

## **54.23 SUPPLY AND INSTALLATION OF W-BEAM GUARDRAIL AND POSTS**

### **54.23.1 GENERAL**

The Work consists of supplying and installing or picking up and installing W-Beam guardrail and posts for use as hazard avoidance barriers.

### **54.23.2 STANDARDS OF REFERENCE**

#### **Alberta Transportation and Utilities Drawings:**

- TEB 3.01 Wood Spacer Block and Post
- TEB 3.02 Rail Detail
- TEB 3.03 Wing End Section
- TEB 3.04 Buried End Section
- TEB 3.06 Bolt, Nut and Washer
- TEB 3.53 Flex Guard Bracket

All materials supplied by the Contractor shall be in accordance with the following standards, specifications or publications. The use of previously installed materials will be subject to the approval of the Engineer.

Canadian Standards Association(CSA): Standards Sales, 178 Rexdale Boulevard, Rexdale, Ontario M9W 1R3

- CSA G40.20 and G40.21-M87 - Structural Quality Steels
- CSA G164-M - Hot Dip Galvanizing of Irregularly Shaped Articles
- CSA W59-M - Welded Steel Construction (Metal Arc Welding)
- CSA 080-M - Wood Preservation

American Society for Testing and Materials(ASTM), 1916 Race Street, Philadelphia, Pennsylvania 19103

- ASTM A307 - Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength
- ASTM E316.3 - Magnetic gauge testing of galvanizing coating

American Association of State Highway and Transportation Officials(AASHTO), 444 North Capitol Street N.W., Suite 225, Washington, D.C. 20001

- AASHTO Standard Designation M-180-841 "Corrugated Sheet Steel Beams for Highway Guardrail"

American Road and Transportation Builders Association(ARTBA), 525 School Street S.W, Washington, D.C. 20024

- ARTBA Technical Bulletin No. 268-B

National Lumber Grades Authority(NLGA), 1460-1055 West Hasting Street, Vancouver, B.C. V6E 2G8

- NLGA Standard Grading Rules for Canadian Lumber

### 54.23.3 MATERIALS

Unless otherwise directed by the Engineer, the Contractor shall supply all materials necessary to complete the Work. The Contractor may be required to maintain an inventory of materials at locations within the Contract boundaries. The quantities of new barrier sections and posts which shall be readily available will be specified in the Special Provisions.

When directed by the Engineer, the Contractor shall pick up guardrail materials from Department sites.

At locations mutually agreeable to the Contractor and the Engineer, the Contractor shall supply used guardrail subject to the approval of the Engineer regarding quality and condition.

#### 54.23.3.1 Rails and Terminal Elements

W-beam guardrail shall consist of rail sections fabricated to develop a continuous beam strength with the necessary safety end feature components.

All rail sections and other components shall match the design profiles and dimensions of the AASHTO/ARTBA hardware requirements for full interchangeability of similar components regardless of the manufacturer.

The name or trademark of the manufacturer, the metal thickness and the year of production shall be clearly and permanently stamped on each component clear of the splicing overlap and on the face opposite the traffic side.

The rails and terminal elements shall be manufactured from open hearth, electric furnace or basic oxygen semi-spring steel sheet and hot dip galvanized after fabrication, all in general accordance with the AASHTO Standard Designation M180-841 and shall conform to the relevant TEB drawings.

Rails shall be punched for splice and post bolts in strict conformity with the AASHTO Standard to the designated number and centre-to-centre spacing of posts. No punching, cutting or welding will be permitted on site except for special details in unforeseen and exceptional cases with the prior approval of the Engineer.

If any guardrail installation requires curved W-beam rails, the Contractor shall form these to the radius specified by the Engineer.

The rails and terminal elements shall be manufactured according to the following standards:

- Metal properties of the base metal for the rails shall conform to the following requirements:
  - Minimum Yield Point: 345 MPa
  - Minimum Tensile Strength: 483 MPa
  - Minimum Elongation: 12% in 50 mm length
- Sheet thickness shall be in accordance with Table 1 (Class A, Type 2) of AASHTO Standard M180-841 with a nominal base metal thickness of 2.8 mm (2.67 mm minimum).
- Sheet width for the W-beam rail shall be 483 mm, with a permissible tolerance of minus 3.2 mm.

Welding for the fabrication of terminal elements shall conform to the requirements of CSA-W59M.

Rails and terminal elements shall be hot dip galvanized after fabrication, in accordance with CSA-G164M.

#### **54.23.3.2 Bolts, Nuts and Washers**

Bolts, nuts and washers shall conform to ASTM-A307, and shall be hot dip galvanized in accordance with CSA-G164M (Drawing TEB 3.06).

#### **54.23.3.3 Wooden Posts**

Posts and offset blocks shall be either douglas fir, hemlock, lodgepole pine or better and shall meet the requirement of the National Lumber Grades Authority (NLGA) for No. 1 Structural Posts and Timbers graded conforming to the NLGA Standard Grading Rules for Canadian Lumber.

Posts and blocks shall be rough sawn with holes drilled to the finished dimensions shown in drawing TEB 3.01. 1.52 m posts are used in most guardrail installations. In areas with steep sideslopes or in areas of frequent collisions, 2.13 m posts may be required.

Posts shall be date stamped at the top of either side of the post not used for rail attachment with the last two digits of the year of fabrication. The stamp shall be 50 mm x 50 mm and have an indentation of 3 mm.

Stamping and drilling shall be completed prior to treating posts. Blocks shall be pressure treated in accordance with the current requirements of CSA Standard 080, with a water borne preservative of chromated copper arsenate (CCA) or ammoniacal copper arsenate (ACA) to 8 kilograms per cubic metre.

The penetration and retention of preservatives shall conform to the requirements of CSA Standard 080.14 Table 1, Minimum Retention of Preservatives in Pressure Treated Wood for Highway Construction, under the headings "Post-Guardrail, Guide, Sign and Sight" for posts, and "Bridge Hand Rails, Guard Rails and Posts" (not in contact with ground or water).

#### **54.23.4 EQUIPMENT**

The Contractor shall supply all equipment necessary to complete the Work.

#### **54.23.5 PROCEDURE**

The Engineer will identify the location of the Work and will direct the Contractor to supply new or salvaged guardrail materials or pick up materials at a Department site.

All work shall be performed during daylight hours only. No Work will be performed when the visibility is less than 700 metres.

Traffic control and signing shall be performed in accordance with Specification 55.1, Traffic Accommodation and Temporary Signing.

Standard installations shall be in accordance with drawing TEB 3.12. Installations at bridge approaches shall be in accordance with drawing TEB 3.48, and construction shall always be started at the bridge. A Strong Post System of installation as shown in drawing TEB 3.09, shall be used on some installations when directed by the Engineer.

Posts shall be accurately set to the required depth and alignment in a smooth, continuous installation, as shown in the drawings or as directed by the Engineer. Permissible tolerance for plumb and grade of posts shall be 6 mm maximum.

Holes for the guardrail posts shall be excavated by auger. The diameter of the holes augered for guardrail posts shall be of sufficient size to allow for pneumatic tamping.

Unsuitable material at the bottom of the holes excavated for the guardrail post shall be replaced with granular material at the Contractor's expense, as directed by the Engineer. The Contractor shall thoroughly compact the bottom of the hole. The guardrail posts shall rest directly and solidly on the bottom of the hole at the time of installation.

Excavated material which is unsuitable for use as backfill shall be substituted with granular material by the Contractor at his expense. Backfill shall be thoroughly compacted using pneumatic tampers, in layers not exceeding 150 mm, for the full depth of the excavation. Cementitious materials shall not be used for post support unless specifically authorized by the Engineer.

Guardrail laps shall be in the direction of traffic flow. Bolts shall be tightened to a torque of 100 N.m. Metal reflectors (Scotchlite or equivalent) shall be attached to the top of every third guardrail post with two 50 mm nails.

The Contractor shall take all necessary precautions to eliminate damage to galvanizing. Minor abrasions shall be repaired by painting with two coats of zinc-rich paint. Major abrasions shall be repaired by regalvanizing. The method to be used for repair of any damage shall be approved by the Engineer before such work is commenced. The Contractor, at his own cost, shall carry out the repair or replace components to the satisfaction of the Engineer.

The guardrail shall be connected to new or existing bridge walls or parapets as shown on the drawings. Surplus excavated material and debris shall be removed from the site and disposed of by the Contractor at his expense.

When performing guardrail repairs, the Contractor shall check the adjoining posts for splitting, rotting or other damage and report these to the Engineer.

Installations facing traffic shall not be left unfinished and open-ended overnight.

The Contractor shall stamp newly installed guardrail posts with the date of installation as directed by the Engineer. The site of the date stamping shall be coated with an approved preservative material when the continuity of the original treatment is compromised.

#### **54.23.6 ACCEPTANCE AND INSPECTION OF MATERIAL**

##### **54.23.6.1 General**

The Contractor shall provide the Engineer with a copy of the manufacturer's certificate verifying that materials supplied conform to Section 16 of CSA G40.20M, for each of the mechanical and chemical tests.

##### **54.23.6.2 Inspection of W-beam Guardrail Material**

The dimensions of finished guardrail shall have a tolerance of  $\pm 3$  mm.

Hot dip galvanized coating shall be smooth, free of beading or sharp projections at edges. Coating adherence shall prevent the peeling of any portion of the zinc coating so as to expose the base metal by cutting or prying with a stout knife under considerable pressure (bond check). A magnetic gauge will be used for checking thickness in accordance with ASTM Standard E316.3(c).

Warped or otherwise deformed rails and terminal elements will be rejected, as will those with injurious defects or excessive roughness of the zinc coating. When the rail is laid on a flat surface, the warpage shall not be greater than 5 cm.

### **54.23.6.3            Inspection of Wooden Posts and Blocks**

The Engineer may verify the penetration and retention of the preservative by the assay method.

Posts and blocks shall be subject to inspection by the Engineer when the bundles are opened immediately prior to use.

### **54.23.7            TIME TO COMPLETE**

In urgent situations the Contractor shall complete the Work within 5 calendar days of the issuance of the Work Order. In all other cases, the Work shall be completed within 60 calendar days of the issuance of the Work Order.

### **54.23.8            MEASUREMENT AND PAYMENT**

Measurement will be made of the number of posts supplied and installed.

Measurement will be in metres of the length of W-Beam guardrail installed.

Payment for guardrail installation will be made at the applicable unit price bid per metre for "Supply and Install W-Beam Guardrail", "Pick up and Install W-Beam Guardrail" or "Supply and Install Previously Used W-Beam Guardrail." This payment will be full compensation for supplying and installing or picking up and installing all required W-Beam guardrail sections including end terminals, traffic accommodation and signing, and all labour, materials, equipment, tools and incidentals necessary to complete the Work.

Payment for supplying and installing new posts will be made at the unit price bid per post for "Supply and Install Guardrail Posts" regardless of the length of the post. This payment will be full compensation for supplying and installing the posts, traffic accommodation and signing, and all labour, materials, equipment, tools and incidentals necessary to complete the Work. When replacing post(s) only, there will be no separate or additional payment for removal of the old post.

In urgent situations where the Contractor is required to complete any type of guardrail Work within 5 calendar days of the issuance of the Work Order, an additional payment will be made at the unit price bid per occurrence for "Guardrail - Premium". This payment will be full compensation for complying with the accelerated scheduling required to complete the Work. This payment will be made only once per Work Order, regardless of the different types of guardrail Work completed.

### **54.23.9            WARRANTY**

The warranty period for this Work shall be 1 year. The permissible tolerance for plumb and grade of the posts at the end of the warranty period shall be 13 mm.