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7.1 SECTION 1 – TRAFFIC SIGNS

7.1.1 DESCRIPTION

This Specification covers the requirements for the supply and installation, removal and reinstallation, removal and disposal and removal and salvage of permanent roadway signs, delineators and kilometre posts and includes traffic control regulatory and warning signs, information signs, guide signs and facility signs for the normal use of the roadway, as shown on the Drawings or as designated by the Engineer.

7.1.2 SUPPLY AND INSTALLATION

7.1.2.1 General

Where specified, new traffic signs, delineators, sign and delineator posts, breakaway base posts, bolts and hardware and kilometre posts shall be supplied by the Contractor.

All materials shall be free from wane, and shipments shall be protected from road and weather conditions.

Any materials damaged by the Contractor shall be replaced by the Contractor at their own expense.

7.1.2.2 Signs and Posts

Signs shall be fabricated and supplied in accordance with the standards set out in the latest edition of the *Manual of Uniform Traffic Control Devices for Canada*.

Galvanized signposts, breakaway base posts, bolts and hardware shall be fabricated and supplied in accordance with the latest version of Standard Drawing SD-200-02-13 "Breakaway Sign Post".

The length of post(s) required for each sign shall be determined by the Contractor, but shall, in all cases, meet the minimum and maximum values shown in the latest version of Standard Drawing SD-200-02-12 “Typical Sign Installation Height and Lateral Locations”.

7.1.2.3 Delineators and Posts

Flexible marker posts, reflective tab delineators and galvanized delineator posts shall be fabricated and supplied in accordance with the latest version of Standard Drawing SD-200-02-11 "Delineators”.

7.1.2.4 Kilometre Posts

Kilometre posts shall be fabricated and supplied in accordance with the latest version of Standard Drawing SD-200-02-14 "Typical Kilometre Post Installation".

7.1.3 REMOVAL AND REINSTALLATION

Where the removal and reinstallation of existing traffic signs, delineators, sign and delineator posts, breakaway base posts, bolts and hardware and kilometre posts is specified, any materials damaged by the Contractor or their agents shall be replaced by the Contractor at their own expense.

7.1.4 REMOVAL AND DISPOSAL

Where the removal and disposal of existing traffic signs, delineators, sign and delineator posts, breakaway base posts, bolts and hardware and kilometre posts is specified, all materials shall become the property of the Contractor. The crushing and burying of the materials are not permitted on the site. The Contractor shall remove and properly dispose of the materials to the satisfaction of all authorities having jurisdiction.

7.1.5 REMOVAL AND SALVAGE

Where the removal and salvage of existing traffic signs, delineators, sign and delineator posts, breakaway base posts, bolts and hardware and kilometre posts is specified, the Contractor shall carefully remove, dismantle, clean and neatly store the materials at a location approved by the Engineer. All salvaged materials shall remain the property of the Department.

Any materials damaged by the Contractor or their agents shall be replaced by the Contractor at their own expense.

7.1.6 CONSTRUCTION

a) Signs and posts, delineators and posts and kilometre posts shall be supplied and installed and/or removed and reinstalled and/or removed and disposed of and/or removed and salvaged in accordance with and at the locations shown in the Drawings, or as designated by the Engineer.
b) Signs shall be installed in accordance with the latest versions of Standard Drawing SD-200-02-12 "Typical Sign Installation Height and Lateral Locations" and Standard Drawing SD-200-02-13 "Breakaway Sign Post".
c) Delineators shall be installed in accordance with the latest version of Standard Drawing SD-200-02-11 "Delineators".
d) Kilometre posts shall be installed in accordance with the latest version of Standard Drawing SD-200-02-14 "Typical Kilometre Post Installation".
e) Signs shall be mounted on single or multiple posts and a single installation may include more than one (1) sign on each post or multiple posts.
f) Posts shall be set vertically and backfilled with material free of organics. The backfill around the posts shall be placed in thin layers and thoroughly compacted for the full depth.
g) Signs, delineators and tabs shall be fixed securely to the post(s).
h) The Contractor is responsible for the maintenance and protection of the signs, delineators, sign and delineator posts, breakaway base posts, bolts and hardware and kilometre posts until the completion of the project.

7.1.7 ACCEPTANCE OF WORK AND WARRANTY

Prior to the final acceptance of the Work, any damage or deficiencies from any cause to the signs, delineators, sign and delineator posts, bolts and hardware or kilometre posts shall be rectified by the Contractor at their own expense, to the satisfaction of the Engineer.

The Contractor shall, during the warranty period, straighten and recompact or reinstall as required, all posts that are more than 50 mm from vertical in a 2 m length of post.

7.1.8 MEASUREMENT

7.1.8.1 Supply and Installation

Measurement for Supply and Install Traffic Signs, Delineators and Kilometre Posts will be the number of complete units acceptably fabricated, supplied and installed in accordance with these Specifications.

The number of complete units shall be the number of posts regardless of the number of signs installed on the same post.

7.1.8.2 Removal and Reinstallation

The Removal and Reinstallation of Traffic Signs, Delineators and Kilometre Posts will not be measured separately for payment and shall be considered incidental to the Work.

The number of complete units shall be the number of posts regardless of the number of signs installed on the same post.

7.1.8.3 Removal and Disposal

The Removal and Disposal of Traffic Signs, Delineators and Kilometre Posts will not be measured separately for payment and shall be considered incidental to the Work.

7.1.8.4 Removal and Salvage

The Removal and Salvage of Traffic Signs, Delineators and Kilometre Posts will not be measured separately for payment and shall be considered incidental to the Work.

7.1.9 BASIS OF PAYMENT

Payment for Supply and Install Traffic Signs, Delineators and Kilometre Posts and/or Remove and Reinstall Traffic Signs, Delineators and Kilometre Posts will be at the contract unit price as per the Unit Price Table for the total number of complete units.

The unit prices shall be compensation in full for removing and reinstalling, fabricating, supplying, unloading, storing, handling and hauling the signs, delineators, sign and delineator posts, breakaway base posts, bolts and hardware and kilometre posts, assembling, installing, cutting and trimming posts, maintenance and protection of all materials and the supply of all equipment, labour, materials, tools and incidentals necessary to complete the Work in accordance with the Specifications.

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7.2 SECTION 2 – STEEL GUARDRAIL REMOVAL

7.2.1 DESCRIPTION

This Work consists of the removal of steel guardrail shown on the Drawings or as designated by the Engineer.

7.2.2 MATERIALS

Not applicable.

7.2.3 CONSTRUCTION

7.2.3.1 Removal and Disposal

Where the removal and disposal of existing steel guardrail is specified, all guardrail materials shall become the property of the Contractor.

Crushing and burying of existing steel guardrail materials is not permitted on the site. The Contractor shall remove and properly dispose of the materials to the satisfaction of all authorities having jurisdiction.

7.2.3.2 Removal and Salvage

Where the removal and salvage of existing steel guardrail is specified, the Contractor shall carefully remove and neatly store the materials, including all hardware, at locations approved by the Engineer. All rails shall be carefully removed from timber posts and offset blocks and dismantled, all posts and offset blocks shall be removed from the ground and cleaned, and all post holes shall be backfilled, firmly compacted and levelled. All guardrail materials shall remain the property of the Department.

If any guardrail materials specified for salvage are damaged beyond use, or to an unacceptable state as determined by the Engineer, by the Contractor or their agents during the removal operation, the Contractor shall replace the damaged guardrail materials at their own expense.

7.2.3.3 Removal and Reinstallation

Where the removal and reinstallation of existing steel guardrail is specified, the Contractor shall carefully remove and neatly store the materials, including all hardware, at locations approved by the Engineer. All rails shall be carefully removed from timber posts and offset blocks and dismantled, all posts and offset blocks shall be removed from the ground and cleaned, and all post holes shall be backfilled, firmly compacted and levelled. All guardrail materials shall remain the property of the Department.

If any guardrail materials specified for reinstallation are damaged beyond use, or to an unacceptable state as determined by the Engineer, by the Contractor or their agents during the removal operation, the Contractor shall replace the damaged guardrail materials at their own expense.

Reinstallation shall be in accordance with Section 7.3.

7.2.4 MEASUREMENT

7.2.4.1 Steel Guardrail Removal

The quantity of Steel Guardrail Removal to be measured for payment will be the number of linear metres based on the total length of guardrail measured from end to end along the face of the rail to be removed, including terminal sections, acceptably removed in accordance with the Specifications. No extra allowance will be made for laps of splices.

7.2.4.2 Steel Guardrail Disposal

The removal and offsite disposal costs for steel guardrail materials will not be measured separately for

payment and shall be considered incidental to the guardrail removal operation.

7.2.4.3 Steel Guardrail Salvage

The salvage, cleaning and storing of guardrail materials will not be measured separately for payment and shall be considered incidental to the guardrail removal operation.

7.2.4.4 Steel Guardrail Reinstallation

The quantity of Steel Guardrail Reinstallation to be measured for payment will be the number of linear metres based on the total length of guardrail measured from end to end along the face of the rail reinstalled, including terminal sections, acceptably installed in accordance with the Specifications. No extra allowance will be made for laps of splices.

7.2.4.5 Accommodation of Traffic

Work required for the safe, controlled and signed accommodation of traffic during the removal of guardrail will not be measured separately for payment and shall be considered incidental to the guardrail removal operation.

7.2.4.6 Damaged Steel Guardrail Materials

The replacement of guardrail materials damaged where salvage is specified will not be measured separately for payment and shall be considered incidental to the guardrail removal operation.

7.2.5 BASIS OF PAYMENT

Payment for Steel Guardrail Removal will be at the Contract unit price per linear metre.

The unit price shall be compensation in full for accommodation of traffic, removing, dismantling, cleaning, hauling, disposing, storing of the guardrail materials, including hardware, backfilling, compacting and levelling post holes and the supply of all equipment, labour, materials, tools and incidentals necessary to complete the Work in accordance with the Specifications.

Payment for Reinstallation of Steel W-Beam Guardrail will be at the Contract unit price per linear metre.

The unit price shall be compensation in full for reinstalling steel guardrail, traffic control and accommodation, excavating holes, placing and trimming posts, erecting the guardrail, burring the bolts, loading, hauling, placing, watering and tamping the backfill material from the Department's source or quarry, all surveying, supplying and attaching reflectors and the supply of all equipment, labour, materials, tools and incidentals necessary to complete the Work in accordance with the Specifications.

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7.3 SECTION 3 – SUPPLY AND INSTALLATION OF STEEL W-BEAM GUARDRAIL

7.3.1 DESCRIPTION

This Work consists of the supply and installation of Steel W-Beam Guardrail on treated timber posts and offset blocks at the locations and in conformity with the dimensions and other details shown on the Drawings or as designated by the Engineer.

7.3.2 MATERIALS

7.3.2.1 Supply

The Contractor shall be responsible for the supply of all guardrail materials.

7.3.2.2 Steel W-Beam Rails and Terminal Elements

Steel W-Beam rails and terminal elements shall consist of rail sections fabricated for installation to develop a continuous beam strength with the necessary safety end feature components.

Rail and terminal elements shall conform to the latest requirements of the latest edition of "Corrugated Sheet Steel Beams for Highway Guardrail" (AASHTO M180).

All rail sections and terminal sections shall conform to the latest AASHTO/ARTBA requirements for full interchangeability of similar components regardless of the source or manufacturer.

All components supplied shall be clearly and permanently stamped, clear of the splicing overlap and on the opposite face to the traffic side, with the following information: manufacturer's name or trademark, nominal thickness of metal, and date of manufacture.

The rails and terminal sections shall also conform to the following requirements:

a) Metal Properties
- Minimum Yield Point: 345 MPa
- Minimum Tensile Strength: 483 MPa
- Minimum Elongation: 12% in 50 mm length

b) Sheet Thickness

The rails and terminal sections shall be manufactured in accordance with the latest requirements of Corrugated Sheet Steel Beams for Highway Guardrail (AASHTO M180), Table 2 (Class A, Type 2), with a nominal base metal thickness of 2.82 mm and a minimum base metal nominal thickness of 2.67 mm.

c) Sheet Width

The sheet width for W-beam rails shall be 483 mm with a permissible tolerance of +/- 3.2 mm.

Welding for the fabrication of terminal elements shall conform to the latest requirements of Welded Steel Construction (Metal Arc Welding) (CSA W59).

Rails and terminal elements shall be hot-dip galvanized after fabrication and shall conform to the latest requirements of Hot Dip Galvanizing of Irregularly Shaped Articles (ASTM A123/123M). The galvanizing shall have a minimum thickness of 80 mm.

Hot dip galvanized coating shall be smooth and free of beading and sharp projections at the edges. The coating shall be sufficiently adherent to prevent peeling by cutting or prying with a stout knife under considerable pressure (bond check). Magnetic gauge testing may be used for verifying the galvanized coating thickness in

accordance with the latest requirements of Magnetic Gauge Testing of Galvanizing Coating (ASTM E316.3). Dimensions of the finished guardrail shall have a tolerance of +/- 3 mm.

7.3.2.3 Bolts, Nuts and Washers

Bolts, nuts and washers shall conform to the latest requirements of Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength (ASTM A307) and shall be hot-dip galvanized in accordance with the latest edition of ASTM F2329/F2329M.

7.3.2.4 Timber Posts and Offset Blocks

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. Timber posts and offset blocks shall be rough sawn with holes drilled to the finished dimensions shown in the Standard Drawings. Timber posts and offset blocks shall conform to the dimensions shown on the Standard Drawings. Unless otherwise specified, the timber posts shall be 1.76 m in length.

Timber 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 at least 50 mm by 50 mm and have an indentation of 3 mm.

Stamping and drilling shall be completed prior to treating the posts and offset blocks. Timber posts and offset blocks shall be pressure treated in accordance with the latest requirements of Wood Preservation (CSA O80) with a water borne preservative of chromated copper arsenate (CCA) or ammoniacal copper arsenate (ACA) to 8 kg/m^3.

The penetration and retention of preservatives shall conform to the requirements of CSA Standard O80.14, 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, Guardrails and Posts" (not in contact with ground or water). The penetration and retention of the preservative may be verified by the Engineer by the array method.

7.3.2.5 Materials Certification and Specifications Conformance

The Contractor shall provide the Engineer with the following, prior to installation:

a) A copy of the manufacturer's certificate(s), conforming to the latest requirements of General Requirements for Rolled or Welded Structural Quality Steel (CSA G40.20/G40.21), for each of the mechanical and chemical tests, and
b) Certification, by letter attached to the copy of the manufacturer's certificate(s), that all the materials provided are from the materials identified by the manufacturer as being represented by the copies of the manufacturer's certificate(s).

All guardrail material that does not conform to the Specifications will be rejected. Rejected guardrail material shall be replaced at the Contractor's expense, including shipping charges and the removal of rejected material from the project site.

7.3.3 CONSTRUCTION

7.3.3.1 Survey, Layout, Staking and Grading Requirements

a) The Contractor shall provide and pay for qualified personnel to carry out all surveying, layout, staking,

grading, and referencing required for the accurate placement and control of guardrail installation operations. This shall include the removal of existing guardrail, where applicable.

b) The Contractor shall notify the Engineer when the guardrail installation has been completed in accordance with the Specifications and shall provide ample opportunity for the Engineer to take verification measurements of the installation.

The Engineer will not take measurements of the guardrail installation at any time prior to notification by the Contractor that the guardrail installation has been completed in accordance with the Specifications, nor will the Engineer be obliged to notify the Contractor of any deficiencies, after the measurements have been completed.

The completion of guardrail installation measurements by the Engineer shall in no way constitute acceptance of the guardrail materials or guardrail installation by the Engineer.

7.3.3.2 Installation

The guardrail, posts and offset blocks shall be accurately set to the required depth, height, line, grade and alignment in a manner that results in a smooth, continuous installation which parallels the line and grade of the highway surface, in accordance with the Standard Drawings. The permissible tolerance for plumb is less than 1.5 degrees from vertical and grade of the posts shall be a maximum of 6 mm.

The diameter of the post holes for the guardrail shall be of sufficient size to allow for pneumatic tamping.

The Contractor shall thoroughly compact the bottom of each post hole and the guardrail posts shall rest directly and solidly on the bottom of each 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. The backfill material shall be free of large stones and shall be thoroughly compacted utilizing pneumatic tampers, in layers not exceeding 150 mm, for the full depth of the excavation.

All rail elements shall be lapped in the direction of traffic. Bolts shall be tightened to a torque of 100 N-m and exposed threads shall be burred.

The Contractor shall repair or replace, at no direct expense to the Department, any guardrail material damaged by his operations, to the satisfaction of the Engineer. Minor damage to galvanized surfaces shall be repaired in accordance with ASTM A780/A780M Method A2, Repair Using Paints Containing Zinc Dust. Major abrasions shall be repaired by re-galvanizing or replacement, as determined by the Engineer.

The guardrail shall be connected to new or existing bridge walls or parapets in accordance with the Drawings.

Surplus excavated material and debris shall be removed from the site by the Contractor at his expense.

7.3.3.3 Guardrail Reflectors

The Contractor shall be responsible for the supply and attachment of reflector strips to the two top corners of the traffic side of every 6th guardrail post/offset block.

Reflectors shall have minimum dimensions of 102 mm x 76 mm.

Reflective sheeting meeting the requirements of ASTM D4956 for Type IX or XI sheeting shall be installed on both sides of the reflector.

White reflectors shall be attached to the top corners of the offset blocks facing adjacent traffic and yellow reflectors shall be attached to the top corners of the offset blocks facing oncoming traffic.

7.3.4 ACCEPTANCE OF WORK AND WARRANTY

Prior to installing any guardrail, the Contractor shall provide the Engineer with copies of the Manufacturer's certificates verifying that the supplied guardrail material conforms to Section 16 of CSA G40.20 for each of the mechanical and chemical tests; and the supplied reflective sheeting conforms to ASTM D4956 for Type IX or XI sheeting.

Prior to final acceptance of the Work, any damage or deficiencies from any cause to the guardrail, posts, offset blocks, bolts and hardware shall be rectified by the Contractor at their own expense.

The permissible tolerance at the end of the warranty period for all posts will be two degrees from vertical for plumb and shall be less than 13 mm for grade.

7.3.5 MEASUREMENT

7.3.5.1 Supply and Installation

The quantity of Supply and Installation of Steel W-Beam Guardrail to be measured for payment will be the number of linear metres based on the total length of guardrail measured from end to end along the face of the installed rail, including rail terminal sections, acceptably fabricated, supplied and installed in accordance with the Specifications. No extra allowance will be made for laps or splices.

The supply and installation of wing terminal sections will not be measured separately for payment and shall be considered incidental to the guardrail supply and installation operation.

The supply and application of paint, if required, will not be measured separately for payment and shall be considered incidental to the guardrail supply and installation operation.

The supply and attachment of guardrail reflectors will not be measured separately for payment and shall be considered incidental to the guardrail supply and installation operation.

7.3.5.2 Accommodation of Traffic

Work required for the safe, controlled and signed accommodation of traffic during installation or removal of guardrail will not be measured separately for payment and shall be considered incidental to the guardrail supply and installation operation.

7.3.6 BASIS OF PAYMENT

Payment for Supply and Installation of Steel W-Beam Guardrail will be at the Contract unit price per linear metre.

The unit price shall be compensation in full for ordering, fabricating, purchasing, loading, transporting, unloading, storing, handling, hauling, delivering and supplying guardrail materials and hardware, including rail terminal sections and wing terminal sections, traffic control and accommodation, excavating holes, loading, hauling, placing, watering and tamping the backfill material from the Department’s source or quarry, all surveying, supplying and attaching metal reflectors and the supply of all equipment, labour, materials, tools and incidentals necessary to complete the Work in accordance with the Specifications.