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TABLE OF ESTIMATED QUANTITIES

Item	Description	Unit	Quantity
0788-6001	CONCRETE BEAM REPAIR	EA	
0788-6002	CONCRETE BEAM REPAIR (CFRP)	EA	
0788-6003	CONCRETE BEAM REP (STRAND SPLICE & CFRP)	EA	

- 1 Item 788-6001, "Concrete Beam Repair"
- 2 Item 788-6002, "Concrete Beam Repair (CFRP)"
- 3 Item 788-6003, "Concrete Beam Rep (Strand Splice & CFRP)"

NOTE TO DESIGNER:
 This drawing is to be used as a guide for repairs to prestressed concrete beams damaged by overheight impacts.
 CFRP notes and details are only valid for Items 0788-6002 and 0788-6003.
 Pneumatically applied concrete may be used for concrete repair in accordance with Item 431, "Pneumatically Placed Concrete" when splicing strands is required or major spalling of the concrete has occurred.
 Contact Bridge Division for guidance on number of strands that may need to be spliced.
 Plan, elevation, and photos shown as example only. Designer to modify as needed. Raster images of plan and elevation from as-built plans highlighting damage locations are acceptable.
 This sheet may not be used without modification. The details shown may need to be amended if the exact existing conditions are not covered. In all cases details and notes not required must be deleted. This note and the phrase "Not to be used as a standard" must be removed and the sheets must be signed and sealed by a Professional Engineer.

MATERIAL NOTES:

- Submit detailed concrete repair procedure for approval prior to beginning work.
- Choose a FRP system prequalified for Structural Member Protection that meets the requirements of DMS 4700, "Externally Bonded Fiber Reinforced Polymer (FRP) System for Repairing and Strengthening Concrete Structure Members."
- Perform CFRP pull-off test according to Item 786, "Carbon Fiber Reinforced Polymer" in the presence of the Engineer.
- Use concrete repair materials listed on the current Material Producer List for DMS 4655 with a minimum 3-day compressive strength of 3,000 psi and a 28-day compressive strength of 6,000 psi for the repairs as approved by the Engineer.

GENERAL NOTES:

- Verify impact damage locations and extents prior to starting work.
- Immediately notify the Engineer if any discrepancies are noted between the plans and actual conditions.
- Refer to TxDOT's Concrete Repair Manual, Chapter 3, Section 5 for details on Epoxy Injection.
- All work for repairing and protecting the beam is paid for in accordance with Item 788, "Concrete Beam Repair."
- The strand-splice assembly and dimensions depicted in the repair detail are for the GRABB-IT Cable Splice system as sold by Prestress Supply, Inc. Contractor may propose other strand-splice systems to Engineer for approval.
- Damage locations and quantities are based on field assessment performed on DATE. Verify extent of damage and repairs prior to proceeding. Immediately notify Engineer if any discrepancies are noted between the plans and actual conditions.
- Submit detailed repair procedures, including proposed proprietary materials, for approval prior to beginning work.
- Perform work in accordance with the "TxDOT Concrete Repair Manual," Item 788, "Concrete Beam Repair" and the details shown in the plans.

LOAD RATING INFORMATION

Repairs performed in accordance with the details shown will result in the following superstructure load ratings:

Operating: HS _____
 Inventory: HS _____

SHEET 1 OF 4

Bridge Division

PRESTRESSED CONCRETE BEAM REPAIR DETAILS

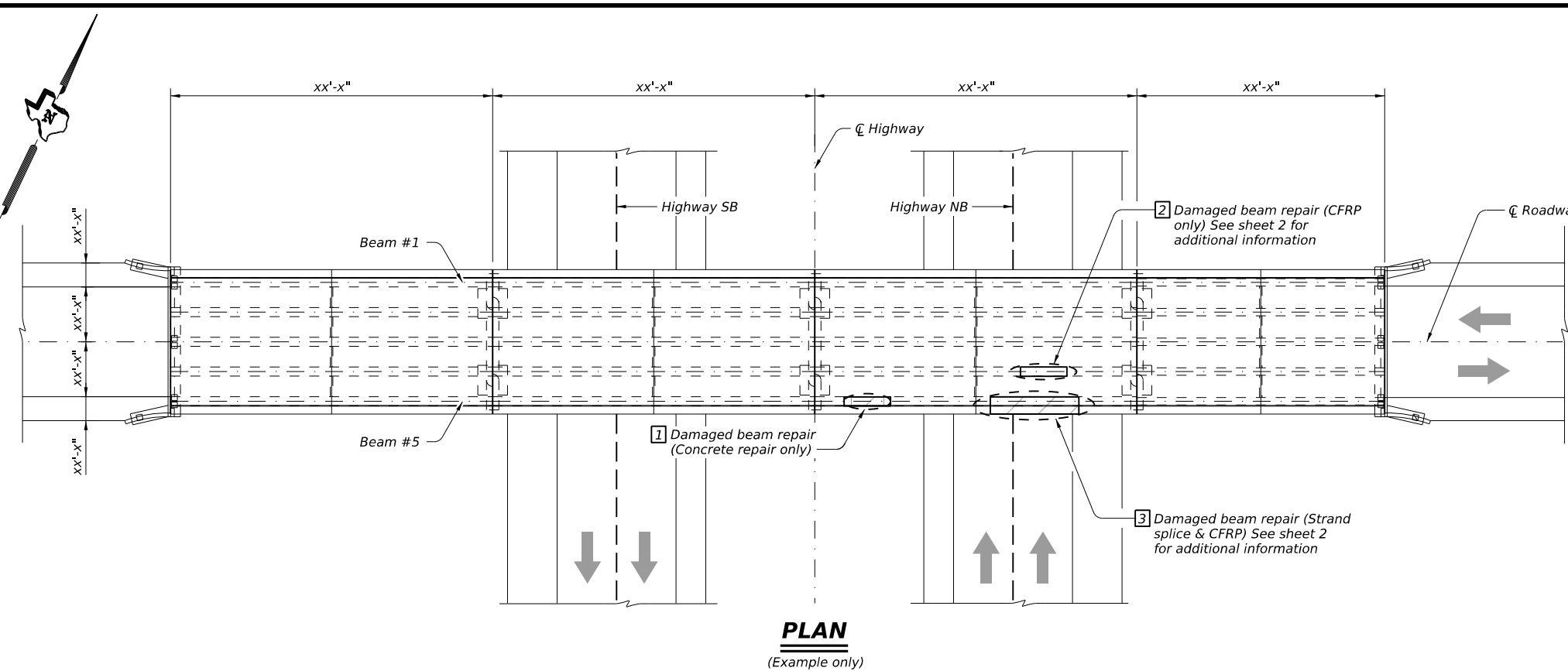
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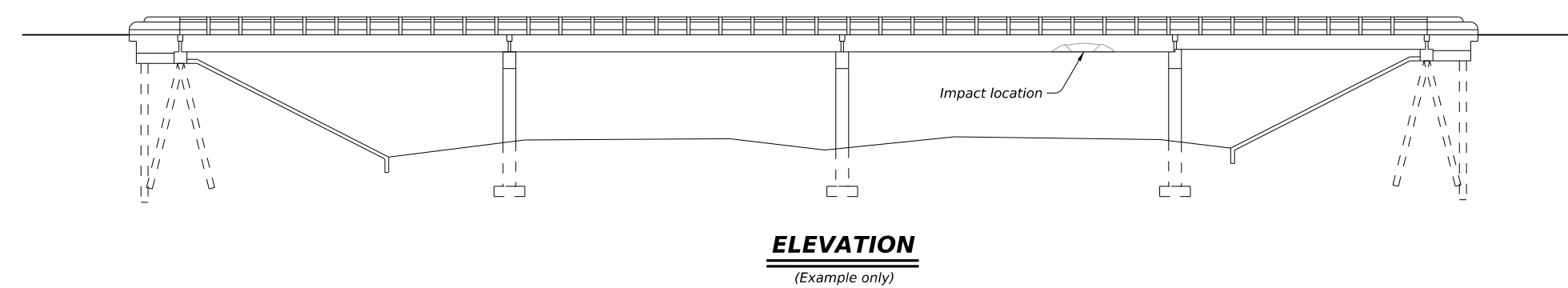
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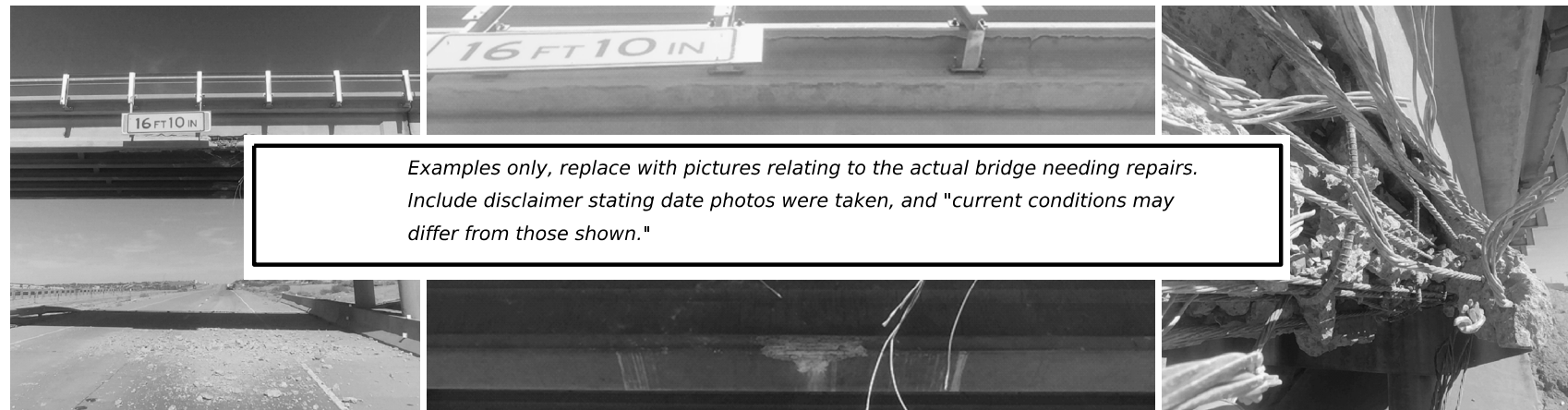
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PLAN
(Example only)



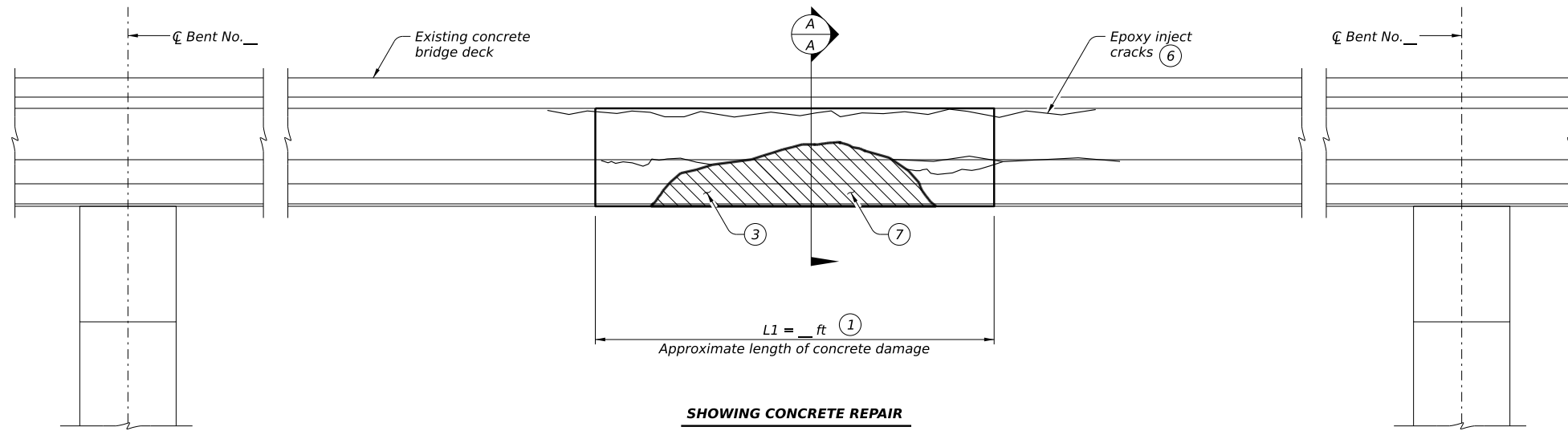
ELEVATION
(Example only)



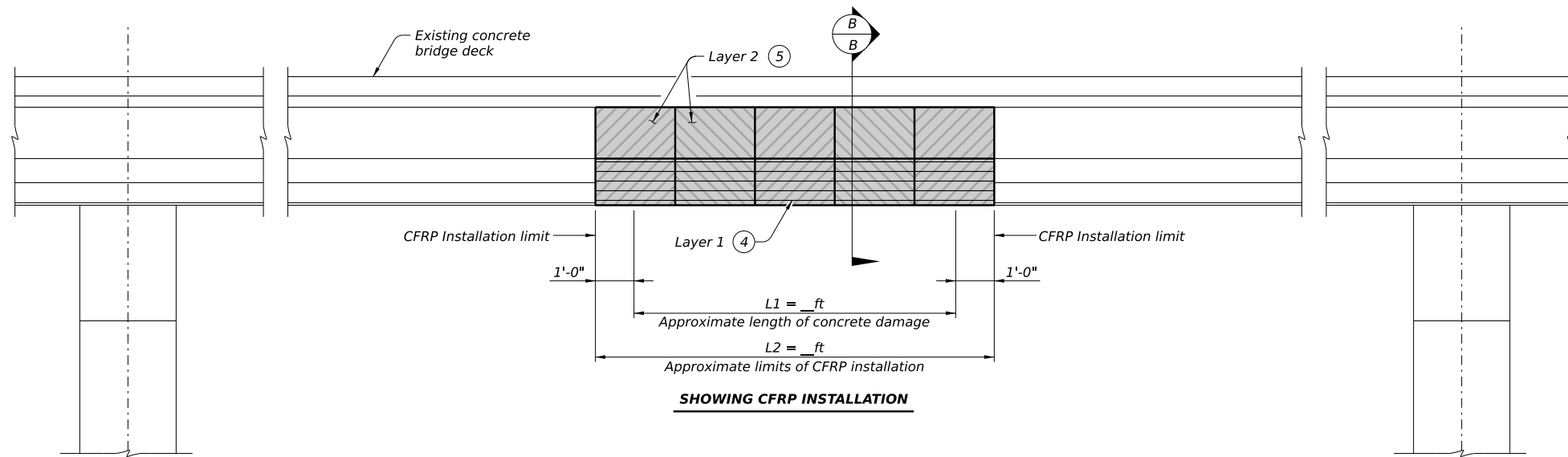
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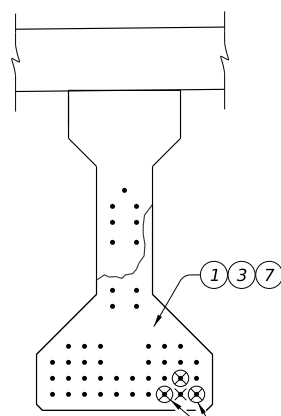


SHOWING CONCRETE REPAIR



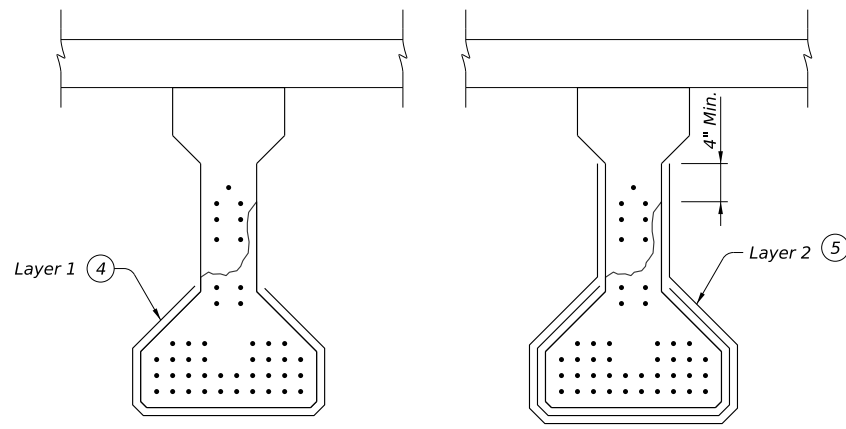
SHOWING CFRP INSTALLATION

ELEVATIONS



ELEVATION

Showing concrete beam repair and strand splicing locations. Remove enough concrete to provide adequate clearance for splices.



ELEVATION

Showing CFRP installation

TABLE OF REPAIRS (8)

NBI	Beam #	Beam Type	Bid Code	Beam Damage Length		CFRP and Coating Application		Crack Repair
				L1(ft)	L2(ft)	Area(SF)	LF	
XX-XXX-0-XXXX-XX-XXX								

- 1 Remove existing damaged and delaminated concrete.
- 2 Splice severed strands in accordance with Item 788, "Concrete Beam Repair." Offset splice locations to reduce congestion. See Sheets 3 and 4 for additional information.
- 3 Repair damaged concrete in accordance with the "TxDOT Concrete Repair Manual" and Item 788, "Concrete Beam Repair."
- 4 First layer - place 24" wide carbon fiber fabric sheets longitudinally on beams/girders, with fiber orientation parallel to beam/girder centerline. Overlap fabric sheets a minimum of 6" in the longitudinal direction.
- 5 Second layer - place carbon fiber fabric sheets transversely on beam/girder, with fiber orientation perpendicular to beam/girder centerline. Wrap sheets on bottom and sides of beam/girder to limits shown. Vertical strips may terminate 4" above topmost horizontal crack.
- 6 Crack length and location are estimates only. Perform crack injection in accordance with Item 780, "Concrete Crack Repair."
- 7 Furnish and place pneumatically applied concrete for concrete beam repair in accordance with Item 431, "Pneumatically Placed concrete."
- 8 Quantities shown are for Contractor's information only. Payment for all repairs shown on these details is subsidiary to Item 788, "Concrete Beam Repair."

PROCEDURE:

1. Set traffic control as directed by the Engineer.
2. Sound and remove loose and delaminated concrete. Use only hand tools or power driven chipping hammers (15 lbs. max) to remove loose and damaged concrete to excavate behind prestressing strands.
3. Splice severed strands.
4. Perform concrete repair work.
5. Perform concrete crack repair.
6. Install CFRP.
7. Coat repair area with concrete paint in accordance with Item 786, "Carbon Fiber Reinforced Polymer."
8. Overpass can be opened to traffic after repair material reaches 3,600 psi and CFRP has completely cured.

INSTALLATION NOTES:

Extent of damaged and spalled concrete varies. See "Table of Repairs" for approximate lengths.
 Repair in accordance with Item 788, "Concrete Beam Repair" and Sections 3.2 and 3.3 of the TxDOT "Concrete Repair Manual."
 Place the carbon fiber reinforced polymer (CFRP) and protective top coat in accordance with Item 786, "Carbon Fiber Reinforced Polymer".
 Extend CFRP at least 12 inches beyond damaged area as shown.

SHEET 2 OF 4

Bridge Division

PRESTRESSED CONCRETE BEAM REPAIR DETAILS

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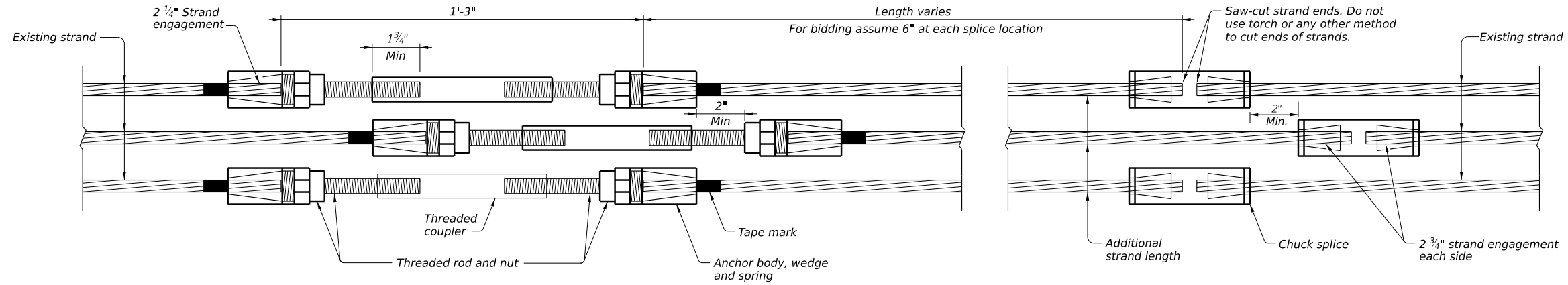
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PRESTRESSED STRAND SPLICE ASSEMBLY DETAIL

(Verify and follow Manufacturer's instructions)

STRAND SPLICE NOTES:

- 1) Field verify strand size and provide chuck splice and strand engagement to accommodate 1/2" diameter low relaxation, 270 ksi (LR270) strand for additional length to fill in gaps. Provide 7-wire prestressing strand and prestressing hardware meeting the requirements of Item 425, "Precast Prestressed Concrete Structural Members."
- 2) Prior to the actual installation of the splice system, perform a mock-up installation with the crew that will perform the production work to demonstrate that the system can be installed in accordance with the manufacturer's instructions and these plans. Refer to Sheet 4 for specific requirements. Schedule mock-up and perform in the presence of the Engineer.
- 3) Use a saw to remove loose sections of existing strand and to cut new strand for filling in gaps. Cut evenly to leave intact whole end for engagement with splicing system. Plan cutting locations to account for staggering splice assemblies to avoid congestion. Do not use a torch to cut new or existing strand. If installing anchors or pins to bond concrete repair material to substrate, do so prior to proceeding to Step 4.
- 4) Prior to installation of the splicing system, clean and lubricate the threads in accordance with the manufacturer's instructions. Keep strands, wedges, and splice chucks free of lubricant.
- 5) Handle and install splicing devices according to manufacturer's instructions. Hand-tighten the splicing system to meet the minimum thread and strand engagement requirements from the manufacturer and this plan sheet. Install splicing system on all strands to be spliced before tensioning any of the splices.
- 6) Splice severed strands and apply a tensile force as shown in the Stressing Table to each strand. Use the same torque wrench calibrated during the system mock-up. Do not reuse any hardware utilized during the mock-up or calibration for production work.
- 7) Tension all strand splices gradually to 50%, then all to 75%, and then all to 100% of the required tensile force.

CONCRETE REPAIR NOTES:

- 1) Remove delaminated, loose, and unsound concrete as indicated on the plans. Remove all previously applied repair material. Use only hand tools or power driven chipping hammers (15 lb. max) to remove concrete and to excavate behind reinforcing bars.
- Note: Notify Engineer after completing Step 1. Engineer will verify extent of damage and strand splice locations. Do not proceed to Step 2 until completing strand splice work.
- 2) Preload the beam by placing a loaded 10 cubic yard dump truck at midspan prior to performing concrete repairs. Leave the truck in place until concrete repair material has obtained a minimum concrete compressive strength of 3,000 psi. The truck may not be removed earlier than 48 hours after applying repair material.
 - 3) Bend, but do not remove, damaged steel reinforcement and strands to ensure there will be 1" minimum concrete cover in the repair area.
 - 4) Remove rust, oil, and other contaminants from concrete and reinforcing steel surfaces. Just prior to applying repair material, blast the repair area using a high-pressure air compressor equipped with filters to remove oil.
 - 5) Cut square or slightly undercut shoulders approximately 1 in. deep along the perimeter of the repair areas. Sandblast the surface to clean all rust from exposed reinforcing steel and to produce a clean, rough-textured surface on the concrete. Wet the surface to achieve an SSD condition.
 - 6) Apply the repair material over a saturated surface-dry (SSD) substrate. Achieve SSD as detailed in the Concrete Repair Manual. Apply the repair material and moist cure for a minimum of 48 hours using wet mats, water spray, ponding, or other method approved by Engineer. Follow all Manufacturer instructions for surface preparation, material application, and curing.

STRESSING TABLE

LR270 Strand Dia (in)	Nominal Area (in ²)	Required Tensile Force, kips (70% of Ultimate)
3/8	0.085	16.0
7/16	0.115	21.0
1/2	0.153	28.0
5/8	0.217	41.0

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SHEET 3 OF 4

Texas Department of Transportation
Bridge Division

PRESTRESSED CONCRETE BEAM REPAIR DETAILS

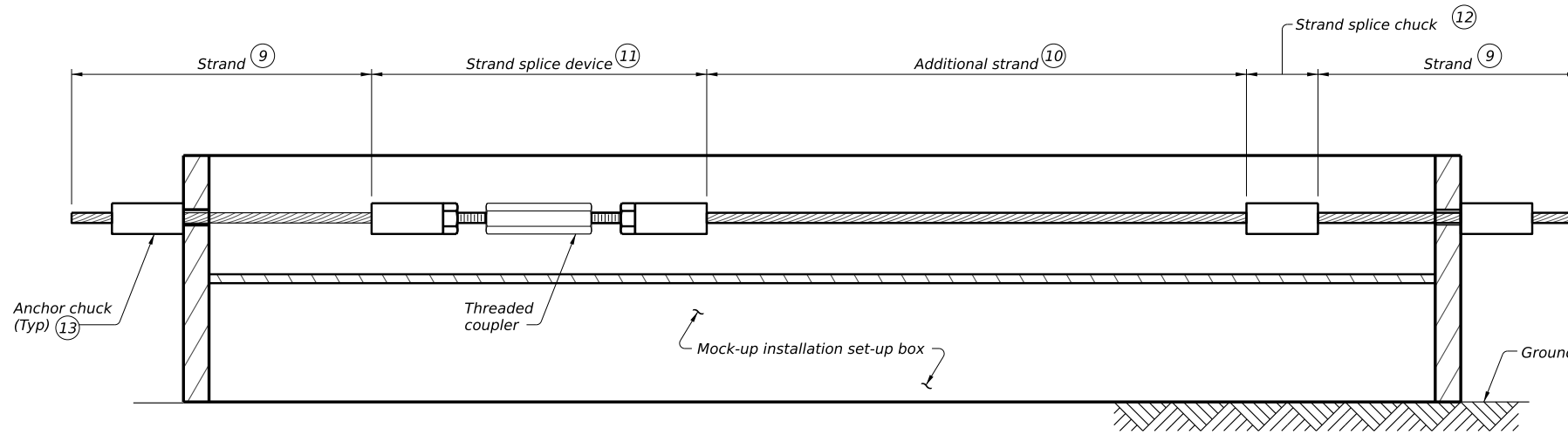
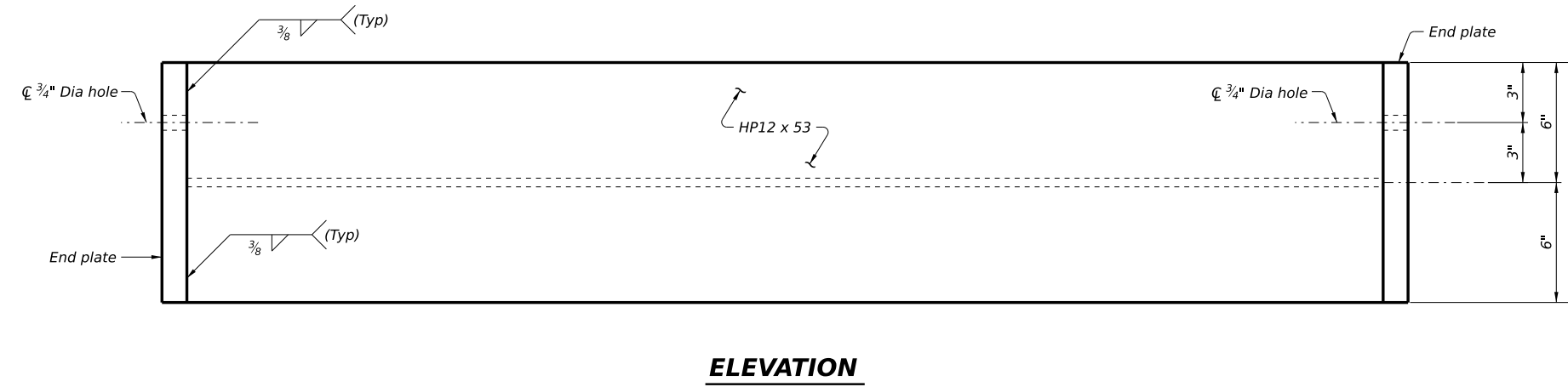
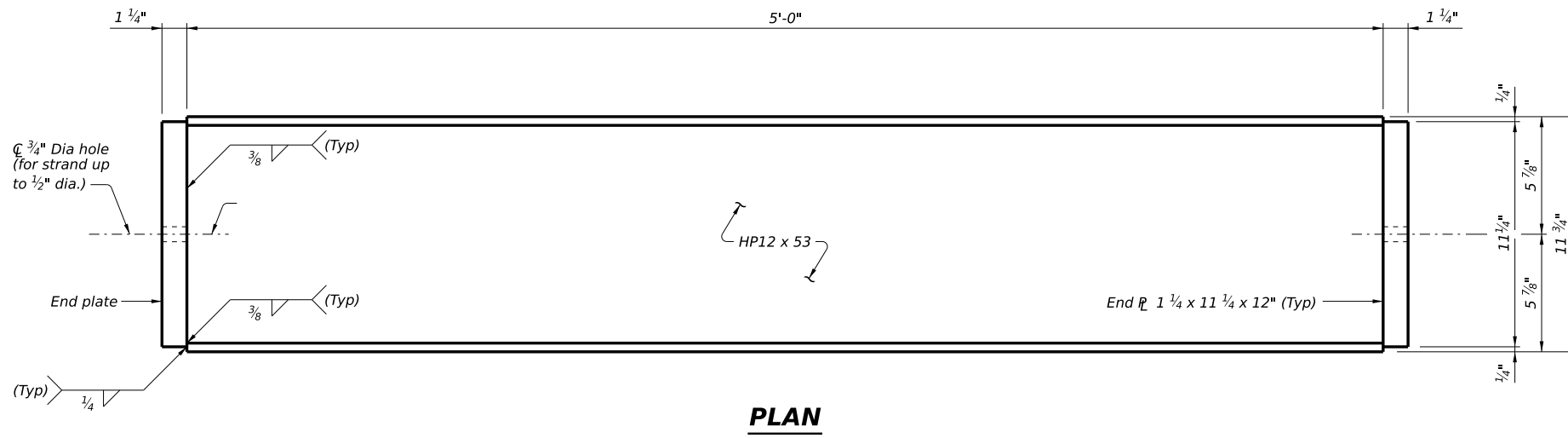
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MOCK-UP NOTES:

This design is to facilitate a mock-up installation for a GRABB-IT Cable Splice, which is a pre-approved strand splice system (a product of Prestress Supply Inc., Florida) to be used for repair of severed prestressed strands in damaged prestressed concrete beams. This design may be used for a similar splice system that is approved to substitute for this system. The purpose of the mock-up is to demonstrate that the installation of the system can be performed by the Contractor to the satisfaction of the Engineer and in accordance with the Manufacturer's instructions. The Contractor may select an alternate design for the mock-up installation subject to approval by the Engineer.

Use Grade 36 or 50 steel for the set-up box. Design the set-up box to hold ultimate strength of 0.5" low relaxation grade 270 strand (LR270). The set-up box may be painted as desired by the Contractor for future uses.

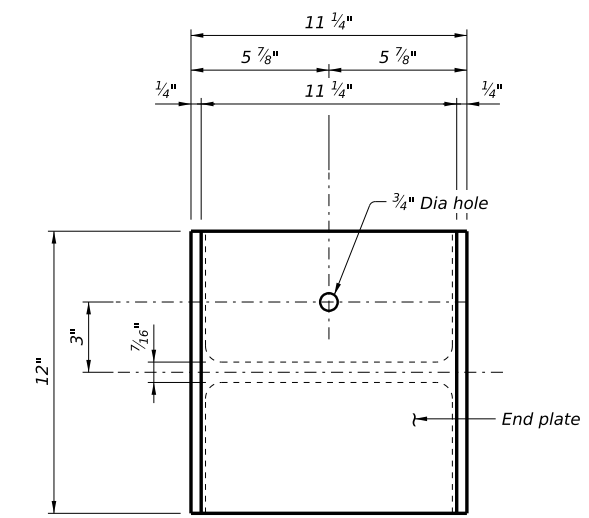
Install and initially tighten the splice by hand satisfying the minimum thread and strand engagements. Tension the spliced strand gradually to 50%, then to 75%, and then to 100% of the required tensile force using a calibrated torque wrench by a 3-person work crew who will perform the installation on the project. Prior to installing the system, thoroughly clean and lubricate threads of the rod and threaded coupler. Do not lubricate the wedges and chucks. Keep strands free of lubricants. Saw cut the strand end evenly. Do not use a torch to cut strands. The tensile force required in the spliced end is equal to an effective prestress force of an undamaged strand in the existing beam and is estimated by the Engineer as show in the repair plans.

Combine the calibration of the torque wrench with the mock-up installation. A bolt calibrator (Skidmore-Wilhelm or equivalent) or load cell must be installed at one end of the set-up box with an anchor chuck and washers properly arranged to enable the calibrator to measure the tension in the strand. This will enable the torque wrench to be calibrated while the mock-up installation is performed.

The same work crew that performs the mock-up must perform the actual installation.



PHOTO OF MOCK-UP INSTALLATION



- ⑨ Simulate an end of a broken strand.
- ⑩ Add additional length of strand to fill the gap. The length should include the minimum strand engagements in GRABB-IT anchor and splice chuck.
- ⑪ The length of GRABB-IT is 19 3/4" when thread engagement of the rod and threaded coupler is 1 3/4" which is a minimum engagement required to meet the design strength of a 1/2" Dia Grade 270 strand. Mark the length of the minimum engagement on threaded rod to ensure that this requirement is met.
- ⑫ One-time-use splice chuck (5 1/2" long). Insert (pock) the strand into the chuck until it reaches the stop in the middle of the chuck. Make sure that the strand end is clean and evenly cut before inserting. Mark the length of the engagement on the strand to ensure that the engagement is met.
- ⑬ Reusable anchor chuck for end anchorage.

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PRESTRESSED CONCRETE BEAM REPAIR DETAILS

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