

1 Restrain overhanging ends of beams or girders both vertically and horizontally to prevent  
2 excess movement. Chains are permitted to secure beams and girders during shipping only  
3 when adequate measures are taken to prevent damage to the material by the use of approved  
4 protective material. If necessary, use adequate bracing to prevent bending of the top flange.

5 Pack bolts of one length and diameter and loose nuts or washers of each size separately. Ship  
6 pins, small parts and packages of bolts, washers and nuts in boxes, crates, kegs or barrels, but  
7 do not allow the gross weight of any package to exceed 300 lb. Plainly mark a list and  
8 description of the contained material on the outside of each shipping container.

9 Steel die stamped fabricator's identity, station number, girder number and span number of  
10 main members into an unpainted area (if available) near the end of the member. Die stamp  
11 members with painted ends outside the painted area but as close to the end as possible.

12 Ship anchor bolts, washers and other anchorage or grillage materials, in time to be  
13 incorporated into the masonry portion of the structure.

## 14 SECTION 1074

### 15 MISCELLANEOUS METALS AND HARDWARE

#### 16 1074-1 WELDING

17 Certify all welders performing any welding on any metals in accordance with the applicable  
18 AWS welding code in the position and process required as approved by the Engineer.

#### 19 1074-2 EXPANSION ANCHORS

20 Unless otherwise shown in the plans, provide expansion anchors consisting of 2 or more units  
21 with a minimum of 2 hard metal conical ring wedges and 2 expandable lead sleeves of  
22 an equally effective design that is approved by the Engineer. Use anchors providing  
23 a minimum safe holding power of 3,000 lb for 3/4" bolts and 2,000 lb for 5/8" bolts, based  
24 upon 1/4 of the actual holding power of the anchor in 3,000 psi concrete. Furnish satisfactory  
25 evidence, based upon actual tests performed by a commercial testing laboratory, which  
26 indicate that the anchors develop the minimum required safe holding power.

27 When it is proposed to use anchors that are previously accepted as meeting the above  
28 requirements, the anchors are accepted on the basis of a certified statement indicating the  
29 prior acceptance of the furnished anchors.

#### 30 1074-3 PLAIN STEEL BARS WITH THREADED ENDS

31 Provide plain steel bars with threaded ends meeting ASTM A307, Grade A.

#### 32 1074-4 HARDWARE FOR TIMBER STRUCTURES

33 Use machine bolts, drift-bolts and dowels that are either wrought iron or medium steel. Use  
34 washers that are cast iron ogee, malleable iron castings or cut from medium steel or wrought  
35 iron plate.

36 Use machine bolts with square heads and nuts. Use nails that are cut or round wire of  
37 standard form. Use spikes that are cut, wire spikes or boat spikes.

38 Use black or galvanized nails, spikes, bolts, dowels, washers and lag screws for untreated  
39 timber.

40 Galvanize or cadmium plate all hardware for treated timber bridges, except malleable iron  
41 connectors.

## Section 1074

### 1 1074-5 METAL BRIDGE RAILING

#### 2 (A) General

3 As an option, use either aluminum or galvanized steel metal rail, provided that the same  
4 material is used on all structures on the project.

5 Certified mill test reports are required for rails and posts.

6 Place a permanent identifying mark that identifies the fabricator on each post. Use  
7 a method and location of the identifying mark such that it does not detract from the  
8 appearance of the post.

9 Where it is necessary for rails to be curved, form the curvature in the shop or in the field.  
10 Uniformly curve the rail without buckling or kinking. Perform all welding in accordance  
11 with AWS D1.1 for steel railing and AWS D1.2 for aluminum railing.

12 Provide an anchor unit of sufficient strength to insure load anchoring capacity as  
13 specified for rail loading in the *AASHTO LRFD Bridge Design Specifications*.

#### 14 (B) Aluminum Rail

15 Supply material for posts, post bases, rails, expansion bars and clamp bars meeting  
16 ASTM B221 for Alloy 6061 T6.

17 Use material for rivets meeting ASTM B316 for Alloy 6061 T6. Use rivets that are  
18 standard button head and cone point cold driven.

19 Use material for nuts meeting ASTM B211 for Alloy 6061 T6.

20 Provide material for washers meeting ASTM B209 for Alloy Alclad 2024 T3.

21 Supply material for shims meeting ASTM B209 for Alloy 6061 T6.

22 Ensure that the handrails meet the dimensional tolerance requirements of ANSI H35.2.

#### 23 (C) Galvanized Steel Rail

24 Use posts, post bases, rails, expansion bars and clamp bars meeting ASTM A36 and  
25 galvanize in accordance with ASTM A123. Grind the cut ends of rail smooth and give  
26 them 2 coats of organic zinc repair paint. Galvanize the posts and post bases after they  
27 are riveted together.

28 Use rivets meeting ASTM A502 for Grade 1 rivets.

29 Use bolts meeting ASTM F593 Alloy 304.

30 Use nuts meeting ASTM F594 Alloy 304.

31 Use washers meeting ASTM F844 except made from Alloy 304 stainless steel.

32 Use materials for shims meeting ASTM A1011 for Grades 36, 40 or 45, or ASTM A1008  
33 for Grade C, and galvanized in accordance with ASTM A123.

### 34 1074-6 STEEL PIPE

35 Steel pipe bent or welded in fabricating shall meet ASTM A53 for standard weight pipe. Use  
36 galvanized pipe unless otherwise shown in the plans.

### 37 1074-7 IRON CASTINGS

#### 38 (A) General

39 Comply with the Department's Iron Casting QA/QC program.

1 Boldly fillet castings at angles, and provide arrises that are sharp and perfect. No sharp,  
2 unfilleted angles or corners are permitted. Provide castings that are true to pattern in  
3 form and dimensions, free from pouring faults, sponginess, cracks, blow holes, and other  
4 defects affecting their strength and value for the service intended. Sand blast or  
5 otherwise effectively clean of scale and sand all castings to present a smooth, clean, and  
6 uniform surface. Welding is not allowed for the purpose of making a casting structurally  
7 sound. Welding for cosmetic or other purposes is not allowed without approval of the  
8 Engineer.

### 9 **(B) Gray Iron Castings**

10 Supply gray iron castings meeting AASHTO M 306. Proof load testing will only be  
11 required for new casting designs during the design process. Acceptance of production  
12 castings will be based on test bars. Cast test bars, of size "B", attached to and integral  
13 with the castings. Instead of this, cast test bars separate from the castings when approved  
14 in writing by the Engineer. The Engineer reserves the right to require that a test bar be  
15 machined from an actual casting if deemed necessary. Unless otherwise specified, do not  
16 coat gray iron castings. Do not perform any welding on castings for any reason without  
17 prior approval from the Engineer. Mark castings with the NCDOT Standard Number of  
18 the casting design, the fabricator's ID and the day, month and year of production.

### 19 **1074-8 STEPS**

20 Fabricate steps for minor drainage structures from deformed reinforcing bars, use gray iron  
21 castings meeting Subarticle 1074-7(B) or use composite plastic-steel construction as shown in  
22 the plans.

23 The use of steps differing in dimension, configuration or materials from those shown in the  
24 plans is allowed by furnishing the Engineer with details of the proposed steps and obtaining  
25 written approval for the use of such steps.

### 26 **1074-9 FABRICATED STEEL GRATES**

27 Use fabricated steel grates made from bars that meet ASTM A36. Galvanize the grates after  
28 fabrication in accordance with AASHTO M 111.

### 29 **1074-10 PINS**

30 Supply pins for bearing assemblies meeting either ASTM A36 or ASTM A108 for  
31 Grades 1016 through 1030, unless otherwise required by the plans or specifications.

### 32 **1074-11 WASHERS**

33 Provide washers for use with fasteners meeting ASTM A436. Provide washers for high  
34 strength bolts meeting Article 1072-5.

35 Ensure that the size and finish (plain, weathering or galvanized) of washers is compatible with  
36 the fastener.

### 37 **1074-12 METAL STAY-IN-PLACE FORMS**

38 Provide metal stay-in-place forms for concrete floor slabs of zinc-coated (galvanized) steel  
39 sheet conforming to ASTM A653, Structural Steel (SS) Grades 33 through 80 and Coating  
40 Class G165 meeting all requirements relevant to steel stay-in-place forms as noted on the  
41 contract plans. Do not use material thinner than 20 gauge.