

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 lbs. 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 Any facility performing welding operations shall be approved by NCDOT Materials and Tests
 18 Unit. Weld other steel items not covered under the Bridge Welding Code in accordance with
 19 the applicable AWS Welding Code. Some examples may include but not limited to;
 20 Structural Welding Code-Steel (AWS D1.1), Structural Welding Code- Aluminum (AWS
 21 D1.2), Structural Welding Code-Sheet Steel (AWS D1.3), Structural Welding Code-
 22 Reinforcing Steel (AWS D1.4) and Structural Welding Code-Stainless Steel (AWS D1.6).
 23 Certify all welders performing any welding on any metals in accordance with the applicable
 24 AWS welding code in the position and process required as approved by the Engineer.

25 1074-2 EXPANSION ANCHORS

26 Unless otherwise shown in the plans, provide expansion anchors consisting of two or more
 27 units with a minimum of two hard metal conical ring wedges and two expandable lead sleeves
 28 of an equally effective design that is approved by the Engineer. Use anchors providing
 29 a minimum safe holding power of 3,000 lbs. for 3/4 inch bolts and 2,000 lbs. for
 30 5/8 inch bolts, based upon 1/4 of the actual holding power of the anchor in 3,000 psi concrete.
 31 Furnish satisfactory evidence, based upon actual tests performed by a commercial testing
 32 laboratory, which indicate that the anchors develop the minimum required safe holding
 33 power.

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

37 1074-3 PLAIN STEEL BARS WITH THREADED ENDS

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

39 1074-4 HARDWARE FOR TIMBER STRUCTURES

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

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

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

Section 1074

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

3 **1074-5 METAL BRIDGE RAILING**

4 **(A) General**

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

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

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

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

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

16 **(B) Aluminum Rail**

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

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

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

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

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

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

25 **(C) Galvanized Steel Rail**

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

30 Use rivets meeting ASTM A502 for Grade 1 rivets.

31 Use bolts meeting ASTM F593 Alloy 304.

32 Use nuts meeting ASTM F594 Alloy 304.

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

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

36 **1074-6 STEEL PIPE**

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

1 1074-7 IRON CASTINGS**2 (A) General**

3 Comply with the Department's Iron Casting QA/QC program. Producers and suppliers
4 furnishing iron castings for Department projects shall comply with this program. The
5 program details are available on the Materials and Tests website.

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

13 (B) Gray Iron Castings

14 Supply gray iron castings meeting all facets of AASHTO M 306 excluding proof load.
15 Proof load testing will only be required for new casting designs during the design
16 process, and conformance to M306 loading (40,000 lbs.) will be required only when
17 noted on the design documents. Acceptance of production castings will be based on test
18 bars. Cast test bars, of size "B", attached to and integral with the castings. Instead of
19 this, cast test bars separate from the castings when approved in writing by the Engineer.
20 The Engineer reserves the right to require that a test bar be machined from an actual
21 casting if deemed necessary. Unless otherwise specified, do not coat gray iron castings.
22 Do not perform any welding on castings for any reason without prior approval from the
23 Engineer. Mark castings with the NCDOT Standard Number of the casting design, the
24 fabricator's ID and the day, month and year of production.

25 1074-8 STEPS

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

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

32 1074-9 FABRICATED STEEL GRATES

33 Use fabricated steel grates made from bars that meet ASTM A36. Galvanize the grates after
34 fabrication in accordance with AASHTO M 111. Mark items with fabricators ID, month and
35 year of production.

36 1074-10 PINS

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

39 1074-11 WASHERS

40 Provide washers for use with fasteners meeting ASTM F436. Provide washers for high
41 strength bolts meeting Article 1072-5.

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

Section 1076

1 1074-12 METAL STAY-IN-PLACE FORMS

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

6 1074-13 STEEL GRID FLOORING

7 Steel grid flooring shall conform to the requirements of AASHTO LRFD Bridge Construction
8 Specifications, Section 12 and these Specifications.

9 SECTION 1076 **10 GALVANIZING**

11 1076-1 GALVANIZING

12 Wherever galvanizing is required, perform the galvanizing in accordance with this section
13 except where other requirements for galvanizing are included in other sections of the
14 *Standard Specifications*.

15 Allow the Engineer to obtain samples of molten zinc directly from the galvanizing vat upon
16 request.

17 1076-2 INSPECTION NOTIFICATION

18 Coordinate galvanizing inspection with the Materials and Tests Unit in accordance with
19 Subarticle 1072-7(A). Before inspection, the galvanizer/supplier shall provide the
20 Department's inspector with NCDOT approved drawing/purchase order, stating contract
21 number, location of project, quantity/type of material being galvanized and mill test report(s)
22 for respective material.

23 1076-3 FABRICATED PRODUCTS

24 Galvanize products fabricated from rolled, pressed and forged steel shapes, plates, bars and
25 strips 1/8 inch thick and heavier in accordance with AASHTO M 111. Fabricate products into
26 the largest unit that is practicable to galvanize before the galvanizing is done. Fabrication
27 includes all operations necessary to complete the unit such as shearing, cutting, punching,
28 forming, drilling, milling, bending, welding and riveting. Galvanize components of bolted or
29 riveted assemblies separately before assembly. When it is necessary to straighten any
30 sections after galvanizing, perform such work without damage to the zinc coating.

31 Completely seal all edges of tightly contacting surfaces by welding and commercial blast
32 clean to SSPC-SP 6 before galvanizing.

33 Commercial blast clean components with partial surface finishes in accordance with
34 Subarticle 442-7(A) before pickling.

35 1076-4 HARDWARE

36 Galvanize iron and steel hardware in accordance with AASHTO M 232.

37 1076-5 ASSEMBLED PRODUCTS

38 Completely seal all edges of tightly contacting surfaces by welding before galvanizing.
39 Galvanize assembled steel products in accordance with AASHTO M 111.

40 1076-6 SHEETS

41 Galvanize iron or steel sheets in accordance with ASTM A653.

42 1076-7 REPAIR OF GALVANIZING

43 Repair galvanized surfaces that are abraded or damaged at any time after the application of
44 zinc coating. Surfaces to be repaired shall be clean, dry and free of oil, grease, pre-existing