasons to use GFRP bars in structures are resistance to corrosion in the presence of chloride ions, lack of interference with electromagnetic fields, and low thermal conductivity. The use of GFRP reinforcement is accepted by the North Carolina Department of Transportation and has been specified in the Harkers Island Bridge replacement project currently under construction.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This proposal adds alternative materials for the design and construction of reinforced structural concrete in Seismic Design Category A and does not preclude the use of conventional reinforced concrete. Thus, there is no cost impact.

ATTACHMENT B

CAROLINAS CHAPTER

July 17, 2023

To: North Carolina Building Code
Council 325 North Salisbury
Street
Raleigh, North Carolina 27603

Attn: North Carolina Building Code Council

Dear Council Members:

Please accept this letter of endorsement from the ACI Carolinas Chapter Board of Directors for incorporation of *ACI 440.11-22, Building Code Requirements for Structural Concrete Reinforced with Glass Fiber Reinforced Polymer (GFRP) Bars* into requirements of the North Carolina State Building Code by reference. This standard represents a recent advancement in reinforced concrete design using lightweight bars that provides additional options for construction of some structures in North Carolina.

The current Board of Directors for ACI Carolinas making this endorsement is comprised of Professional Engineers registered in the State of North Carolina, and those that provide services related to design, construction, education, materials production, and testing for concrete and other building materials in the State of North Carolina. We believe that ACI 440.11-22, written and maintained by industry experts through ANSI accredited processes, provides fundamental and important direction for practicing engineers in the interest of safe and efficient design of reinforced concrete structures using GFRP reinforcing steel where permitted by that Standard.

ACI Carolinas Chapter is a separate legal entity from ACI International and was formed in 1975. Among its purposes are the active involvement in disseminating technical and educational information for advancing the knowledge-base and ability of local Engineers, Architects, Producers, Contractors, Material Suppliers, Testing Agencies, Students, Educators, Agencies and others for the safe and durable construction and repair of concrete structures.

I hope you are well. Please let me know if I can be of assistance.

Respectfully submitted,
ACI Carolinas Chapter Board of Directors

Edward Deaver President

ACI CAROLINAS CHAPTER
3122 FINCHER FARM ROAD, SUITE
100 #548
MATTHEWS, NC 28105

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38800 Country Club Drive
Farmington Hills, MI 48331 USA
+1.248.848.3700
www.concrete.org

North Carolina Building Codes Council
Attention: Carl Martin
325 North Salisbury Street Room 5_44
Raleigh, North Carolina 27603

July 26, 2023

Re: Code Change Proposal – 2024 NC State Building Code, Section 1901

Dear Mr. Martin,

Please find enclosed 1copies of the code change proposal and supporting information submitted by ACI on behalf of the ACI Carolinas Chapter, as well as other local and national associations and industry supporters with presence in North Carolina. Two hard copies of ACI Code 440.11-22 are also included for your review. In addition, ACI can make available complimentary digital copies of ACI 440.11-22 to all BCC and Structural Ad-Hoc committee members upon request. To receive a complimentary digital copy, I would need the name and email of the individual requesting a copy.

I look forward to hearing back from you regarding the NC Building Codes Council review of the proposal. Please contact me directly if you have any questions.

Sincerely,

Ms. Kerry Sutton, PE
American Concrete Institute
Code Advocacy Engineer
(734) 673-2195
ksutton@concrete.org

Letter to NC State Building Council

Adding ACI 440 as a Reference Standard

To whom it may concern:

My name is Jay Pease from Owens Corning Infrastructure Solutions, a manufacturer of Glass Fiber Reinforced Polymer (GFRP) rebar based in Harrisburg, North Carolina. As the in-house structural engineer for Owens Corning, I'd like to emphasize a few aspects of structural concrete design and construction with GFRP bars.

GFRP rebars have been used in concrete structures as a substitute for carbon steel rebars due to their non-corrosive behavior for more than 30 years. Removing the problems related to reinforcement corrosion provides significant benefits to the public. Let's take as an example the case of building balconies. Balconies alone represent one of the building components most affected by distress and degradation due to reinforcement corrosion. This is due to several causes such as chloride penetration, concrete carbonation, galvanic activity, and defective detailing. Resolving this problem by using GFRP reinforcement provides maintenance savings, avoids occupants inconvenience, eliminates the cause of costly litigation, and most importantly increases public safety.

A recent study was undertaken to investigate the durability of GFRP rebars extracted from 11 bridges in service for 15 to 20 years. This study commissioned by the American Concrete Institute (ACI) Strategic Development Council (SDC) intended to provide scientific evidence on field performance that is critical for the overall validation of the technology. The bridges investigated in this study are in the US and have been exposed to wet-dry cycles, freeze-thaw cycles, and deicing salts. These conditions would normally impair the long-term durability of conventionally reinforced structures. The study showed that GFRP bars did not show signs of significant physical-mechanical deterioration due to alkalinity and moisture of the surrounding concrete.

Owens Corning Infrastructure Solutions recently completed delivery of all rebar to the Harkers Island Bridge Project in eastern North Carolina. This bridge is a 28 span, 3200ft. structure entirely reinforced with FRPs. Carbon Fiber prestressing tendons were used in the bridge girders and piles, while the rest of the mild reinforcing throughout the rest of the structure was GFRP. This bridge represented a milestone for the GFRP industry due to both the scope and scale of the project, and the major benefit to the state replacing a structurally deficient steel reinforced bridge from the early 1970s with a FRP reinforced structure that will not suffer from the same ailments as the original structure.

Finally, at this time, GFRP Rebar made in accordance with ASTM D7957 is cost competitive with black steel A615 steel rebar. In some areas of the country, it is more available through distribution and local big box home improvement stores. Contractors are wanting to use GFRP rebar and building officials are continually asking for clarification regarding it's state building code approval. With the incorporation of ACI 440 and ASTM D7957 into the North Carolina State Building Code, these types of clarifications will be resolved quickly and satisfactorily to all involved parties.

Jay Pease, PE