SPECIAL SPECIFICATION

7660

DIRECT FIXATION TRACK CONSTRUCTION

1. Description. This section specifies the construction of direct fixation (DF) track to the lines and grades shown. The work is comprised of the installation of track slab concrete, direct fixation rail fasteners, rail, field welding, and other incidentals, as specified.

A. Reference Standards

1. American Association of State Highway and Transportation Officials (AASHTO):
   a. AASHTO M148 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete

2. American Railway Engineering and Maintenance-of-Way-Association (AREMA):
   a. AREMA - “Manual for Railway Engineering” (AREMA Manual)

3. ASTM International (Formerly known as American Society for Testing and Materials) (ASTM):
   b. ASTM D570 - Standard Test Method for Water Absorption of Plastics
   c. ASTM D638 - Standard Test Method for Tensile Properties of Plastics

4. The Society for Protective Coatings (Formerly known as Steel Structures Painting Council) (SSPC):
   a. SSPC-SP 1 - Solvent Cleaning

B. Submittals

1. Installation Procedures: Prepare and submit a description of the procedures and methods to be employed in the execution of the installation of direct fixation trackwork for review and approval by the Contracting Officer. At a minimum, include the following:

   a. The method of laying out the work including track concrete pads, inserts, and fasteners, to result in finished track meeting the alignment requirements within the
specified tolerances.

b. In accordance with the requirements of TxDOT Standard Specification 420, “Concrete Structures”, submit the track concrete construction procedures, including:

(1) Procedures for forming, mixing, placing, and curing of concrete.

(2) Proposed concrete materials; include packing, storing, handling, proportioning, additives, mixing, and placing details.

(3) Proposed method for measuring and controlling substrate temperature during concrete setting and curing.

c. The method of locating and installing inserts.

d. The details for securing the fastener inserts in the track concrete, including the following:

(1) The brand or manufacturer of each component.

(2) Proposed temperature range of the substrate for setting inserts and curing anchor material; supported by test data.

(3) Proposed wetness range for placing and curing anchor material.

(4) Proposed packing, storing, handling, proportioning, mixing, and placing details.

(5) Proposed insert cleaning degreasing details.

(6) Proposed method for measuring and controlling substrate temperature during setting and curing of anchoring materials.

e. The equipment and procedures for completing the insert pull-out tests as specified.

f. Quality control procedures to ensure proper installation.

g. The procedure for handling, installing, and field welding continuous welded rail on direct fixation track.

2. Product Data: Submit product data for bonding agent, insert anchor grout, and concrete bonding agent for review and approval by the Contracting Officer.

3. Mix Design: Submit concrete mix design as specified in TxDOT Standard Specification 420, “Concrete Structures” for review and approval by the Contracting
4. Certification: Certification of concrete mix design, reinforcement, and bonding agents for review and approval by the Contracting Officer.


A. Contractor Furnished Materials

1. Concrete Materials:


   b. Provide concrete reinforcement as specified in TxDOT Standard Specification 420, “Concrete Structures”.


2. Bonding Agent: Provide a bonding agent free of polysulfides; resistant to acids and petroleum products; with a water absorption rate of less than one percent when tested in accordance with ASTM D570; and with a minimum tensile strength of 4000 psi when tested in accordance with ASTM 0638.

3. Insert Anchor Grout: The following grouts are acceptable for use in the installation of the direct fixation insert anchorage systems. Provide one of these insert anchorage grouts, or an approved equal.


   b. FX-830 polyester resin grout: As manufactured by Fox Industries, Incorporated, Baltimore, MD 21211.

   c. Five Star ET epoxy grout or Five Star REG epoxy grout: As manufactured by U.S. Grout Corporation, Fairfield, CT 06430.

4. Shims:

   a. ASTM, A167, UNS S30400; and 1/16,1/8, and 1/4 inch.

   b. Shims shall be of a design that permits installation or removal without removal of the fastener body. The design shall incorporate a positive means of preventing the shim or shims from being displaced under operating conditions and of preventing
the rail fastener from overhanging of the shim.

5. Concrete bonding agent: As proposed by Contractor and approved by Contracting Officer.

6. Direct Fixation Hardware: Provide all direct fixation devices, attachment hardware, and other components as specified in the Plans and Contractor’s submitted procedures or as required for completion of this Section.

3. Construction or Work Methods

A. Drainage System Protection

1. Prior to the start of direct fixation track construction, proof test with a mandrel all under track drainage systems.

2. Protect track drainage systems at all times during construction. Ensure that the track drainage system is kept free of the intrusion of concrete, aggregates, grouts, oils, or other materials.

3. At the completion of direct fixation track construction, proof test all track drainage systems to demonstrate that the Contractor’s operations have not plugged the drains. Clean the drainage system of all foreign materials found as a result of the post construction operations mandrel proofing.

B. Concrete Formwork and Reinforcement

1. Prepare concrete formwork in accordance with TxDOT Standard Specification 420, “Concrete Structures”.

2. Provide concrete reinforcement in accordance with TxDOT Standard Specification 420, “Concrete Structures”.

C. Anchor Assembly and Templates

1. Install the direct fixation anchorage assembly using a template approved by the Contracting Officer. Ensure that the template allows the spacing shown and that the anchorage assembly is located properly with respect to rail location, elevation, and orientation.

2. Ensure that the top of the female anchorage assembly insert is flush with, or embedded no lower than 1/32 inch below the surface of the track concrete slab. Set the insert normal, plus or minus one degree, to the plane of the fastener assembly.
3. Remove oil, grease, and other foreign matter from the outside of the anchorage using a solvent, caustic degreaser, or steam cleaning in accordance with SSPC SP1.

4. Keep the anchorage clean and free of dirt, debris, and loose concrete during installation.

5. Prior to concrete placement, coat the anchorages with a bonding agent.

6. Welding or mechanically affixing anything to the anchorage or the anchorage insert is prohibited.

D. Alternate Anchorage Installation

1. Submit alternate anchorage assembly installation procedures and methods to the Contracting Officer for approval. Impact installation of anchorage assemblies on aerial structures is prohibited.

E. Concrete Placement

1. Prior to concrete placement, clean existing surfaces in accordance with the requirements of TxDOT Standard Specification 420, “Concrete Structures”.

2. Coat the surface of the existing concrete slab with concrete bonding agent in accordance with the manufacturer’s recommendations.

3. Place the track concrete in accordance with the requirement TxDOT Standard Specification 420, “Concrete Structures”.

4. Utilize a stubby, 4 inch long “Shallow Slab” vibrator in placing concrete, unless otherwise approved by Contracting Officer.

F. Concrete Finish

1. Steel trowel finish the top surface of the track slab as described in TxDOT Standard Specification 420, “Concrete Structures”.

G. Concrete Tolerances

1. Do not cast the direct fixation support area across any construction, expansion, or contraction joints.

2. Direct Fixation Support Area Dimensional Tolerances:

   a. The direct fixation support area shall extend a minimum of six inches beyond the edge of the fasteners except where lesser space is required to provide clearance for switch rods, detector rods, and other switch machine connecting
rods.

b. Top of track direct fixation support area surface: Parallel to a plane passing through the top of both rails, and even with adjacent fastener bearing surface.

c. Cross slope variation: Not to exceed plus or minus 1/2 degrees.

d. Difference in elevation at the rail centerline at two adjacent fastener locations: Not to exceed 1/16 inch.

**H. Insert Assembly Grout Placement**

1. Prepare nonshrink grout in accordance with the approved manufacturer’s recommendations.

   a. Clean all grout mixing equipment prior to preparing grout mix.

   b. Mix only that quantity of grout which can be placed prior to initial set as determined by the manufacturer’s recommendations and existing conditions.

   c. Mix grout when components achieve a temperature between 70 degrees F. and 80 degrees F.

2. Grout placement temperature requirements:

   a. Place grout when the surface temperature at insert assembly location is at least 50 degrees F and rising.

   b. Do not place grout when the surface temperature at the insert assembly location is expected to fall below 50 degrees F within 48 hours of placement.

   c. Do not place grout when insert assembly surface temperatures exceed 90 degrees F. Shade or cool insert assemblies to achieve a surface temperature at or below 90 degrees F.

3. Thoroughly clean and dry the insert assembly and the insert assembly locations using approved methods.

**I. Insert Pull-Out Tests**

1. After the curing of the track concrete slab, subject at least one anchorage assembly in every 200 installed to a restrained and an unrestrained pull-out test, as described.

2. Restrained Pull-out Test:
a. Place a 6 inch by 6 inch x 1/2 inch steel plate with a 1.75 inch diameter hole in the center over the anchor bolt in an installed anchorage assembly.

b. Apply an upward vertical load of 1000 lbs. per second, against the plate, until a load of 20,000 pounds occurs; after achieving 20,000 pounds, release the load.

3. Unrestrained Pull-out Test:

   a. Remove the steel plate described above.

   b. Apply the upward vertical load of 1000 lbs. per second as described until a load of 10,000 pounds is achieved and release the load.

   c. The test assembly shall be as described in the AREMA Fastening Uplift Test. Vol.1, Chapter 10, Sec. 1.9.1.10.

4. Record all tests, identifying each bolt location, the loads applied and the results and submit copies of the documentation to the Contracting Officer.

5. Acceptance Criteria: Restrained pull-out test: No evidence of failure by either slippage or cracking of the concrete to anchorage assembly bond before the load of 10,000 pounds is achieved.

**J. Direct Fixation Fastener Assembly Installation**

1. Ensure that the surface of the track slab to receive the direct fixation fastener assembly is free of dirt and debris or concrete which might affect the proper setting of the assemblies.

2. Set the direct fixation fastener assemblies over the anchorage assembly insert and temporarily secure them to the track slab.

3. Install fastener assemblies in pairs, within a tolerance of one inch, except at skewed structural joints.

4. Install fasteners at right angles to the centerline of the track, one fastener under each running rail.

5. Direct fixation fasteners shall be installed so as to permit plus or minus 1/4 inch gauge adjustment of rail at each fastener to accommodate future rail wear.

6. Install fastener assemblies spaced every 30 inches, unless otherwise shown or specified. Every 25 feet of length as measured along the rail must shall 10 fasteners.

**K. Shims**
1. Install shims between the direct fixation fastener assembly and the track concrete in accordance with the manufacturer’s recommendations in order to ensure proper rail line and grade.

2. Unless otherwise approved, do not chip concrete to adjust the direct fixation assembly fasteners line and grade.

**L. Laying Continuous Welded Rail (CWR)**

1. Lay, fasten and field weld CWR as specified in Section 02450, “General Track Construction”, and Section 02458, “Field Rail Welding”.

**M. Zero Thermal Stress Temperature**

1. Determine rail temperature as specified in Section 05650, “Railroad”.

2. At-Grade Direct Fixation Rail:
   
a. Install, fasten, and field weld rail in at-grade direct fixation track to produce zero thermal stress in rail at 85 degrees F plus 10 degrees F. and minus 5 degrees F.

b. U-Wall sections are considered to be at-grade for zero thermal stress temperature if the walls are less than 30 feet high above top of rail.

3. The temperature of opposite rails to be within 5 degrees F of each other.

**N. Adjusting Rail**

1. Bring the rail to final line with the rail bearing against the field side shoulder of the fastener.

2. Tension the anchor bolts in accordance with the approved installation procedures.
   
a. If power wrenches are used for tensioning, adjust them to stall or cut out at the required tension.

b. If manual torque wrenches are used, torque the bolts until the calibrated tension is achieved. Ensure that the anchor bolt is in the tightening position when the torque is measured.

**O. Fastening Direct Fixation Track**

1. Fully tension anchor bolts on the direct fixation fasteners prior to fastening any string of continuous welded rail.
2. Anchor CWR by applying the direct fixation rail clips in accordance with the manufacturer’s recommendations and the approved installation procedures.

P. Field Welding in Direct Fixation Track

1. Perform field welding of direct fixation track in accordance with the requirements of Section 05650, “Railroad”.

4. Measurement

A. Materials furnished by the Authority will not be measured for payment.

B. Direct fixation track construction will be measured on a unit price per linear track foot, complete-in-place.

5. Payment

A. Payment for direct fixation track construction will be made at the unit price bid for “Direction Fixation Track, Complete-in-Place”. Such unit price shall be considered as full compensation for direct fixation track construction with continuously welded standard and premium rail including Contractor-furnished materials, direct fixation materials, transportation, storage, and handling of Authority furnished materials, and other work specified in this section