

# **Development and Applications of FRP Reinforcements (DA-FRPR'21)**

Held at the ACI Virtual Concrete Convention 2021  
ACI SP 356

Online  
17 - 21 October 2021

**Editor:**

**Radhouane Masmoudi**

ISBN: 978-1-7138-8026-4

**Printed from e-media with permission by:**

Curran Associates, Inc.  
57 Morehouse Lane  
Red Hook, NY 12571



**Some format issues inherent in the e-media version may also appear in this print version.**

Copyright© (2021) by American Concrete Institute  
All rights reserved.

Printed with permission by Curran Associates, Inc. (2023)

For permission requests, please contact American Concrete Institute  
at the address below.

American Concrete Institute  
38800 Country Club Drive  
Farmington Hills, MI 48331 USA

Phone: (248) 848-3700  
Fax: (248) 848-3701

BKStore@concrete.org

**Additional copies of this publication are available from:**

Curran Associates, Inc.  
57 Morehouse Lane  
Red Hook, NY 12571 USA  
Phone: 845-758-0400  
Fax: 845-758-2633  
Email: curran@proceedings.com  
Web: www.proceedings.com

## TABLE OF CONTENTS

### **SP-356—1**

Bond Study of Corrosion-Free Reinforcement Embedded in Eco-Friendly Concrete .....1-35  
Authors: Ali F. Al-Khafaji, John J. Myers, and Hayder H. Alghazali

### **SP-356—2**

Numerical Investigation on Mechanical Splices for GFRP Reinforcing Bars ..... 36-45  
Authors: Nafiseh Kiani, Steven Nolan, and Antonio Nanni

### **SP-356—3**

Preliminary Experimental Results of the Bond Between GFRP Bars and Concrete ..... 46-60  
Authors: Mohammad Minhajur Rahman, Xudong Zhao, Tommaso D'Antino,  
Zahra Ameli, Francesco Focacci, and Christian Carloni

### **SP-356—4**

Development Length of GFRP Rebars in Reinforced Concrete Members under Flexure ..... 61-71  
Authors: Alvaro Ruiz Emparanza, Francisco De Caso, and Antonio Nanni

### **SP-356—5**

Modeling of Thermal Spalling for a GFRP-Reinforced Concrete Slab..... 72-87  
Authors: Jun Wang and Yail J. Kim

### **SP-356—6**

Evaluation of Progressive Damage in GFRP Bars – Low and Large Strain  
Experimental Program and Numerical Simulations..... 88-108  
Authors: Piotr Wiciak, Maria Anna Polak, and Giovanni Cascante

### **SP-356—7**

Evaluation of FRP Bars and Meshes Used as Secondary Reinforcement for  
Nonstructural Concrete Members for Building Code Compliance .....109-119  
Authors: Mahmut Ekenel, Hossein Roghani, Francisco De Caso y Basalo, and  
Antonio Nanni

### **SP-356—8**

Reliability of Compression-Controlled FRP RC Flexural Members Designed  
Using North American Codes and Standards: Comparison and FRP Material  
Resistance/Strength Reduction Factor Calibration .....120-130  
Authors: Fadi Oudah and Adam Hassan

### **SP-356—9**

Implementation of GFRP-Reinforced Concrete Draft Code Provisions .....131-151  
Authors: Isaac Higgins, Vicki Brown, and Brendan Kearns

### **SP-356—10**

Design and Driving Performance of Two GFRP-Reinforced Concrete Piles.....152-169  
Authors: Roberto Rodriguez, Vanessa Benzecry, Steven Nolan, and Antonio Nanni

### **SP-356—11**

Assessment of Shear Strength Design Models for Fiber-Reinforced Concrete  
Deep Beams Reinforced with Steel or FRP Bars .....170-190  
Authors: Ahmed G. Bediwy and Ehab F. El-Salakawy

**SP-356—12**

Effects of Masonry Infill Retrofit with FRP Materials on The Seismic Behaviour of RC Frames .....191-202  
Authors: Gianni Blasi, Daniele Perrone, and Maria Antonietta Aiello

**SP-356—13**

Literature Review on External Carbon-Fiber-Reinforced Polymer (CFRP) Reinforcements for Concrete Bridges .....203-223  
Authors: Mohamed Ahmed, Slimane Metiche, and Radhouane Masmoudi

**SP-356—14**

Nondestructive Evaluation of Reinforced-Concrete Slabs Rehabilitated with Glass Fiber-Reinforced Polymers.....224-237  
Authors: Wael Zatar, Hai Nguyen, and Hien Nghiem

**SP-356—15**

Finite Element Modeling of The Bond-Slip Behavior of CFRP Anchors .....238-257  
Authors: José Luis Jiménez and Hernán Santa María

**SP-356—16**

Effect of Prestressing Ratio on Concrete-Filled FRP Rectangular Tube Beams Tested in Flexure .....258-272  
Authors: Asmaa Abdeldaim Ahmed, Mohamed Hassan, and Radhouane Masmoudi

**SP-356—17**

Numerical Evaluation of a New Concrete Sandwich Panel Containing UHPC Wythes, and GFRP Reinforcement and Connectors ..... 273-290  
Authors: Akram Jawdhari and Amir Fam

**SP-356—18**

Flexural Design of Masonry Walls Reinforced with FRP Bars Based on Full-Scale Structural Tests .....291-311  
Authors: Nancy Torres, J. Gustavo Tumialan, Antonio Nanni, Richard M. Bennet, and Francisco J. De Caso Basalo

**SP-356—19**

Behaviour of Circular Concrete-Filled FRP Tube Columns under Lateral Impact Loading: Numerical Study .....312-326  
Authors: Maha Hussein Abdallah, Hamzeh Hajiloo, and Abass Braimah

**SP-356—20**

Nonlinear Finite Element Modeling of Continuous RC Beams Strengthened with Near Surface Mounted FRP Bars ..... 327-346  
Authors: Majid M.A. Kadhim, Akram Jawdhari, and Mohammed Altaee

**SP-356—21**

Ultimate And Fatigue Responses of GFRP-Reinforced, UHPC-Filled, Bridge Deck Joints ..... 347-374  
Authors: Imad Eldin Khalafalla and Khaled Sennah