Section 4151. Steel Reinforcement

4151.01 DESCRIPTION.
Use the size and type specified in the contract documents. Meet the requirements for the type and use specified. Use chairs, bolsters, and other support devices, either plastic or steel, that meet the requirements of Materials I.M. 451.01.

4151.02 PAVEMENT REINFORCEMENT.
Meet the requirements of Article 4151.03, and where mesh is specified, Article 4151.04.

A. Pavement Tie Bars.

1. Use epoxy coated bars coated according to Article 4151.03, C. Cut or sheared ends need not be recoated.

2. Use deformed bars meeting requirements of ASTM A 615/A 615M, Grade 40 or 60 (300 or 400) if the pavement tie bars are to be bent and later straightened. Bend the tie bars back reasonably straight. Replace tie bars broken during rebending by drilling a hole and setting the bar in epoxy, at no additional cost to the Contracting Authority.

B. Pavement Dowel Bars.

1. Use plain round bars meeting requirements of:
- ASTM A 663/A 663M, Grade 60 (415) or higher,
- ASTM A 675/A 675M, Grade 60 (415) or higher, or
- ASTM A 615/A 615M, Grade 40 (300) or higher.

2. Approved manufacturers and suppliers of load transfer dowels and dowel assemblies are listed in Materials I.M. 451.03, B, Appendix C.

3. Furnish dowels, with the exceptions of end of run and header joints, in approved assemblies, suitable for skewed or perpendicular joints as shown in the contract documents. Ensure all dowels, including end of run and header dowels, have an epoxy coating. Ensure the coating is applied by the electrostatic spray method complying with the requirements of AASHTO M 254, Type B, with a minimum coating thickness of 6 mils (150 µm) after cure. Epoxy powders approved for use are listed in Materials I.M. 451.03, B, Appendix B.

4. The ends of dowels may be saw cut or sheared. The sawed and sheared ends need not be coated. If the dowel bars are saw cut, ensure they are free of burrs and projections. Also ensure the deformation of the bars from true round shape does not exceed 0.04 inches (1 mm) in diameter or in thickness.

5. Prior to delivery to the work site, the assemblies are to be dipped in a bond breaker meeting the requirements of Section 4137, 4138, or 4140. The bond breaker may be bituminous or paraffin.

C Reinforcement For Bridge Approach Sections, Reinforced Paved Shoulders, and Full-Width Reinforcement of Pavements.
Comply with the following:
- Deformed bars meeting the requirements of ASTM A 615/A 615M, Grade 40 0r 60 (300 or 400); or ASTM A 706/A 706M, Grade 60,
- Epoxy coated, and
- Meet the requirements of Article 4151.03, except that cut or sheared ends need not be recoated.

4151.03 REINFORCEMENT FOR STRUCTURES.

A. General.

1. Unless otherwise specified, use deformed bars meeting the requirements of ASTM A 615/A 615M, ASTM A 706/A 706M or ASTM A 996/A996M. Use bars fabricated according to Article 2404.03, B.

2. Spirals of No. 5 (15) bars or smaller and any bars No. 3 (10) or smaller for stirrups or hoops of a specified shape may, at the Contractor's option, be:
   - Material meeting requirements of ASTM A 82 reinforcement specified above, or
   - Steel meeting physical and chemical requirements of ASTM A 615/A 615M, Grade 40 (300).

3. For spirals in precast and prestressed concrete piling and all wire ties, use steel wire with a minimum tensile strength of 40,000 psi (300 MPa), with other properties such as to permit bending as shown in the contract documents.

B. Galvanized Reinforcement.

1. Perform cutting and bending prior to galvanizing and according to the requirements of Section 2404. After cutting and bending, galvanize all reinforcement required to be galvanized according to the requirements of ASTM A 123. Take precautionary measures to prevent loss in the height of the deformation pattern.

2. Apply a chromate conversion coating immediately after galvanizing. This may be accomplished by either: 1) quenching the bars, immediately after galvanizing, in a solution containing at least 0.2% (by weight (mass)) of sodium dichromate in water; or 2) quench chromating in a minimum 0.2% chromic acid solution. The quench water should be at least 90°F (32°C). Proprietary chromate solutions of equivalent effectiveness may be substituted for the above procedure. If the reinforcing material is allowed to cool before chromate treating as specified above, 0.5% to 1.0% concentration of sulfuric acid should be added as an activator to the chromate solution.

3. Galvanize tie wires and wire or pressed steel chairs to be used with galvanized reinforcing steel. Either turn up or coat the ends of chairs which may be exposed in the finished concrete. Stainless steel chairs, plastic coated carbon steel chairs, or other types of chairs may be approved by the Engineer. Galvanizing of hangers is optional (required only when to remain exposed), according Article 2412.03, A.

4. Handle bars in a manner to prevent damage to the galvanized coating.

C. Epoxy Coated Reinforcement.

1. Ensure reinforcement (deformed and plain) required to be epoxy-coated has a protective coating of epoxy applied by electrostatic spray method according to the requirements of ASTM A 775/A 775M.

2. Acceptance and handling of epoxy-coated reinforcing steel reinforcement bars at the project site are to be according to the requirements of these specifications and the requirements of Materials I.M. 451.03B.

D. Surface Preparation.

1. Thoroughly blast (near-white) clean reinforcing steel surfaces to be coated. Remove mill scale, rust, and foreign matter. Ensure the blast media produces a suitable anchor pattern profile (a depth of 2.0 to 4.0 mils (50 µm to 100 µm)). Apply the coating within 0.5 hour after cleaning.

2. Ensure blast media meets the requirements of Materials I.M. 451.03B.

E. Repair to Damage Incurred During Fabrication.
Ensure coating damage due to fabrication or handling at the fabricator facility is repaired using patching material meeting the requirements of Section 3.1 of ASTM D 3963/D 3963M. The fabricator is responsible for the repair.

F. Repair of Damage Incurred during Shipment and Handling at the Job Site.
Comply with the following:

1. Repair visible damage incurred during shipment, storage, and /or placement of epoxy-coated bars at the job site.

2. Use coating patch materials of organic composition consisting of a two-component liquid properly mixed that hardens to a solid form upon curing. Approved repair/patch compounds are listed in Materials I.M. 451.03B.

3. Repair damage to the coating caused by shipment, storage, and/or placement at the job site.

4. Ensure sheared ends/saw-cut ends of the coated bars have adequate coating, have no signs of surface rust or damage, and are repaired and/or coated with the same patching material that is used for repairing damaged coating.

5. The maximum amount of repaired, damaged areas is not to exceed 2% of the total surface area in each 1.0 linear foot (0.3 m) of the bar. Should the amount of damage exceed the 2% in 1.0 linear foot (0.3 m), then remove that bar and replace with an acceptable bar. Coating the cut ends will not be included in the repair percentage.

6. Apply a minimum coating thickness of 7 mils (175 µm) to areas to be repaired.

7. Allow patches to cure (dry to the touch) before placing concrete over the coated bars.

8. Prepare the surface, repair it, and apply patches according to the resin manufacturer's recommendations.

G. Storage, Handling, and Placement at the Job Site.

1. Comply with the following:
- **a.** Store coated bars or bundles above ground on wooden or padded supports with padded timbers placed between bundles when stacking is necessary. Place supports to prevent sags in the bundles.
- **b.** Ensure systems for handling (loading, unloading, storing) the coated bars at the job site have padded contact areas. Do not drop or drag coated bars or bundles.
- **c.** Store coated and uncoated steel reinforcing bars separately.
- **d.** Minimize handling and re-handling of the coated bars.
- **e.** Tie coated bars using tie wire coated with epoxy, plastic, Nylon, or other non-conductive Materials that will not damage or cut the coating.
- **f.** Use a non-conductive Material compatible with concrete to coat or fabricate bar supports or spacers.

2. Use a non-transparent material to cover coated bars if they will be exposed for 2 months or more. Ensure adequate ventilation is provided to minimize condensation under the cover.

4151.04 WIRE MESH REINFORCEMENT.
Use the size and spacing shown in the contract documents. Ensure it meets the requirements of ASTM A 185.

4151.05 STEEL FOR PRESTRESSING CONCRETE.
Comply with one of the following classifications, as required by the contract documents:

A. Uncoated Seven Wire Stress Relieved Strand.
Meet the requirements of AASHTO M 203, except furnish a load elongation curve for each heat number delivered. Low relaxation strand described in the AASHTO M 203 Supplement may be furnished at the Contractor's option.

B. Uncoated Stress Relieved Wire.
Meet the requirements of AASHTO M 204.

C. High Strength Alloy Steel Reinforcement.
Meet the requirements of AASHTO M 275.