

Tahoe Palisades Slab Strengthening

Slab Strengthening Utilizing the LOCTITE Tyfo FRP Systems

SURFACE PREPARATION

1. Ensure all structural cracks, spalls, damaged and unsound concrete are repaired with conventional methods to create a flat or slightly convex surface (by others) prior to surface preparation or installation of the LOCTITE Tyfo FRP systems. All crack injection & concrete repairs shall be cured & free of moisture prior to surface preparation or installation of the LOCTITE Tyfo FRP systems.

2. Surfaces shall be prepared for bonding by means of abrasive blasting or grinding to remove existing laitance and expose aggregate [minimum ICRI CSP-3 concrete surface profile].

3. The surface to receive the composite shall be free from fins, sharp edges and protrusions that will cause voids behind the installed composite or that, in the opinion of the Engineer of Record, will damage the fibers.

4. For drilling anchor holes or creating penetrations, scanning steel rebar / tendons shall be done (by others) to avoid damaging steel reinforcement.

5. The surfaces to receive the composite shall have no free moisture at the time of application.

6. All contact surfaces shall be cleaned by hand, vacuum or compressed air.
11. Protect areas adjacent to surfaces that will receive composite (e.g. prevent epoxy staining or contamination).

12. Apply one prime coat of epoxy resin to the substrate (2 mil TYP.). Allow sufficient time for primer to become tacky to the touch or to soak into the substrate and create a damp surface with no standing liquid.

13. Apply a uniform layer of thickened LOCTITE Tyfo S Epoxy (15-30 mil TYP.) to prepare for bonding composite material and to fill uneven surfaces (up to 0.5" bug holes). Ensure that out of plane deviations are less than one-half inch per foot.

14. Apply saturated fabric to substrate by hand. Fiber waviness or skew cannot exceed one-half inch per foot. Ensure proper orientation of the fabric.

15. Pre-saturate composite anchors by hand in a bath. Installation of dry anchors is prohibited.

16. Fill the drilled hole MIN. 75% volume with thickened LOCTITE Tyfo S epoxy prior to installation.

17. Embed saturated anchor (with insertion tool) to the specified depth. Maintain tension in the anchor with the insertion tool and splay free end of anchor as detailed.

18. Apply subsequent composite layers, continuously or spliced, until designed number of layers is achieved.

INSTALLATION

1. Verify ambient and concrete temperatures. No work shall proceed if the temperature of the concrete surface is less than 50°F or greater than 100°F or as specified on the epoxy component labels. Substrate shall be at least 5°F above the dew point.

2. The concrete substrate shall have no free moisture at the time of FRP application and shall remain dry during the FRP system installation.

3. The LOCTITE Tyfo SCH-41 system applied to the concrete substrate shall be protected from exposure to direct water (rain, river water) for a minimum 72 hours after installation when the average daily temperature is at least 70°F. The installed FRP system shall be fully cured, exhibiting a solid surface with no tackiness to the touch before being exposed to any direct water

4. Fabric shall be completely saturated prior to application to contact surface. Both the epoxy resin and fabric shall be measured accurately, combined, and applied uniformly at the rates shown on the product data sheets.

5. All cutting of fabrics, mixing of epoxy and combination thereof shall take place in a protected area away from critical structure functions and any electrical equipment.

6. Clearly mark exact hole locations for drilling FRP anchors. Clearly mark exact FRP placement over the roughened surface to prevent waviness or out-of-straightness deviations.

7. Drill holes for fiber anchors with a rotary hammer drill and a carbide bit. Grind edges around anchor holes for smooth transitions. Scanning steel rebar / tendons shall be done (by others) to avoid damaging steel reinforcement.

8. Clean anchor holes with a steel bristle pipe brush equal to or greater than the concrete bit size (perform 5 insertions minimum).

9. Remove dust and debris created by anchor hole drilling and grinding with HEPA filtration vacuum equipment.

10. Repeat the previous two anchor installation/cleaning steps until all holes are created.
19. Using a roller or hand pressure, release or roll out entrapped air, and ensure that each individual layer is firmly embedded and adhered to the preceding layer or substrate.

20. Finish all exposed surfaces of the FRP systems, including overlaps, seams and edges, with a 20-30 mil thick coat of thickened LOCTITE Tyfo S Epoxy. Thickened LOCTITE Tyfo S Epoxy to extend 1-2" beyond fabric onto roughened surface.

Key-Coat Finish (Top of slab): Immediately apply a 15-to-20mil coat of thickened Tyfo S epoxy to all exposed surfaces extending at least 1" (25mm) past all edges. Immediately broadcast 10-to-16 mesh coarse, washed, dry sand to all exposed surfaces. Immediately blow any excess sand via a portable blower forward into the wet coating and discard any excess/loose sand. Allow installation to cure, undisturbed for at least 48-hours prior to the application of flooring or roofing materials.

21. At 75°F, allow a minimum cure time of 24 hours prior to the application of finishes. If after 72 hours the epoxy is cured, the surface must be roughened by hand sanding or brush blasting, prior to finishing. Cure is a function of the environment, and thus environmental conditions dictate the applications window.

22. Suggested finish: Two-coats of owner-approved, exterior grade paint. Finish requirements and color specified in the project specifications shall supersede Fyfe's suggested finish and the installer shall select a finish coat system to meet those requirements. The Fyfe LOCTITE Tyfo FRP Systems are inert and, therefore, compatible with all finish coat systems. See general notes for proper surface preparation prior to coating.

Sheet Set	
Sheet 1	Title sheet & General Notes
Sheet 2	Special Inspection & Testing
Sheet 3	Slab Plan View - Top FRP Layout
Sheet 4	Slab Plan View - Bottom FRP Layout
Sheet 5	Typical Details
Sheet 6	Typical Details

MATERIALS:

LOCTITE Tyfo SCH-41-2X Unidirectional Carbon Fiber System

7/8" Diameter LOCTITE Tyfo SCH Composite Anchors

LOCTITE Tyfo S Epoxy

10-16 Mesh, Coarse, Washed, Kin-dried Sand

Thickened LOCTITE Tyfo S Epoxy: LOCTITE Tyfo S Epoxy thickened with Cab-o-sil TS-720 (or Fyfe-approved inert filler) to provide a smooth base for applying the fiber-epoxy resin laminate. The amount of Cab-o-sil TS-720 added shall not exceed 7% by weight and is field adjusted based on application and temperature.

GENERAL NOTE: The details in this shop drawing set are based on the project drawings and any verified site conditions prior to installation. Any site conditions that are not shown in these shop drawings which would impede or alter the installation of the LOCTITE Tyfo Systems as detailed, shall be immediately communicated to FYFE and/or the Engineer-of-Record. Do not proceed with any work at these locations until revised detailing is approved.

DISCLAIMER: FYFE did not analyze the capacity of the existing structural members or its condition. The details and notes shown on these drawings are only relevant to and only intend for the specific LOCTITE Tyfo products called out. In no event should these drawings or any details or notes herein be used without the specific LOCTITE Tyfo products called out. No use or reliance on these drawings or any details or notes herein without the specific LOCTITE Tyfo products is strictly prohibited. Should other products be used on the project, these stamped drawings shall be considered null and void and FYFE its employees, directors, and affiliates assume no liability with respect to such use. These stamped drawings do not in any way infer equivalency of any product(s) to that of the LOCTITE Tyfo FRP systems shown. These stamped drawings do not imply the approval from any relevant authority having jurisdiction.



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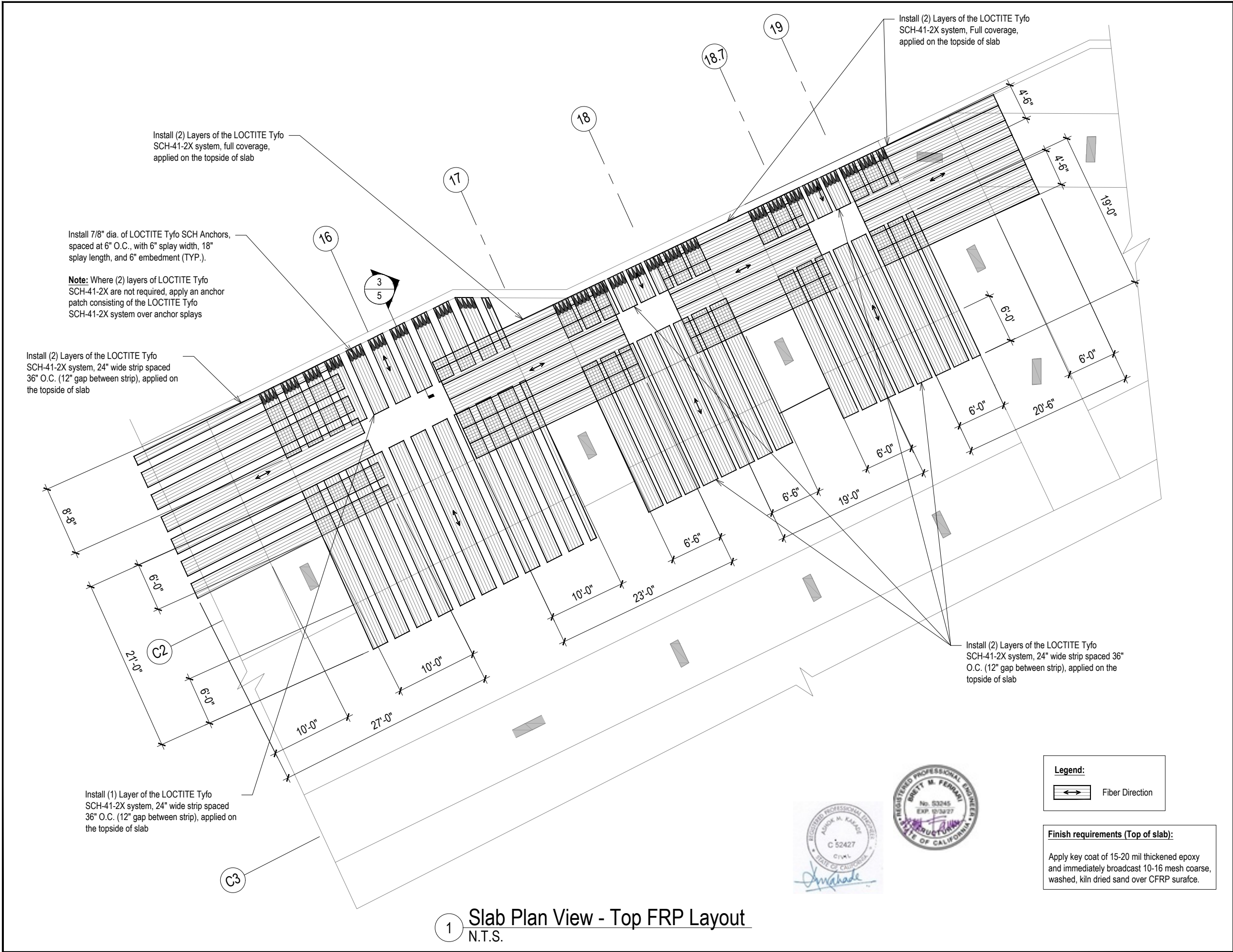


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Dwg. No.:	Sheet 1 of 6	Title sheet & General Notes	

INSPECTION AND TESTING A. Field Inspection 1. The contractor shall monitor the mixing of all epoxy components for proper ratio and adherence to manufacturer's recommendations. Record batch numbers for fabric and epoxy used each day and note locations of installation. 2. Special inspection is required. The Inspector shall observe all aspects of preparation, mixing, saturation and application. All FRP composite applied areas shall be inspected in accordance with the manufacturer's specifications. All defective areas shall be repaired as per Section 3.04 in this specification. B. ASTM D7522 – Direct Tension Adhesion Tests 1. Direct tension adhesion testing shall be conducted using the method described by ASTM D7522. A minimum of one test location per 1,000 ft² of surface area, per type of substrate, type of structure, or for each surface preparation technique used. One test location requires three pull-off tests. 2. The pull-off test shall be performed on one layer of the FRP composite material required for the strengthening application. 3. Pull-off tests shall be performed on a representative area adjacent to the repair location whenever possible. If no adjacent areas exist, the tests shall be conducted on areas where the installed FRP system will be subjected to relatively low stress during service. Patch pull-off test locations if the test is conducted on the areas requiring strengthening (e.g. if an adjacent representative area was not available). 4. The bonded FRP shall be applied utilizing representative surface preparation and FRP installation methods. The test location shall be allowed to cure per manufacturer's requirements before execution of the direct tension pull-off test. 5. The minimum acceptable value for any pull-off test is 200 psi. Additional tests may be performed to qualify the work at each identified area. Each pull-off test is to exhibit a failure mode in the substrate and not the epoxy-to-substrate bond plane. C. Laboratory Tensile Testing 1. Sampling a. Record lot number of fabric and epoxy resin used, and location of installation. Measure square footage of fabric and volume of epoxy used each day. Label each sample from each day's production. b. Contractor shall make one "sample batch" per day. A "sample batch" shall consist of two 12" x 12" samples of cured composite. The owner is to keep one 12" x 12" sample and the certified applicator shall keep the other from each sample batch. The samples to be tested shall be a percentage of the samples retained by the owner or owner's representative. The reported properties for the ultimate tensile stress and the tensile modulus shall be based on the gross laminate thickness as indicated on the product data sheet. 2. Preparation of Samples a. Prepare sample on a smooth, flat, level surface covered with polyethylene sheeting, or 16 mil plastic film, prime with epoxy resin. Then place saturated fabric and apply additional topping of epoxy. Samples can be 1 or 2 layers depending on the product thickness and as per manufacturer's instructions. Cover with plastic film and squeegee out all bubbles. b. Samples shall not be moved for a minimum 48 hours after casting. After removing from sample table, samples shall be stored in a secured location / box. The prepared, identified samples shall be given to a pre-approved and experienced testing laboratory. The laboratory shall then precondition samples for 48 hours at 140°F before testing. 3. ASTM D7565 and/or ASTM D3039 – Material Tension Tests a. (Test at owner's discretion) Typically, a minimum of 15% of the owner's samples are tested. If one 12" x 12" sample fails (on average), an additional sample shall be randomly chosen and tested. If these specimens also fail (on average), another 12" x 12" sample shall be randomly chosen and shall be sent to an alternate testing lab to be tested. In the extreme case that this sample also fails, remedial measures, per Section 3.6, will be taken to ensure integrity of the system. 4. Acceptance Criteria a. The test results obtained from the ASTM D7565 and/or ASTM D3039 field test specimens shall be evaluated as per ACI SPEC 440.12 Section 3.5.5.8. Properties shall be based on gross laminate thickness as reported by the manufacturer. b. If the calculated test results are lower than the values in section 2.01, the following remedial measures shall be considered: i. Calculations performed using the tested value shown to meet the original design demand as accepted by the engineer of record (EOR). ii. Additional material installed as accepted by the EOR at no additional cost to the owner.	Revision No.	Revised By	Revision Date
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Dwg. No.:	Sheet 2 of 6	Special Inspection & Testing	





1 Slab Plan View - Top FRP Layout
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Revision No.	Revised By	Revision Date

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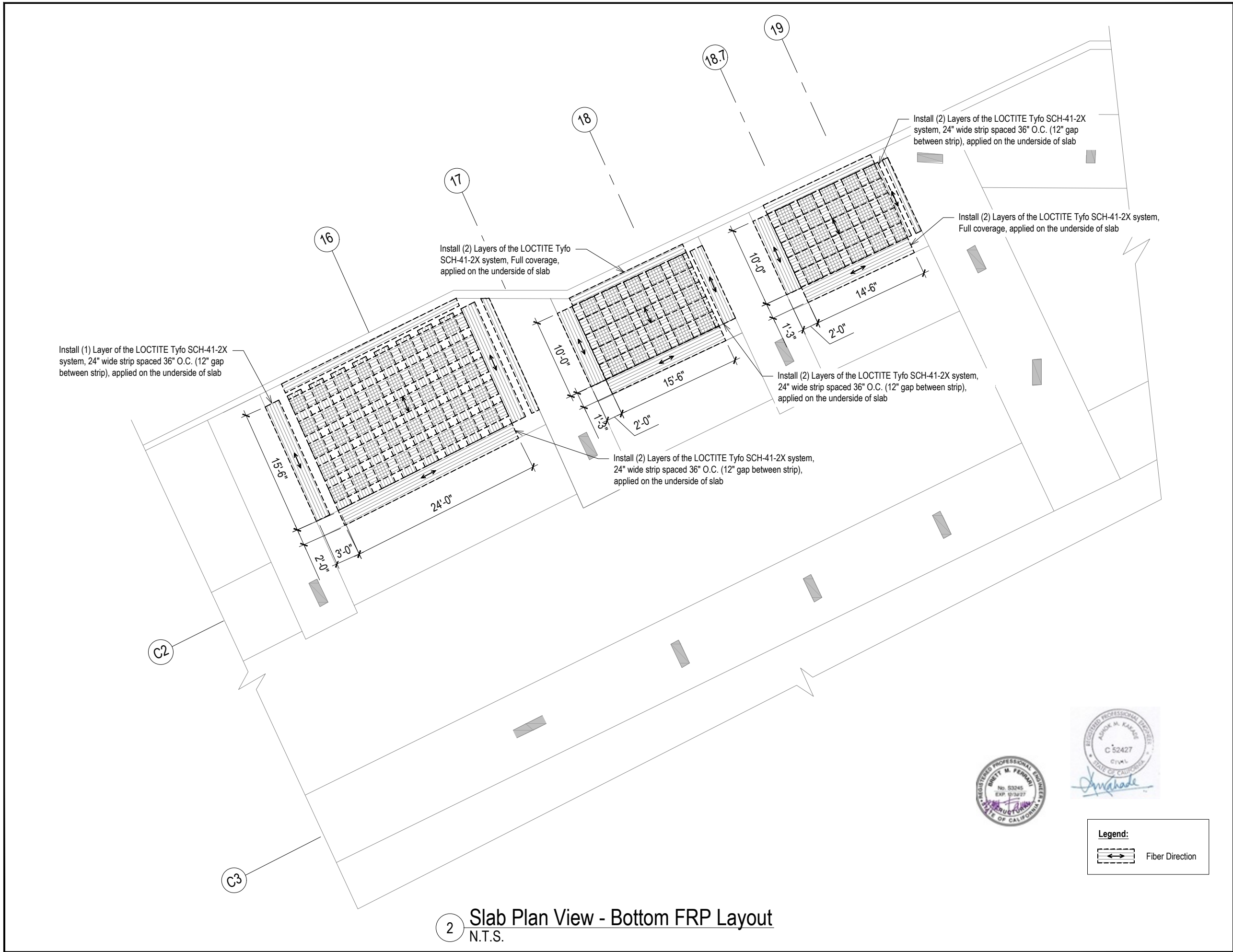
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Dwg. No.:	Sheet 3 of 6	Slab Plan View - Top FRP Layout	



2 Slab Plan View - Bottom FRP Layout
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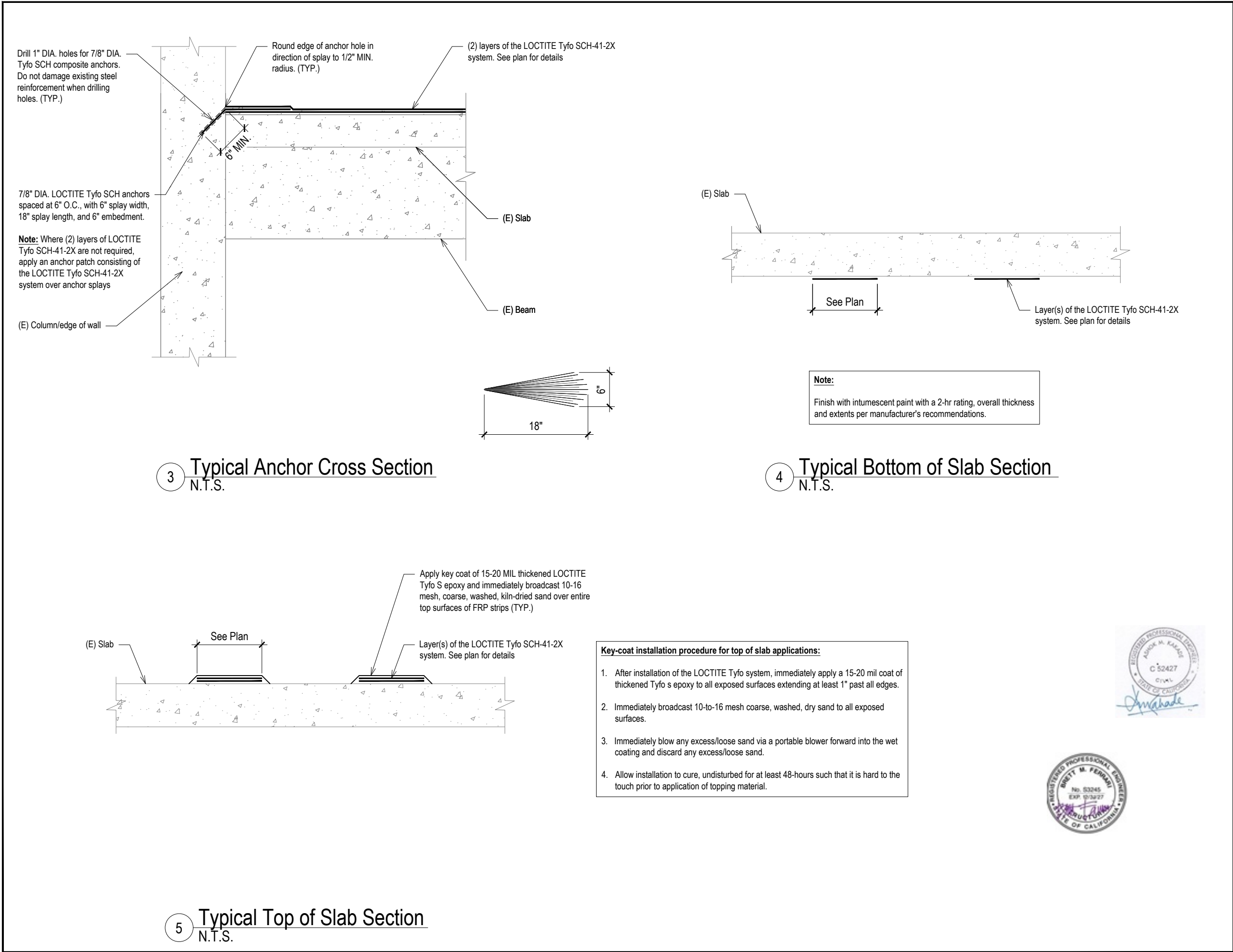
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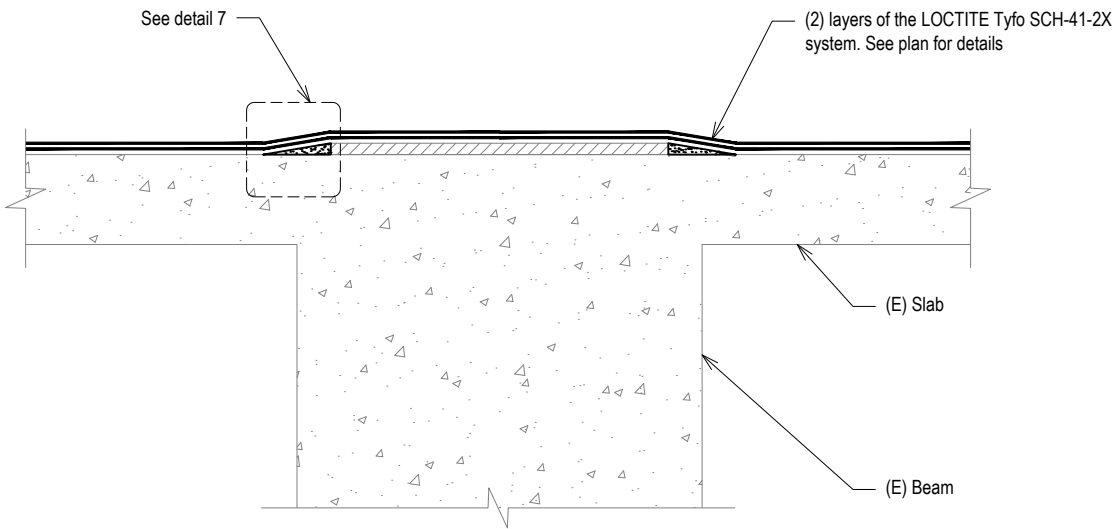


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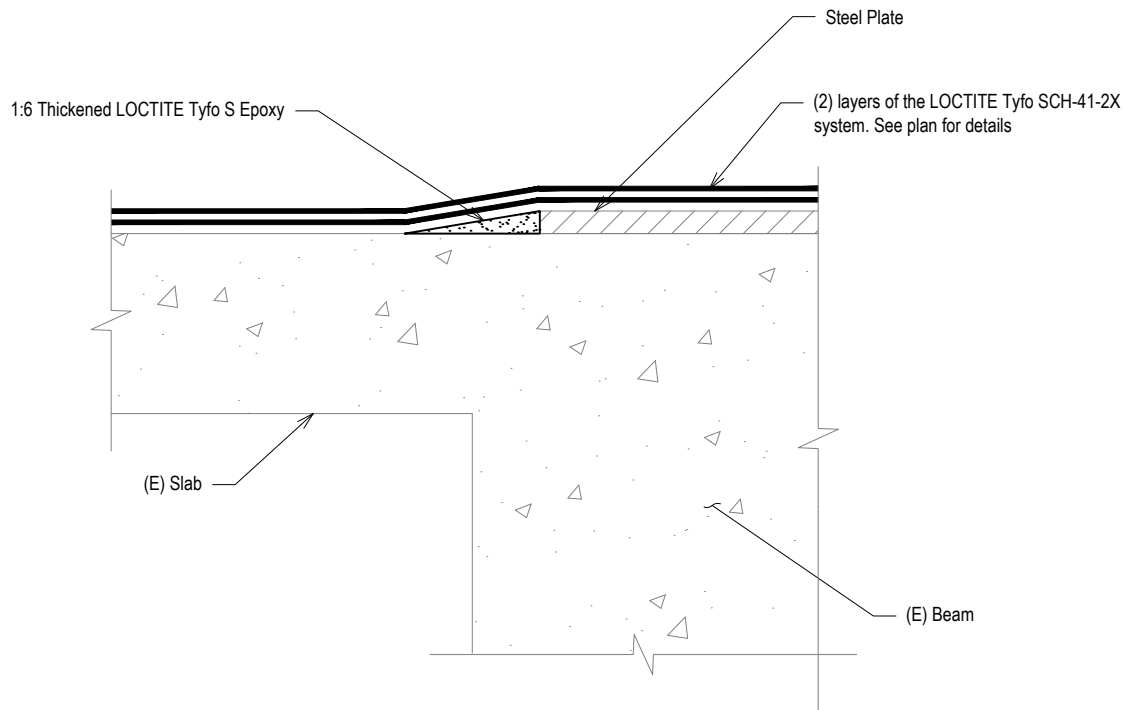
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Dwg. No.:	Sheet 4 of 6	Slab Plan View - Bottom FRP Layout	



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Dwg. No.:	Sheet 5 of 6	Typical Beam Elevation



6 FRP Over Steel Plates Detail
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7 FRP Over Steel Plates Detail
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Dwg. No.:	Sheet 6 of 6	Typical Details	