



# ICC-ES Evaluation Report

## ESR-3663

Reissued January 2023

This report is subject to renewal January 2025.

**DIVISION: 03 00 00—CONCRETE**  
**Section: 03 01 00—Maintenance of Concrete**  
**Section 03 01 30—Maintenance of Cast-in-Place Concrete**

**REPORT HOLDER:**

**SPARTAN ACQUISITION, LLC (D/B/A GEOTREE SOLUTIONS)**

**EVALUATION SUBJECT:**

**CONCRETE STRENGTHENING USING THE RENEWWRAP® FIBER-REINFORCED POLYMER COMPOSITE SYSTEM**

**1.0 EVALUATION SCOPE**

**Compliance with the following codes:**

- 2021, 2018, 2015, 2012, and 2009 *International Building Code®* (IBC)
- 2021, 2018, 2015, 2012, and 2009 *International Residential Code®* (IRC)
- 1997 *Uniform Building Code™* (UBC)

For evaluation for compliance with codes adopted by Los Angeles Department of Building and Safety (LADBS), see [ESR-3663 LABC and LARC Supplement](#).

**Properties evaluated:**

- Structural
- Durability
- Fire resistance
- Fire propagation

**2.0 USES**

The RenewWrap Fiber-reinforced Polymer (FRP) Composite System is used to externally strengthen normal-weight reinforced concrete structural elements as an alternative to those systems permitted in the IBC and UBC. For structures regulated under the IRC, the RenewWrap FRP system may be used where an engineering design is submitted in accordance with Section R301.1.3 and may be used where approved by the code official in accordance with Section R104.11.

**3.0 DESCRIPTION**

**3.1 General:**

The RenewWrap FRP Composite System consists of high-strength fibers combined with a polymer matrix to create the FRP composite system.

**3.2 Material:**

All materials must comply with the approved specifications outlined in the GeoTree Solutions, quality documentation, dated February 10, 2022 (Rev. 6).

**3.2.1 RenewWrap Fabric Sheets:** The CF335, CF600, and CF1400 fabric sheets are made from carbon fibers that resist tensile stresses. Standard rolls of fabric are available in widths of 4, 6, 12, 24 and 48 inches (102, 152, 305, 610 and 1220 mm) and in lengths up to 100 yards (91.4 m). The rolls of fabric are packaged in boxes. RenewWrap fabrics are available with or without the EZ-Slit system. The EZ-Slit system consists of pre-established slitting zones located at various locations across the width of the roll to enable fabrics to be slit into narrower widths in the field.

**3.2.2 Polymer Matrix:**

**3.2.2.1 RenewWrap ESR:** RenewWrap ESR Saturant is a two-component, 100 percent solids, two-phase epoxy matrix used for saturating the fabric sheets. RenewWrap ESR Saturant is an ambient cure epoxy. Components A and B of the matrix are packaged in 0.25, 0.50, 1, 2.5, 5, or 55-gallon (0.95, 1.9, 3.8, 9.5, 18.9, or 208-liter) containers and are mixed at the jobsite prior to application. Custom container sizes area also available. The mixing ratio is 2:1 by volume (2 Part A to 1 Part B).

**3.2.2.2 RenewWrap LPL:** RenewWrap LPL Saturant is a two-component, 100 percent solids, two-phase epoxy matrix used for saturating the fabric sheets. RenewWrap LPL Saturant is an ambient cure epoxy. Components A and B of the matrix are packaged in 0.25, 0.50, 1, 2.5, 5, or 55-gallon (0.95, 1.9, 3.8, 9.5, 18.9, or 208-liter) containers and are mixed at the jobsite prior to application. Custom container sizes area also available. The mixing ratio is 2:1 by volume (2 Part A to 1 Part B).

**3.2.3 RenewWrap Composites:** The RenewWrap Composite System, consisting of materials described in Sections 3.2.1 and 3.2.2, have the following properties:

**3.2.3.1 RenewWrap CF335 with ESR Saturant:** In the primary (0°) direction, the composite has a design tensile modulus of 9,550 ksi (65.8 GPa), a design tensile strength of 112 ksi (770 MPa), and a corresponding elongation of 1.12 percent. Nominal ply thickness is 0.023 inches (0.58 mm).

**3.2.3.2 RenewWrap CF600 with ESR Saturant:** In the primary (0°) direction, the composite has a design tensile modulus of 9,600 ksi (66 GPa), a design tensile strength of 123 ksi (850 MPa), and a corresponding elongation of 1.16 percent. Nominal ply thickness is 0.050 inches (1.3 mm).

**3.2.3.3 RenewWrap CF1400 with ESR Saturant:** In the primary (0°) direction, the composite has a design tensile modulus of 12,300 ksi (84.8 GPa), a design tensile strength of 76.8 ksi (530 MPa), and a corresponding elongation of 0.624 percent. Nominal ply thickness is 0.085 inches (2.16 mm).

**3.2.3.4 RenewWrap CF335 with LPL Saturant:** In the primary (0°) direction, the composite has a design tensile modulus of 8,550 ksi (59 GPa), a design tensile strength of 102.7 ksi (707 MPa), and a corresponding elongation of 1.2 percent. Nominal ply thickness is 0.030 inches (0.78 mm).

**3.2.3.5 RenewWrap CF600 with LPL Saturant:** In the primary (0°) direction, the composite has a design tensile modulus of 10,000 ksi (69 GPa), a design tensile strength of 128 ksi (880 MPa), and a corresponding elongation of 1.28 percent. Nominal ply thickness is 0.05 inches (1.25 mm).

**3.2.3.6 RenewWrap CF1400 with LPL Saturant:** In the primary (0°) direction, the composite has a design tensile modulus of 11,500 ksi (80 GPa), a design tensile strength of 105.8 ksi (730 MPa), and a corresponding elongation of 0.92 percent. Nominal ply thickness is 0.083 inches (2.10 mm).

**3.2.4 Storage Recommendations:** The materials must be stored in a clean, dry area at an ambient temperature between 40°F (4.4°C) and 90°F (32.2°C). When properly stored under these conditions, CF335, CF600 and CF1400 fabrics have an unlimited shelf life. The Saturant epoxies have a shelf life of two years under the same conditions and in unopened containers.

## 4.0 DESIGN AND INSTALLATION

### 4.1 Design:

Design of the composite system is based on strength design in accordance with Chapter 19 of the IBC or the UBC. The registered design professional is responsible for determining, through analysis, the strengths and demands of the structural elements to be enhanced by the RenewWrap FRP Composite System, subject to the approval of the code official.

**4.1.1 Design Details:** Design of the RenewWrap system is based on test results and principles of structural analysis as set forth in Section 1604.4 of the IBC. The bases of design include strain compatibility, load equilibrium and limit states. All designs must follow procedures as detailed in the IBC or UBC; in the ICC-ES Acceptance Criteria for Concrete and Reinforced and Unreinforced Masonry Strengthening Using Externally Bonded Fiber-reinforced Polymer (FRP) Composite Systems (AC125), dated November 2021 (editorially revised February 2022); and in the RenewWrap System Design Criteria Report (Design Manual), dated February 2022 (Rev. 3).

**4.1.2 Design Strength:** Design strengths must be taken as the nominal strengths, computed in accordance with

Section 4.1.1 of this report, multiplied by strength reduction factors in Section 21.2 of ACI 318-19 (2021 IBC) and ACI 318-14 (2018 and 2015 IBC) or Section 9.3 of ACI 318-11 (2012 IBC) and ACI 318-08 (2009 IBC), or Chapter 19 of the UBC, as applicable.

**4.1.3 Load Combinations:** The load combinations used in design must comply with Section 1605 of the IBC and Section 5.3 of ACI 318-19 and ACI 318-14 (Section 9.2 of ACI 318-11, and ACI 318-08) or Section 1612.2 of the UBC, as applicable.

### 4.1.4 Columns:

**4.1.4.1 Potential Applications:** RenewWrap Composite System are applied to columns to enhance ductility and axial and shear strength. The RenewWrap System can also be utilized to improve the confinement of circular concrete columns.

**4.1.4.2 Structural Design Requirements:** Concrete circular column design must comply with the Design Manual and Chapter 19 of the IBC or UBC, as applicable.

### 4.1.5 Beams and Slabs:

**4.1.5.1 Potential Applications:** RenewWrap composite systems are applied to concrete beams and slabs to enhance flexural strength for gravity loads only.

**4.1.5.2 Structural Design Requirements:** Concrete beam and slab design must comply with the Design Manual and Chapter 19 of the IBC or UBC, as applicable.

**4.1.6 Bond Strength:** Where the performance of the FRP composite material depends on bond, the bond strength of FRP composite material to concrete must not be less than 200 psi (1378 kPa). Bond testing must exhibit failure in the concrete substrate. Testing in accordance with ASTM D7234 or D7522 may be used to estimate the bond strength of bond-critical installations.

## 4.2 Installation:

The RenewWrap FRP Composite System must be installed on structural elements as detailed in the manufacturer's document *RenewWrap Installation Guide*, dated February 2022 (Rev. 5). A copy of the Installation Guide must be submitted to the code official for approval of each project that uses the RenewWrap system. The on-site quality control procedures are detailed in the *GeoTree Solutions, RenewWrap Installation Manual*. Installation must be performed by applicators formally trained by GeoTree Solutions, in accordance with the QCM.

**4.2.1 Saturation:** The fabric and resin matrix of the laminate must be combined according to a volume or weight ratio as defined in the Installation Manual. Saturation may be either by hand or by a mechanical saturator.

**4.2.2 Application:** Manual methods must be used to apply the saturated laminate to concrete members prior to cure of the epoxy. Surface preparation, fiber orientation, and removal of air bubbles and voids must take place in accordance with specifications noted in the installation manual.

**4.2.3 Finishing:** The composite system is typically painted to satisfy aesthetic and environmental considerations.

**4.2.4 Flame Spread:** When applied to structural elements to satisfy requirements of the applicable code, the RenewWrap system with ESR Saturant (without any finishing described in Section 4.2.3) yields a Class 1 and Class A flame-spread classification and smoke-density in accordance with Section 802.2 of the UBC and Section 803.1 of the IBC, respectively. The composite with ESR Saturant is limited to a maximum of four plies for CF335, a

maximum of two plies for CF600, and one ply of CF1400. The thickness of each ply must be 0.023 inch (0.58 mm) for CF335, 0.05 inch (1.27 mm) for CF600 and 0.085 inch (2.16 mm) for CF1400. Flame-spread classification and smoke-density of composites with LPL Saturant have not been evaluated and outside the scope.

#### 4.3 Special inspection:

Special inspection during the installation of the system must be in accordance with the ICC-ES Acceptance Criteria for Inspection and Verification of Concrete and Unreinforced Masonry Strengthening Using Fiber-reinforced Polymer (FRP) Composite Systems (AC178), dated October 2017 (editorially revised December 2020). A statement of special inspection must be prepared in accordance with Section 1704.3 of the 2021, 2018, 2015 and 2012 IBC or Section 1705 of the 2009 IBC. Inspection must also comply with Sections 1704 and 1705 of the 2021, 2018, 2015 and 2012 IBC, Sections 1704 through 1707 of the 2009 IBC, or Section 1701 of the UBC,.

#### 5.0 CONDITIONS OF USE

The RenewWrap Fiber-reinforced Polymer Composite System described in this report comply with, or is a suitable alternative to what is specified in, those codes listed in Section 1.0 of this report, subject to the following conditions:

- 5.1 Design and installation must be in accordance with this report, the manufacturer's instructions, and the IBC or UBC, as applicable.
- 5.2 Copies of the GeoTree Solutions, RenewWrap Design Manual, dated February 2022 (Rev. 3); and the Installation Guide, dated February 2022 (Rev. 5), must be submitted to the code official for approval, upon request, for each project that uses the system.
- 5.3 Complete construction documents, including plans and calculations verifying compliance with this report, must be submitted to the code official for each project at the time of permit application. The construction documents must be prepared and sealed by a registered design professional where required by the statutes of the jurisdiction in which the project is to be constructed.
- 5.4 The fire-resistance rating of the assembly must comply with Chapter 7 of the IBC or UBC, and is not reduced by the application of the RenewWrap system. The structural load-carrying capacities of fire-resistance-rated assemblies must be based on the design of the concrete without the RenewWrap system. Fire resistance of assemblies with structural load-carrying capacities increased beyond the levels permitted by the UBC or IBC is beyond the scope of this report.
- 5.5 Special inspection must be provided in accordance with Section 4.3 of this report.
- 5.6 Application of the systems to concrete members at a fabricator's facility must be performed by an approved fabricator complying with Section 1704.2 of the IBC or Section 1701.7 of the UBC, or at a jobsite with continuous special inspections in accordance with Section 1704.4 of the IBC or Sections 1701.5.1 and 1701.5.3 of the UBC.
- 5.7 RenewWrap materials are manufactured by GeoTree Solutions, under a quality control program with inspections by ICC-ES.

#### 6.0 EVIDENCE SUBMITTED

Data in accordance with the ICC-ES Acceptance Criteria for Concrete and Reinforced and Unreinforced Masonry Strengthening Using Fiber-reinforced Polymer (FRP) Composite Systems (AC125), dated November 2021 (editorially revised February 2022); and quality control documentation.

#### 7.0 IDENTIFICATION

- 7.1 Components of the RenewWrap FRP Composite System are labeled with the GeoTree Solutions, name and address; the product name; the date of manufacture; and the evaluation report number (ESR-3663).

- 7.2 The report holder's contact information is the following:

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**DIVISION: 03 00 00—CONCRETE**  
**Section: 03 01 00—Maintenance of Concrete**  
**Section 03 01 30—Maintenance of Cast-in-Place Concrete**

**REPORT HOLDER:**

**SPARTAN ACQUISITION, LLC (D/B/A GEOTREE SOLUTIONS)**

**EVALUATION SUBJECT:**

**CONCRETE STRENGTHENING USING THE RENEWWRAP® FIBER-REINFORCED POLYMER COMPOSITE SYSTEM**

**1.0 REPORT PURPOSE AND SCOPE****Purpose:**

The purpose of this evaluation report supplement is to indicate that the RenewWrap Fiber-reinforced Polymer (FRP) Composite System, described in ICC-ES evaluation report [ESR-3663](#), have also been evaluated for compliance with the codes noted below as adopted by the Los Angeles Department of Building and Safety (LADBS).

**Applicable code editions:**

- 2020 *City of Los Angeles Building Code* (LABC)
- 2020 *City of Los Angeles Residential Code* (LARC)

**2.0 CONCLUSIONS**

The RenewWrap Fiber-reinforced Polymer (FRP) Composite System, described in Sections 2.0 through 7.0 of the evaluation report [ESR-3663](#), comply with the LABC Chapter 19, and the LARC, and are subject to the conditions of use described in this supplement.

**3.0 CONDITIONS OF USE**

The RenewWrap Fiber-reinforced Polymer (FRP) Composite System, described in this evaluation report supplement must comply with all of the following conditions:

- All applicable sections in the evaluation report [ESR-3663](#).
- The design, installation, conditions of use and identification of the composite systems are in accordance with the 2018 *International Building Code*® (IBC) provisions noted in the evaluation report [ESR-3663](#).
- The design, installation and inspection are in accordance with additional requirements of LABC Chapters 16, 17, and 95, as applicable.
- The RenewWrap Fiber-reinforced Polymer (FRP) Composite System must not be used as compressive reinforcement for strengthening concrete structure.
- Under the LARC, an engineered design in accordance with LARC Section R301.1.3 must be submitted.

This supplement expires concurrently with the evaluation report, reissued January 2023.

**DIVISION: 03 00 00—CONCRETE**

**Section: 03 01 00—Maintenance of concrete**

**Section: 03 01 30—Maintenance of Cast-in-Place concrete**

**REPORT HOLDER:**

**SPARTAN ACQUISITION, LLC (D/B/A GEOTREE SOLUTIONS)**

**EVALUATION SUBJECT:**

**CONCRETE STRENGTHENING USING THE RENEWWRAP® FIBER -REINFORCED POLYMER COMPOSITE SYSTEM**

**1.0 REPORT PURPOSE AND SCOPE**

**Purpose:**

The purpose of this evaluation report supplement is to indicate that the Concrete Strengthening Using The RenewWrap® Fiber-Reinforced Polymer Composite System, described in ICC-ES evaluation report ESR-3663, has also been evaluated for compliance with the code(s) noted below.

**Applicable code edition(s):**

- 2022 California Building Code (CBC)

For evaluation of applicable Chapters adopted by the California Office of Statewide Health Planning and Development (OSHPD) AKA: California Department of Health Care Access and Information (HCAI) and the Division of State Architect (DSA), see Sections 2.1.1 and 2.1.2 below.

- 2022 California Residential Code (CRC)

**2.0 CONCLUSIONS**

**2.1 CBC:**

The Concrete Strengthening Using The RenewWrap® Fiber-Reinforced Polymer Composite System, described in Sections 2.0 through 7.0 of the evaluation report ESR-3663, complies with CBC Chapter 19, provided the design and installation are in accordance with the 2021 *International Building Code*® (IBC) provisions noted in the evaluation report and the additional requirements of CBC Chapters 16, 17 and 19, as applicable.

**2.1.1 OSHPD:**

The applicable OSHPD Sections and Chapters of the CBC are beyond the scope of this supplement.

**2.1.2 DSA:**

The applicable DSA Sections and Chapters of the CBC are beyond the scope of this supplement.

**2.2 CRC:**

The Concrete Strengthening Using The RenewWrap® Fiber-Reinforced Polymer Composite System, described in Sections 2.0 through 7.0 of the evaluation report ESR-3663, complies with CRC Section R301, provided the design and installation are in accordance with the 2021 *International Residential Code*® (IRC) provisions noted in the evaluation report and the additional requirements of CRC Chapter R301, as applicable.

This supplement expires concurrently with the evaluation report, reissued January 2023.