

# **Traffic Signal and Pedestrian Corridor Structures**

*Standard Specifications*

*February 2000*

**Traffic Signal and Pedestrian Corridor  
Structures - Standard Specifications  
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Province of Manitoba  
Department of Highways and Transportation  
Traffic Engineering Branch

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*Prepared by*

**Dillon Consulting Limited**

**MANITOBA HIGHWAYS AND TRANSPORTATION  
TRAFFIC ENGINEERING  
SPECIFICATION FOR SUPPLY OF  
GALVANIZED STEEL ANCHOR BOLTS FOR  
TRAFFIC SIGNAL AND PEDESTRIAN CORRIDOR STANDARDS**

**1. DESCRIPTION**

This Specification covers the fabrication and delivery of galvanized steel anchor bolts for traffic signal and pedestrian corridor standards.

**2. MATERIALS**

**2.1 Supplied by the Contractor**

Materials supplied by the Contractor shall be new, conform to the requirements of the Canadian Standards Association and as shown on the Drawings, and be approved by the Engineer before any construction is undertaken. If materials, in whole or in part, do not conform to the requirements of the Canadian Standards Association and as shown on the Drawings, or are found to be defective in manufacture, or have become damaged in transit and handling operation, then such material shall be rejected by the Engineer and shall be replaced at the Contractor's expense.

**2.2 Submissions**

The Contractor shall submit the following information to the Traffic Engineering Branch in triplicate prior to any fabrication:

- (a) Mill certificates for structural steel anchor bolts and components.

No fabrication shall commence until the required submissions have been reviewed and returned to the Supplier. All costs resulting from any changes or due to failure to have submissions reviewed shall be borne by the Contractor.

**3. MATERIALS**

**3.1 Anchor Bolt Rods**

Anchor bolt rods shall be solid rounds with the following sizes and material specifications:

- (a) MK. AB1: 29 mm (1 1/8") diameter CSA G40.21, Grade 300W steel.
- (b) MK. AB2: 32 mm (1 1/4") diameter CSA G40.21, Grade 300W steel.
- (c) MK. AB3: 51 mm (2") diameter AISI/SAE 4140 steel in the annealed condition.

**3.2 Nuts**

Nuts shall be heavy hex in accordance with ASTM A194 Grade 2H. Nuts shall be tapped with oversize threads to accommodate galvanized anchor bolts.

Locking nuts shall be half-height nuts in accordance with ASTM A194 Grade 2H.

**3.3 Steel Plates and Washers**

Steel plates and washers shall be in accordance with CSA G40.21, Grade 300W.

### **3.4 Hot-Dip Galvanizing**

Hot-dip galvanizing shall be in accordance with CSA G164 to a net minimum retention of 600 g/m<sup>2</sup>.

## **4. FABRICATION**

Fabrication of anchor bolts shall be carried out in accordance with the details shown on the Drawings.

All components shall be fabricated prior to hot-dip galvanizing.

After galvanizing, and prior to delivery, each anchor bolt rod shall be assembled with the required nuts, plates, and washers, as shown on the Drawings.

## **5. DELIVERY**

All anchor bolts shall be bundled in groups of four anchor bolt assemblies for each type. Non-metallic strapping shall be used to secure each bundle. Each bundle shall have a weatherproof identification label indicating the appropriate mark number and date of manufacture. Delivery shall be F.O.B. Manitoba Highways and Transportation Warehouse Stores, 1550 Dublin Avenue, Winnipeg, Manitoba.

The anchor bolt assemblies shall be inspected by the Director of Traffic Engineering or his representative upon receipt, before acceptance by this Department.

The Director of Traffic Engineering shall be informed 48 hours in advance of the anticipated delivery date.

## **6. METHOD OF MEASUREMENT**

The supply of anchor bolts will be measured on a unit basis, per anchor bolt assembly. The number of anchor bolt assemblies to be paid for shall be the total number of assemblies supplied in accordance with this Specification and accepted by the Engineer.

## **7. BASIS OF PAYMENT**

The supply of anchor bolts will be paid for at the Contract Unit Price per anchor bolt assembly for the "Items of Work," listed below, measured as specified herein, which price shall be payment in full for supplying all materials and performing all operations herein described, and all other items incidental to the work included in this Specification.

### Items of Work

Supply of Anchor Bolts

- (a) MK. AB1.
- (b) MK. AB2.
- (c) MK. AB3.

**MANITOBA HIGHWAYS AND TRANSPORTATION  
TRAFFIC ENGINEERING  
SPECIFICATION FOR STRAIGHT STANDARDS**

**1. DESCRIPTION**

This Specification covers the fabrication and delivery of straight standards.

Standards are intended to support one to three 5-section 300 mm traffic signal heads, made of aluminum, complete with standard backboards.

**2. STRUCTURE CONFIGURATIONS**

**2.1 General**

Items forming part of this Specification include Component Nos.:

E-016C 2.9 m Straight Post Top Signal Standard

E-016X 5.0 m Straight Standard

The details shown on the Drawings shall not be changed unless approved in writing by the Engineer. Care shall be taken to ensure flange connections remain interchangeable.

**2.2 Type of Standards**

Standards shall be as follows:

Type	Use	Arm Lengths (m)
Straight (Type 1)	Traffic Signal - 2.9 m high	N/A
Straight (Type 8)	Traffic Signal - 5.0 m high	N/A

Straight standards shall be supplied in 2.9 m or 5.0 m lengths, as specified on the purchase order.

Each tubular component shall be fabricated in one piece.

### **3. MATERIALS**

#### **3.1 General**

The Contractor shall be responsible for the supply, safe storage, and handling of all materials set forth in this Specification.

All materials used for fabrication of traffic signal and pedestrian corridor standards shall be new, previously unused material.

#### **3.2 Handling and Storage of Materials**

All materials shall be handled in a careful and workmanshiplike manner, to the satisfaction of the Engineer. Storage of materials shall be in accordance with the requirements of CSA Standard CAN3 A23.1.8-M77, Storage of Materials, except as otherwise specified herein.

#### **3.3 Structural Steel**

Structural steel for items with 3 mm (11 ga) thick shaft material shall be in accordance with CSA G40.21 Grade 350W. All other parts shall be minimum Grade 300W material. For purposes of hot-dip galvanizing, the silicon content in the steel shall be controlled within 0 to 0.03%.

The Supplier is advised that copies of mill test certificates showing the chemical and physical properties of all structural steel to be supplied under this Specification must be submitted to the Engineer. The mill test certificates shall be submitted prior to commencement of product fabrication for acceptance by the Engineer.

Steel shall not be acceptable unless the mill test certificate states the grade to be 350 MPa (50 ksi) and 300 MPa (44 ksi) minimum yield for the applicable parts. Lower grade steel shall not be acceptable (despite favourable published mill test yield results), and items fabricated without steel certification shall be rejected.

All costs resulting from any changes or due to failure to have submissions reviewed shall be borne by the Supplier.

#### **3.4 Hot-Dip Galvanizing**

Hot-dip galvanizing shall be in accordance with CSA G164 to a net minimum retention of 600 g/m<sup>2</sup>.

#### **3.5 Galvanizing Touch-up**

Galvanizing touch-up and shall be done with self-fluxing, low-temperature, zinc-based alloy rods in accordance with ASTM A780-80 for "Repair of Damaged Hot-Dip Galvanized Coatings." Approved products are Galvalloy as manufactured by Metalloy Products Company, P.O. Box No. 3093, Terminal Annex, Los Angeles, California, and Welco Gal-Viz Galvanizing Alloy, as manufactured by Thermocote Welco, Highway 161, York Road, Kings Mountain, North Carolina. Locally, both products are available from Welder Supplies Limited, 25 McPhillips Street, Winnipeg.

#### **3.6 Welding Consumables**

Welding consumables for all processes shall be certified by the manufacturer to be complying with the requirements of CSA Standard W59-M1984 and the following Specifications:

a) Manual shielded metal arc welding (SMAW):

All electrodes shall be basic-type electrodes conforming to CSA W48.1-M1991 or W48.3-M1982, classification E480XX, or imperial equivalent.

b) Gas metal arc welding (GMAW):

All electrodes shall conform to CSA W48.4-M1980, classification ER480S-X, or imperial equivalent.

c) Flux cored arc welding (FCAW):

All electrodes shall conform to CSA W48.5-M1982, classification E480XT-X or imperial equivalent. Electrodes shall be controlled by hydrogen (CH) designation.

d) Submerged arc welding (SAW):

All electrodes shall conform to CSA W48.6-M1980, classification F480X-EXXX or imperial equivalent.

e) Shielding gas shall be welding grade carbon-dioxide with a guaranteed dew point of  $-46^{\circ}\text{C}$ .

f) All electrodes, wires, and fluxes used shall be of a classification requiring a minimum impact of 27 joules at  $-18^{\circ}\text{C}$ .

The proposed welding procedures and welding consumable certificates shall be submitted to the Engineer for approval at least two (2) days prior to the scheduled commencement of any fabrication.

### **3.7 Connection Bolts**

Connection bolts shall be ASTM A325 high strength bolts each with one grade DH nut and one hardened washer, all hot-dip galvanized.

The galvanized nuts shall be overtapped to the minimum amount required for fastener assembly. The nuts shall be lubricated with a lubricant containing a visible dye. The lubricant shall be clean and dry to the touch.

### **3.8 Hardware for Handhole Covers**

Hardware for handhole covers shall be in accordance with ASTM A276 Type 316 stainless steel.

### **3.9 Miscellaneous Materials**

Miscellaneous material incidental to this work shall be as approved by the Engineer.

## **4. CONSTRUCTION METHODS**

### **4.1 General Requirements**

- a) Holes in the base plates shall be oversized by 6 mm.
- b) Adequate venting and drainage holes shall be provided in enclosed sections for hot-dip galvanizing. The galvanizing facilities shall be consulted regarding the size and location of these holes. Holes shall be provided by drilling not burning.
- c) Prior to fabrication, the dimensional limitations on the size and shape imposed by the galvanizing facilities shall be determined for hot-dip galvanizing all individual components of the traffic signal and pedestrian corridor standards.

#### **4.2 Fabrication**

All fabrication shall be carried out in accordance with this Specification and the Contract Drawings, as well as AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaries, and Traffic Signals - 1994, plus all subsequent revisions.

The punching of identification marks on the members will not be allowed, except as specified herein.

Any damage to members during fabrication shall be drawn to the attention of the Engineer in order that the Engineer may approve remedial measures.

All portions of the work shall be neatly finished. Shearing, cutting, clipping, and machining shall be done neatly and accurately. Finished members shall be true to line, free from twists, bends, sharp corners, and edges.

Cut edges shall be true and smooth and free from excessive burrs or ragged breaks. Re-entrant cuts shall be avoided wherever possible. If used, they shall be filleted by drilling prior to cutting.

All holes shall be provided by drilling not burning. All holes shall be free of burrs and rough edges.

#### **4.3 Welding**

Welding shall be in accordance with CSA W59, "Welded Steel Construction."

All seams shall be continuously welded and free from any slag and splatter. Longitudinal welds shall be a minimum of 70% penetration, except those within 200 mm of baseplates, flanges, end openings, access openings, and circumferential welds, which shall be 100% penetration. All circumferential groove welds shall be 100% penetration, and where circumferential welds are used at a butt joint, an internal backup strip shall be provided.

Longitudinal seam welds in davit arms and extensions shall be located at the bottom of the horizontal members. Only one longitudinal seam is permitted in each member.

All welds shall be ground smooth and flush with the adjacent surface prior to hot-dip galvanizing.

#### **4.4 Surface Preparation and Cleaning**

Surface preparation and cleaning of materials prior to hot-dip galvanizing shall be in accordance with CSA G164 and SSPC Specification SP:6, "Commercial Blast Cleaning," unless otherwise specified

herein. The Contractor shall ensure that all individual components of the traffic signal and pedestrian corridor standards are blast cleaned prior to pickling to achieve the minimum zinc coating mass of 600 g/m<sup>2</sup>. All welding and provision of holes is to be completed prior to surface preparation and cleaning, except where shown on the Drawings.

The sandblasting and cleaning of all components shall be done in the shop.

After the fabricated components have been sandblasted and cleaned, an inspection agency appointed by the Department will carry out a visual inspection of the components in the shop before they are shipped to the galvanizing plant.

## **4.5 Hot-Dip Galvanizing**

### **4.5.1 General**

The hot-dip galvanizing plant shall be a Regular Member of the American Galvanizers Association, Inc. and certified to CSA G164.

All outside surfaces and interior surfaces of all individual components of the traffic signal and pedestrian corridor standards shall be hot-dip galvanized in accordance with the requirements of this Specification.

The galvanizing coating on outside surfaces of the structures shall be generally smooth and free of blisters, lumpiness and runs. In particular, the outside surfaces of the bottom 2.5 m of the vertical support members shall have a smooth finish equal to the finish on hot-dipped galvanized handrails.

In addition to the provision of corrosion protection by the galvanized coating, the aesthetic appearance of the structure after hot-dip galvanizing will also be a criteria in the acceptance or rejection of the galvanized coating. The galvanized coating on the entire structure shall have a uniform "silver" colour and lustre. Galvanizing with parts of the structure having dull grey coating or streaks or mottled appearance will not be acceptable. If the galvanizing is rejected for aesthetic reasons, the Contractor shall rectify the appearance by applying spray-on molten zinc metallizing with 85/15 zinc/aluminum alloy. The metallizing shall be carried out in the shop before the structure is installed.

To prevent problems with aesthetic appearance of structures after hot-dip galvanizing, the Contractor shall be responsible for ensuring that the silicon content in the steel used for fabricating the structures is controlled within 0 to 0.03%.

Minor defects in the galvanizing coating shall be repaired in accordance with Section 4.5.2 of this Specification. The Engineer shall be consulted before repairs are made. Use of cold applied spray-on galvanizing will not be permitted and will be cause for rejection.

Other defects and contaminants in the galvanizing coating, such as heavy dross protrusions, flux inclusions and ash inclusions shall be grounds for rejection of the galvanizing coating system.

The Contractor shall verify the thickness of galvanized coatings as directed by the Contract Administrator.

All threaded couplings shall be rethreaded after the sign structures have been hot-dip galvanized.



The structures shall be stored on timber blocking after hot-dip galvanizing.

#### **4.5.2 Repair of Damaged Galvanizing**

All areas of damaged galvanizing shall be repaired by touch-up galvanizing.

Surfaces to receive touch-up galvanizing shall be cleaned using a wire brush, a light grinding action, or mild blasting to remove loose scale, rust, paint, grease, dirt, or other contaminants. Preheat the surface to 315°C and wire brush the surface during preheating. Rub the cleaned preheated area with the repair stick to deposit an evenly distributed layer of zinc alloy. Spread the alloy with a wire brush, spatula, or similar tool. Touch-up galvanizing shall be blended into existing galvanizing of surrounding surfaces and shall be buffed and polished if required to match the surrounding surfaces. Care shall be taken to not overheat surfaces beyond 400°C and to not apply direct flame to the alloy rods.

### **5. IDENTIFICATION**

Each base plate flange of straight standards shall be identified with the appropriate identification stock code number (as indicated on the Specification sheet) and the date of manufacture. This shall be stamped on the handhole side of the base plate.

### **6. QUALITY CONTROL**

#### **6.1 General**

All workmanship and all materials furnished and supplied under this Specification are subject to close and systematic inspection and testing by the Department, including all operations from the selection and production of materials, through to final acceptance of the work. The Contractor shall be wholly responsible for the control of all operations incidental thereto notwithstanding any inspection approval that may have been previously given. The Department reserves the right to reject any materials or works that are not in accordance with the requirements of this Specification.

The Contractor shall be responsible for making a thorough inspection of materials to be supplied under this Contract. All material shall be free of surface imperfections and other defects.

#### **6.2 Welding Qualifications**

The Contractor shall produce evidence that the plant has recently been fully approved by the C.W.B. to the requirements of CSA W47.1 Division 2.1 for welding of steel structures.

Approved welding procedures shall be submitted to the Engineer prior to fabrication of any steel items.

#### **6.3 Inspection**

##### **6.3.1 General**

The Department will appoint an inspection agency to carry out inspections and testing of work in this Specification. The inspection agency shall report to the Department based on plant inspections of welds, material, fabrication procedures, quality control, mill test certificates, etc. All inspection costs will be borne by the Department. The inspections will include the following:

- a) Inspection of all material and proposed fabrication procedures prior to the start of manufacturing.
- b) Inspection of all fabricated components prior to hot-dip galvanizing.
- c) A final inspection following application of hot-dip galvanizing, prior to shipment from the manufacturer's plant.

The inspection agency shall carry out the following welding inspections and testing:

a) **Circumferential Welded Splices**

100% of circumferential welds used to join pole sections together shall be inspected. Inspection shall be performed by radiography or ultrasonics, or by destructive tests acceptable to the Engineer. Only one time repair of circumferential welds is allowed without written permission of the Engineer.

b) **Longitudinal Seam Welds**

100% of full penetration welds and a random 25% of partial penetration welds of longitudinal seams shall be inspected. Full penetration weld inspections shall be performed by radiography or ultrasonics. In addition, partial penetration welds may be inspected by magnetic particle. Both types of weld may be tested by destructive methods acceptable to the Engineer.

c) **Base Connection and Flange Plate Connection Welds**

A random 25% of all base connection and flange plate connection welds shall be inspected. Full penetration weld inspection may be performed by radiography or ultrasonics. Fillet welds may be inspected by magnetic particle. Both types of weld may be tested by destructive methods acceptable to the Engineer. Only one time repair of base connection or flange plate connection welds is allowed without written permission of the Engineer.

Welds that are found by any of the inspection methods to be inadequate and unsatisfactory shall be repaired in accordance with CSA W59 and then retested. The cost of the repairs and the cost of the retest shall be paid for by the Contractor.

No repair shall be made until agreed to by the Engineer.

#### **6.4 Unacceptable Work**

Any welding work found to be unacceptable shall be corrected in accordance with CSA W59.

No repair shall be made until agreed to by the Engineer.

#### **7. DELIVERY**

Standards and component parts shall be delivered F.O.B. Warehouse Stores, 1550 Dublin Avenue, Winnipeg, Manitoba.

Non-metallic strapping shall be used to secure groups of standards for delivery.

Standards shall be inspected by the Director of Traffic Engineering or his representative upon receipt, before acceptance by this Department.

The Director of Traffic Engineering shall be informed 48 hours in advance of the anticipated delivery date.

**8. GUARANTEE**

The Supplier shall guarantee all material against defects in quality or workmanship for a period of one year after final acceptance by the Department.

**9. METHOD OF MEASUREMENT**

Fabrication of traffic signal straight standards will be measured on a unit basis, per standard. The number of standards to be paid for shall be the total number of standards fabricated in accordance with this Specification and accepted by the Engineer.

**10. BASIS OF PAYMENT**

Fabrication of traffic signal straight standards will be paid for at the Contract Unit Price per standard for the "Items of Work" listed below, measured as specified herein, which price shall be payment in full for supplying all materials and performing all operations herein described, and all other items incidental to the work included in this Specification.

Items of Work

Fabrication of Standards

- a) Straight Standards - Type 1
- b) Straight Standards - Type 8

**MANITOBA HIGHWAYS AND TRANSPORTATION  
TRAFFIC ENGINEERING  
SPECIFICATION FOR  
LIGHT SERIES TRAFFIC SIGNAL  
AND PEDESTRIAN CORRIDOR DAVIT STANDARDS**

## 1. DESCRIPTION

This Specification covers the fabrication and delivery of light series traffic signal and pedestrian corridor davit standards.

Standards are intended to support one to three 5-section 300 mm traffic signal heads, made of aluminum, complete with standard backboards, or one or two internally illuminated pedestrian corridor fixtures, and one or two street blade signs.

## 2. STRUCTURE CONFIGURATIONS

### 2.1 General

Items forming part of this Specification include Component Nos.:

E-016F Stub - Light Series Davit  
E-016G Arm Extension - Light Series Davit  
E-016P Stub - Light Series Davit (no arm extension)

The details shown on the Drawings shall not be changed unless approved in writing by the Engineer. Care shall be taken to ensure flange connections remain interchangeable.

### 2.2 Type of Standards

Standards shall be as follows:

Type	Use	Arm Lengths (m)
Light Series Davit (Type 2)	Traffic Signal	2.5, 5.0
	Pedestrian Corridor	5.0

Davit standards shall be supplied in 2.5 m or 4.8 m lengths, as specified on the purchase order.

Davit arm height (loaded) shall be 6400 mm  $\pm$  50 mm above the base plate, measured at the end of the arm, except for 2.5 m light series davits which shall be 6000 mm  $\pm$  50 mm.

All extension arms shall be one piece without any flanges, except where the arm is attached to the vertical member.

Each tubular component shall be fabricated in one piece.

## 3. MATERIALS

### **3.1 General**

The Contractor shall be responsible for the supply, safe storage, and handling of all materials set forth in this Specification.

All materials used for fabrication of traffic signal and pedestrian corridor standards shall be new, previously unused material.

### **3.2 Handling and Storage of Materials**

All materials shall be handled in a careful and workmanshiplike manner, to the satisfaction of the Engineer. Storage of materials shall be in accordance with the requirements of CSA Standard CAN3 A23.1.8-M77, Storage of Materials, except as otherwise specified herein.

### **3.3 Structural Steel**

Structural steel shall be in accordance with CSA G40.21 Grade 300W. For purposes of hot-dip galvanizing, the silicon content in the steel shall be controlled within 0 to 0.03%.

The Supplier is advised that copies of mill test certificates showing the chemical and physical properties of all structural steel to be supplied under this Specification must be submitted to the Engineer. The mill test certificates shall be submitted prior to commencement of product fabrication for acceptance by the Engineer.

Steel shall not be acceptable unless the mill test certificate states the grade to be 300 MPa (44 ksi) minimum yield. Lower grade steel shall not be acceptable (despite favourable published mill test yield results), and items fabricated without steel certification shall be rejected.

All costs resulting from any changes or due to failure to have submissions reviewed shall be borne by the Supplier.

### **3.4 Hot-Dip Galvanizing**

Hot-dip galvanizing shall be in accordance with CSA G164 to a net minimum retention of 600 g/m<sup>2</sup>.

### **3.5 Galvanizing Touch-up**

Galvanizing touch-up and shall be done with self-fluxing, low-temperature, zinc-based alloy rods in accordance with ASTM A780-80 for "Repair of Damaged Hot-Dip Galvanized Coatings." Approved products are Galvalloy as manufactured by Metalloy Products Company, P.O. Box No. 3093, Terminal Annex, Los Angeles, California, and Welco Gal-Viz Galvanizing Alloy, as manufactured by Thermocote Welco, Highway 161, York Road, Kings Mountain, North Carolina. Locally, both products are available from Welder Supplies Limited, 25 McPhillips Street, Winnipeg.

### **3.6 Welding Consumables**

Welding consumables for all processes shall be certified by the manufacturer to be complying with the requirements of CSA Standard W59-M1984 and the following Specifications:

- a) Manual shielded metal arc welding (SMAW):

All electrodes shall be basic-type electrodes conforming to CSA W48.1-M1991 or W48.3-M1982, classification E480XX, or imperial equivalent.

b) Gas metal arc welding (GMAW):

All electrodes shall conform to CSA W48.4-M1980, classification ER480S-X, or imperial equivalent.

c) Flux cored arc welding (FCAW):

All electrodes shall conform to CSA W48.5-M1982, classification E480XT-X or imperial equivalent. Electrodes shall be controlled by hydrogen (CH) designation.

d) Submerged arc welding (SAW):

All electrodes shall conform to CSA W48.6-M1980, classification F480X-EXXX or imperial equivalent.

e) Shielding gas shall be welding grade carbon-dioxide with a guaranteed dew point of -46°C.

f) All electrodes, wires, and fluxes used shall be of a classification requiring a minimum impact of 27 joules at -18°C.

The proposed welding procedures and welding consumable certificates shall be submitted to the Engineer for approval at least two (2) days prior to the scheduled commencement of any fabrication.

### **3.7 Connection Bolts**

Connection bolts shall be ASTM A325 high strength bolts each with one grade DH nut and one hardened washer, all hot-dip galvanized.

The galvanized nuts shall be overtapped to the minimum amount required for fastener assembly. The nuts shall be lubricated with a lubricant containing a visible dye. The lubricant shall be clean and dry to the touch.

### **3.8 Hardware for Handhole Covers**

Hardware for handhole covers shall be in accordance with ASTM A276 Type 316 stainless steel.

### **3.9 Miscellaneous Materials**

Miscellaneous material incidental to this work shall be as approved by the Engineer.

## **4. CONSTRUCTION METHODS**

### **4.1 General Requirements**

a) Holes in the base plates shall be oversized by 6 mm.

b) Adequate venting and drainage holes shall be provided in enclosed sections for hot-dip galvanizing. The galvanizing facilities shall be consulted regarding the size and location of these holes. Holes shall be provided by drilling not burning.

- c) Prior to fabrication, the dimensional limitations on the size and shape imposed by the galvanizing facilities shall be determined for hot-dip galvanizing all individual components of the traffic signal and pedestrian corridor standards.

#### **4.2 Fabrication**

All fabrication shall be carried out in accordance with this Specification and the Contract Drawings, as well as AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaries, and Traffic Signals - 1994, plus all subsequent revisions.

The punching of identification marks on the members will not be allowed, except as specified herein.

Any damage to members during fabrication shall be drawn to the attention of the Engineer in order that the Engineer may approve remedial measures.

All portions of the work shall be neatly finished. Shearing, cutting, clipping, and machining shall be done neatly and accurately. Finished members shall be true to line, free from twists, bends, sharp corners, and edges.

Cut edges shall be true and smooth and free from excessive burrs or ragged breaks. Re-entrant cuts shall be avoided wherever possible. If used, they shall be filleted by drilling prior to cutting.

All holes shall be provided by drilling not burning. All holes shall be free of burrs and rough edges.

#### **4.3 Welding**

Welding shall be in accordance with CSA W59, "Welded Steel Construction."

All seams shall be continuously welded and free from any slag and splatter. Longitudinal welds shall be a minimum of 70% penetration, except those within 200 mm of baseplates, flanges, end openings, access openings, and circumferential welds, which shall be 100% penetration. All circumferential groove welds shall be 100% penetration, and where circumferential welds are used at a butt joint, an internal backup strip shall be provided.

Longitudinal seam welds in davit arms and extensions shall be located at the bottom of the horizontal members. Only one longitudinal seam is permitted in each member.

All welds shall be ground smooth and flush with the adjacent surface prior to hot-dip galvanizing.

#### **4.4 Surface Preparation and Cleaning**

Surface preparation and cleaning of materials prior to hot-dip galvanizing shall be in accordance with CSA G164 and SSPC Specification SP:6, "Commercial Blast Cleaning," unless otherwise specified herein. The Contractor shall ensure that all individual components of the traffic signal and pedestrian corridor standards are blast cleaned prior to pickling to achieve the minimum zinc coating mass of 600 g/m<sup>2</sup>. All welding and provision of holes is to be completed prior to surface preparation and cleaning, except where shown on the Drawings.

The sandblasting and cleaning of all components shall be done in the shop.

After the fabricated components have been sandblasted and cleaned, an inspection agency appointed by the Department will carry out a visual inspection of the components in the shop before they are shipped to the galvanizing plant.

## **4.5 Hot-Dip Galvanizing**

### **4.5.1 General**

The hot-dip galvanizing plant shall be a Regular Member of the American Galvanizers Association, Inc. and certified to CSA G164.

All outside surfaces and interior surfaces of all individual components of the traffic signal and pedestrian corridor standards shall be hot-dip galvanized in accordance with the requirements of this Specification.

The galvanizing coating on outside surfaces of the structures shall be generally smooth and free of blisters, lumpiness and runs. In particular, the outside surfaces of the bottom 2.5 m of the vertical support members shall have a smooth finish equal to the finish on hot-dipped galvanized handrails.

In addition to the provision of corrosion protection by the galvanized coating, the aesthetic appearance of the structure after hot-dip galvanizing will also be a criteria in the acceptance or rejection of the galvanized coating. The galvanized coating on the entire structure shall have a uniform "silver" colour and lustre. Galvanizing with parts of the structure having dull grey coating or streaks or mottled appearance will not be acceptable. If the galvanizing is rejected for aesthetic reasons, the Contractor shall rectify the appearance by applying spray-on molten zinc metallizing with 85/15 zinc/aluminum alloy. The metallizing shall be carried out in the shop before the structure is installed.

To prevent problems with aesthetic appearance of structures after hot-dip galvanizing, the Contractor shall be responsible for ensuring that the silicon content in the steel used for fabricating the structures is controlled within 0 to 0.03%.

Minor defects in the galvanizing coating shall be repaired in accordance with Section 4.5.2 of this Specification. The Engineer shall be consulted before repairs are made. Use of cold applied spray-on galvanizing will not be permitted and will be cause for rejection.

Other defects and contaminants in the galvanizing coating, such as heavy dross protrusions, flux inclusions and ash inclusions shall be grounds for rejection of the galvanizing coating system.

The Contractor shall verify the thickness of galvanized coatings as directed by the Contract Administrator.

All threaded couplings shall be rethreaded after the sign structures have been hot-dip galvanized.

The structures shall be stored on timber blocking after hot-dip galvanizing.

### **4.5.2 Repair of Damaged Galvanizing**

All areas of damaged galvanizing shall be repaired by touch-up galvanizing.



Surfaces to receive touch-up galvanizing shall be cleaned using a wire brush, a light grinding action, or mild blasting to remove loose scale, rust, paint, grease, dirt, or other contaminants. Preheat the surface to 315°C and wire brush the surface during preheating. Rub the cleaned preheated area with the repair stick to deposit an evenly distributed layer of zinc alloy. Spread the alloy with a wire brush, spatula, or similar tool. Touch-up galvanizing shall be blended into existing galvanizing of surrounding surfaces and shall be buffed and polished if required to match the surrounding surfaces. Care shall be taken to not overheat surfaces beyond 400°C and to not apply direct flame to the alloy rods.

## **5. IDENTIFICATION**

Each mating flange of davit-arm type standards shall be identified with the appropriate identification stock code number (as indicated on the Specification sheet) and the date of manufacture. This shall be stamped on the bottom side of each flange.

## **6. QUALITY CONTROL**

### **6.1 General**

All workmanship and all materials furnished and supplied under this Specification are subject to close and systematic inspection and testing by the Department, including all operations from the selection and production of materials, through to final acceptance of the work. The Contractor shall be wholly responsible for the control of all operations incidental thereto notwithstanding any inspection approval that may have been previously given. The Department reserves the right to reject any materials or works that are not in accordance with the requirements of this Specification.

The Contractor shall be responsible for making a thorough inspection of materials to be supplied under this Contract. All material shall be free of surface imperfections and other defects.

### **6.2 Welding Qualifications**

The Contractor shall produce evidence that the plant has recently been fully approved by the C.W.B. to the requirements of CSA W47.1 Division 2.1 for welding of steel structures.

Approved welding procedures shall be submitted to the Engineer prior to fabrication of any steel items.

## **6.3 Inspection**

### **6.3.1 General**

The Department will appoint an inspection agency to carry out inspections and testing of work in this Specification. The inspection agency shall report to the Department based on plant inspections of welds, material, fabrication procedures, quality control, mill test certificates, etc. All inspection costs will be borne by the Department. The inspections will include the following:

- a) Inspection of all material and proposed fabrication procedures prior to the start of manufacturing.
- b) Inspection of all fabricated components prior to hot-dip galvanizing.
- c) A final inspection following application of hot-dip galvanizing, prior to shipment from the manufacturer's plant.

The inspection agency shall carry out the following welding inspections and testing:

- a) Circumferential Welded Splices

100% of circumferential welds used to join pole sections together shall be inspected. Inspection shall be performed by radiography or ultrasonics, or by destructive tests acceptable to the Engineer. Only one time repair of circumferential welds is allowed without written permission of the Engineer.

- b) Longitudinal Seam Welds

100% of full penetration welds and a random 25% of partial penetration welds of longitudinal seams shall be inspected. Full penetration weld inspections shall be performed by radiography or ultrasonics. In addition, partial penetration welds may be inspected by magnetic particle. Both types of weld may be tested by destructive methods acceptable to the Engineer.

- c) Base Connection and Flange Plate Connection Welds

A random 25% of all base connection and flange plate connection welds shall be inspected. Full penetration weld inspection may be performed by radiography or ultrasonics. Fillet welds may be inspected by magnetic particle. Both types of weld may be tested by destructive methods acceptable to the Engineer. Only one time repair of base connection or flange plate connection welds is allowed without written permission of the Engineer.

Welds that are found by any of the inspection methods to be inadequate and unsatisfactory shall be repaired in accordance with CSA W59 and then retested. The cost of the repairs and the cost of the retest shall be paid for by the Contractor.

No repair shall be made until agreed to by the Engineer.

## **6.4 Unacceptable Work**

Any welding work found to be unacceptable shall be corrected in accordance with CSA W59.

No repair shall be made until agreed to by the Engineer.

**7. DELIVERY**

Standards and component parts shall be delivered F.O.B. Warehouse Stores, 1550 Dublin Avenue, Winnipeg, Manitoba.

Non-metallic strapping shall be used to secure groups of standards for delivery.

Standards shall be inspected by the Director of Traffic Engineering or his representative upon receipt, before acceptance by this Department.

The Director of Traffic Engineering shall be informed 48 hours in advance of the anticipated delivery date.

**8. GUARANTEE**

The Supplier shall guarantee all material against defects in quality or workmanship for a period of one year after final acceptance by the Department.

**9. METHOD OF MEASUREMENT**

Fabrication of pedestrian corridor and traffic signal standards will be measured on a unit basis, per standard. The number of standards to be paid for shall be the total number of standards fabricated in accordance with this Specification and accepted by the Engineer.

**10. BASIS OF PAYMENT**

Fabrication of pedestrian corridor and traffic signal standards will be paid for at the Contract Unit Price per standard for the "Items of Work" listed below, measured as specified herein, which price shall be payment in full for supplying all materials and performing all operations herein described, and all other items incidental to the work included in this Specification.

Items of Work

Fabrication of Standards

- a) Light Series Davit Standards - Type 2

**MANITOBA HIGHWAYS AND TRANSPORTATION  
TRAFFIC ENGINEERING  
SPECIFICATION FOR  
INTERMEDIATE SERIES  
PEDESTRIAN CORRIDOR DOUBLE DAVIT STANDARDS**

**1. DESCRIPTION**

This Specification covers the fabrication and delivery of intermediate series pedestrian corridor double davit standards.

Standards are intended to support two internally illuminated pedestrian corridor fixtures.

**2. STRUCTURE CONFIGURATIONS****2.1 General**

Items forming part of this Specification include Component Nos.:

E-016Y Intermediate Series Double Davit

The details shown on the Drawings shall not be changed unless approved in writing by the Engineer. Care shall be taken to ensure flange connections remain interchangeable.

**2.2 Type of Standards**

Standards shall be as follows:

Type	Use	Arm Lengths (m)
Intermediate Series Double Davit (Type 5)	Pedestrian Corridor	Double Davit 4.5 (each side)

Double davit standards shall be supplied in two 4.5 m lengths, as specified on the purchase order.

Davit arm height (loaded) shall be 5800 mm  $\pm$  50 mm above the base plate, measured at the end of the arm.

All extension arms shall be one piece without any flanges, except where the arm is attached to the vertical member.

Each tubular component shall be fabricated in one piece.

**3. MATERIALS****3.1 General**

The Contractor shall be responsible for the supply, safe storage, and handling of all materials set forth in this Specification.

All materials used for fabrication of traffic signal and pedestrian corridor standards shall be new, previously unused material.

### **3.2 Handling and Storage of Materials**

All materials shall be handled in a careful and workmanshiplike manner, to the satisfaction of the Engineer. Storage of materials shall be in accordance with the requirements of CSA Standard CAN3 A23.1.8-M77, Storage of Materials, except as otherwise specified herein.

### **3.3 Structural Steel**

Structural steel shall be in accordance with CSA G40.21 Grade 300W. For purposes of hot-dip galvanizing, the silicon content in the steel shall be controlled within 0 to 0.03%.

The Supplier is advised that copies of mill test certificates showing the chemical and physical properties of all structural steel to be supplied under this Specification must be submitted to the Engineer. The mill test certificates shall be submitted prior to commencement of product fabrication for acceptance by the Engineer.

Steel shall not be acceptable unless the mill test certificate states the grade to be 300 MPa (44 ksi) minimum yield. Lower grade steel shall not be acceptable (despite favourable published mill test yield results), and items fabricated without steel certification shall be rejected.

All costs resulting from any changes or due to failure to have submissions reviewed shall be borne by the Supplier.

### **3.4 Hot-Dip Galvanizing**

Hot-dip galvanizing shall be in accordance with CSA G164 to a net minimum retention of 600 g/m<sup>2</sup>.

### **3.5 Galvanizing Touch-up**

Galvanizing touch-up shall be done with self-fluxing, low-temperature, zinc-based alloy rods in accordance with ASTM A780-80 for "Repair of Damaged Hot-Dip Galvanized Coatings." Approved products are Galvalloy as manufactured by Metalloy Products Company, P.O. Box No. 3093, Terminal Annex, Los Angeles, California, and Welco Gal-Viz Galvanizing Alloy, as manufactured by Thermocote Welco, Highway 161, York Road, Kings Mountain, North Carolina. Locally, both products are available from Welder Supplies Limited, 25 McPhillips Street, Winnipeg.

### **3.6 Welding Consumables**

Welding consumables for all processes shall be certified by the manufacturer to be complying with the requirements of CSA Standard W59-M1984 and the following Specifications:

- a) Manual shielded metal arc welding (SMAW):

All electrodes shall be basic-type electrodes conforming to CSA W48.1-M1991 or W48.3-M1982, classification E480XX, or imperial equivalent.

b) Gas metal arc welding (GMAW):

All electrodes shall conform to CSA W48.4-M1980, classification ER480S-X, or imperial equivalent.

c) Flux cored arc welding (FCAW):

All electrodes shall conform to CSA W48.5-M1982, classification E480XT-X or imperial equivalent. Electrodes shall be controlled by hydrogen (CH) designation.

d) Submerged arc welding (SAW):

All electrodes shall conform to CSA W48.6-M1980, classification F480X-EXXX or imperial equivalent.

e) Shielding gas shall be welding grade carbon-dioxide with a guaranteed dew point of -46°C.

f) All electrodes, wires, and fluxes used shall be of a classification requiring a minimum impact of 27 joules at -18°C.

The proposed welding procedures and welding consumable certificates shall be submitted to the Engineer for approval at least two (2) days prior to the scheduled commencement of any fabrication.

### **3.7 Connection Bolts**

Connection bolts shall be ASTM A325 high strength bolts each with one grade DH nut and one hardened washer, all hot-dip galvanized.

The galvanized nuts shall be overtapped to the minimum amount required for fastener assembly. The nuts shall be lubricated with a lubricant containing a visible dye. The lubricant shall be clean and dry to the touch.

### **3.8 Hardware for Handhole Covers**

Hardware for handhole covers shall be in accordance with ASTM A276 Type 316 stainless steel.

### **3.9 Miscellaneous Materials**

Miscellaneous material incidental to this work shall be as approved by the Engineer.

## **4. CONSTRUCTION METHODS**

### **4.1 General Requirements**

a) Holes in the base plates shall be oversized by 6 mm.

- b) Adequate venting and drainage holes shall be provided in enclosed sections for hot-dip galvanizing. The galvanizing facilities shall be consulted regarding the size and location of these holes. Holes shall be provided by drilling not burning.
- c) Prior to fabrication, the dimensional limitations on the size and shape imposed by the galvanizing facilities shall be determined for hot-dip galvanizing all individual components of the traffic signal and pedestrian corridor standards.

#### **4.2 Fabrication**

All fabrication shall be carried out in accordance with this Specification and the Contract Drawings, as well as AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaries, and Traffic Signals - 1994, plus all subsequent revisions.

The punching of identification marks on the members will not be allowed, except as specified herein.

Any damage to members during fabrication shall be drawn to the attention of the Engineer in order that the Engineer may approve remedial measures.

All portions of the work shall be neatly finished. Shearing, cutting, clipping, and machining shall be done neatly and accurately. Finished members shall be true to line, free from twists, bends, sharp corners, and edges.

Cut edges shall be true and smooth and free from excessive burrs or ragged breaks. Re-entrant cuts shall be avoided wherever possible. If used, they shall be filleted by drilling prior to cutting.

All holes shall be provided by drilling not burning. All holes shall be free of burrs and rough edges.

#### **4.3 Welding**

Welding shall be in accordance with CSA W59, "Welded Steel Construction."

All seams shall be continuously welded and free from any slag and splatter. Longitudinal welds shall be a minimum of 70% penetration, except those within 200 mm of baseplates, flanges, end openings, access openings, and circumferential welds, which shall be 100% penetration. All circumferential groove welds shall be 100% penetration, and where circumferential welds are used at a butt joint, an internal backup strip shall be provided.

Longitudinal seam welds in davit arms and extensions shall be located at the bottom of the horizontal members. Only one longitudinal seam is permitted in each member.

All welds shall be ground smooth and flush with the adjacent surface prior to hot-dip galvanizing.

#### **4.4 Surface Preparation and Cleaning**

Surface preparation and cleaning of materials prior to hot-dip galvanizing shall be in accordance with CSA G164 and SSPC Specification SP:6, "Commercial Blast Cleaning," unless otherwise specified herein. The Contractor shall ensure that all individual components of the traffic signal and pedestrian corridor standards are blast cleaned prior to pickling to achieve the minimum zinc coating mass of 600

g/m<sup>2</sup>. All welding and provision of holes is to be completed prior to surface preparation and cleaning, except where shown on the Drawings.

The sandblasting and cleaning of all components shall be done in the shop.

After the fabricated components have been sandblasted and cleaned, an inspection agency appointed by the Department will carry out a visual inspection of the components in the shop before they are shipped to the galvanizing plant.

## **4.5 Hot-Dip Galvanizing**

### **4.5.1 General**

The hot-dip galvanizing plant shall be a Regular Member of the American Galvanizers Association, Inc. and certified to CSA G164.

All outside surfaces and interior surfaces of all individual components of the traffic signal and pedestrian corridor standards shall be hot-dip galvanized in accordance with the requirements of this Specification.

The galvanizing coating on outside surfaces of the structures shall be generally smooth and free of blisters, lumpiness and runs. In particular, the outside surfaces of the bottom 2.5 m of the vertical support members shall have a smooth finish equal to the finish on hot-dipped galvanized handrails.

In addition to the provision of corrosion protection by the galvanized coating, the aesthetic appearance of the structure after hot-dip galvanizing will also be a criteria in the acceptance or rejection of the galvanized coating. The galvanized coating on the entire structure shall have a uniform "silver" colour and lustre. Galvanizing with parts of the structure having dull grey coating or streaks or mottled appearance will not be acceptable. If the galvanizing is rejected for aesthetic reasons, the Contractor shall rectify the appearance by applying spray-on molten zinc metallizing with 85/15 zinc/aluminum alloy. The metallizing shall be carried out in the shop before the structure is installed.

To prevent problems with aesthetic appearance of structures after hot-dip galvanizing, the Contractor shall be responsible for ensuring that the silicon content in the steel used for fabricating the structures is controlled within 0 to 0.03%.

Minor defects in the galvanizing coating shall be repaired in accordance with Section 4.5.2 of this Specification. The Engineer shall be consulted before repairs are made. Use of cold applied spray-on galvanizing will not be permitted and will be cause for rejection.

Other defects and contaminants in the galvanizing coating, such as heavy dross protrusions, flux inclusions and ash inclusions shall be grounds for rejection of the galvanizing coating system.

The Contractor shall verify the thickness of galvanized coatings as directed by the Contract Administrator.

All threaded couplings shall be rethreaded after the sign structures have been hot-dip galvanized.

The structures shall be stored on timber blocking after hot-dip galvanizing.



#### **4.5.2 Repair of Damaged Galvanizing**

All areas of damaged galvanizing shall be repaired by touch-up galvanizing.

Surfaces to receive touch-up galvanizing shall be cleaned using a wire brush, a light grinding action, or mild blasting to remove loose scale, rust, paint, grease, dirt, or other contaminants. Preheat the surface to 315°C and wire brush the surface during preheating. Rub the cleaned preheated area with the repair stick to deposit an evenly distributed layer of zinc alloy. Spread the alloy with a wire brush, spatula, or similar tool. Touch-up galvanizing shall be blended into existing galvanizing of surrounding surfaces and shall be buffed and polished if required to match the surrounding surfaces. Care shall be taken to not overheat surfaces beyond 400°C and to not apply direct flame to the alloy rods.

### **5. IDENTIFICATION**

Each mating flange of davit-arm type standards shall be identified with the appropriate identification stock code number (as indicated on the Specification sheet) and the date of manufacture. This shall be stamped on the bottom side of each flange.

### **6. QUALITY CONTROL**

#### **6.1 General**

All workmanship and all materials furnished and supplied under this Specification are subject to close and systematic inspection and testing by the Department, including all operations from the selection and production of materials, through to final acceptance of the work. The Contractor shall be wholly responsible for the control of all operations incidental thereto notwithstanding any inspection approval that may have been previously given. The Department reserves the right to reject any materials or works that are not in accordance with the requirements of this Specification.

The Contractor shall be responsible for making a thorough inspection of materials to be supplied under this Contract. All material shall be free of surface imperfections and other defects.

#### **6.2 Welding Qualifications**

The Contractor shall produce evidence that the plant has recently been fully approved by the C.W.B. to the requirements of CSA W47.1 Division 2.1 for welding of steel structures.

Approved welding procedures shall be submitted to the Engineer prior to fabrication of any steel items.

#### **6.3 Inspection**

##### **6.3.1 General**

The Department will appoint an inspection agency to carry out inspections and testing of work in this Specification. The inspection agency shall report to the Department based on plant inspections of welds, material, fabrication procedures, quality control, mill test certificates, etc. All inspection costs will be borne by the Department. The inspections will include the following:

- a) Inspection of all material and proposed fabrication procedures prior to the start of manufacturing.

- b) Inspection of all fabricated components prior to hot-dip galvanizing.
- c) A final inspection following application of hot-dip galvanizing, prior to shipment from the manufacturer's plant.

The inspection agency shall carry out the following welding inspections and testing:

a) Circumferential Welded Splices

100% of circumferential welds used to join pole sections together shall be inspected. Inspection shall be performed by radiography or ultrasonics, or by destructive tests acceptable to the Engineer. Only one time repair of circumferential welds is allowed without written permission of the Engineer.

b) Longitudinal Seam Welds

100% of full penetration welds and a random 25% of partial penetration welds of longitudinal seams shall be inspected. Full penetration weld inspections shall be performed by radiography or ultrasonics. In addition, partial penetration welds may be inspected by magnetic particle. Both types of weld may be tested by destructive methods acceptable to the Engineer.

c) Base Connection and Flange Plate Connection Welds

A random 25% of all base connection and flange plate connection welds shall be inspected. Full penetration weld inspection may be performed by radiography or ultrasonics. Fillet welds may be inspected by magnetic particle. Both types of weld may be tested by destructive methods acceptable to the Engineer. Only one time repair of base connection or flange plate connection welds is allowed without written permission of the Engineer.

Welds that are found by any of the inspection methods to be inadequate and unsatisfactory shall be repaired in accordance with CSA W59 and then retested. The cost of the repairs and the cost of the retest shall be paid for by the Contractor.

No repair shall be made until agreed to by the Engineer.

#### **6.4 Unacceptable Work**

Any welding work found to be unacceptable shall be corrected in accordance with CSA W59.

No repair shall be made until agreed to by the Engineer.

#### **7. DELIVERY**

Standards and component parts shall be delivered F.O.B. Warehouse Stores, 1550 Dublin Avenue, Winnipeg, Manitoba.

Non-metallic strapping shall be used to secure groups of standards for delivery.

Standards shall be inspected by the Director of Traffic Engineering or his representative upon receipt, before acceptance by this Department.

The Director of Traffic Engineering shall be informed 48 hours in advance of the anticipated delivery date.

**8. GUARANTEE**

The Supplier shall guarantee all material against defects in quality or workmanship for a period of one year after final acceptance by the Department.

**9. METHOD OF MEASUREMENT**

Fabrication of pedestrian corridor double davit standards will be measured on a unit basis, per standard. The number of standards to be paid for shall be the total number of standards fabricated in accordance with this Specification and accepted by the Engineer.

**10. BASIS OF PAYMENT**

Fabrication of pedestrian corridor double davit standards will be paid for at the Contract Unit Price per standard for the "Items of Work" listed below, measured as specified herein, which price shall be payment in full for supplying all materials and performing all operations herein described, and all other items incidental to the work included in this Specification.

Items of Work

Fabrication of Standards

- a) Intermediate Series Double Davit Standards - Type 5

**MANITOBA HIGHWAYS AND TRANSPORTATION  
TRAFFIC ENGINEERING  
SPECIFICATION FOR MEDIUM SERIES  
TRAFFIC SIGNAL  
AND PEDESTRIAN CORRIDOR DAVIT STANDARDS**

**1. DESCRIPTION**

This Specification covers the fabrication and delivery of medium series traffic signal and pedestrian corridor davit standards.

Standards are intended to support one to two 5-section 300 mm traffic signal heads, made of aluminum, complete with standard backboards, or one internally illuminated pedestrian corridor fixtures, and one street blade signs.

**2. STRUCTURE CONFIGURATIONS****2.1 General**

Items forming part of this Specification include Component Nos.:

E-016H Stub - Medium Series Davit  
E-016J Arm Extension - Medium Series Davit

The details shown on the Drawings shall not be changed unless approved in writing by the Engineer. Care shall be taken to ensure flange connections remain interchangeable.

**2.2 Type of Standards**

Standards shall be as follows:

Type	Use	Arm Lengths (m)
Medium Series Davit (Type 3)	Traffic Signal	5.0, 6.0, 7.5
	Pedestrian Corridor	5.5, 7.0

Davit arm height (loaded) shall be 6400 mm  $\pm$  50 mm, above the base plate, measured at the end of the arm. The davit arm angle loaded shall not be less than 92° from vertical.

All extension arms shall be one piece without any flanges, except where the arm is attached to the vertical member.

Each tubular component shall be fabricated in one piece.

**3. MATERIALS****3.1 General**

The Contractor shall be responsible for the supply, safe storage, and handling of all materials set forth in this Specification.

All materials used for fabrication of traffic signal and pedestrian corridor standards shall be new, previously unused material.

### **3.2 Handling and Storage of Materials**

All materials shall be handled in a careful and workmanshiplike manner, to the satisfaction of the Engineer. Storage of materials shall be in accordance with the requirements of CSA Standard CAN3 A23.1.8-M77, Storage of Materials, except as otherwise specified herein.

### **3.3 Structural Steel**

Structural steel shall be in accordance with CSA G40.21 Grade 300W. For purposes of hot-dip galvanizing, the silicon content in the steel shall be controlled within 0 to 0.03%.

The Supplier is advised that copies of mill test certificates showing the chemical and physical properties of all structural steel to be supplied under this Specification must be submitted to the Engineer. The mill test certificates shall be submitted prior to commencement of product fabrication for acceptance by the Engineer.

Steel shall not be acceptable unless the mill test certificate states the grade to be 300 MPa (44 ksi) minimum yield. Lower grade steel shall not be acceptable (despite favourable published mill test yield results), and items fabricated without steel certification shall be rejected.

All costs resulting from any changes or due to failure to have submissions reviewed shall be borne by the Supplier.

### **3.4 Hot-Dip Galvanizing**

Hot-dip galvanizing shall be in accordance with CSA G164 to a net minimum retention of 600 g/m<sup>2</sup>.

### **3.5 Galvanizing Touch-up**

Galvanizing touch-up and shall be done with self-fluxing, low-temperature, zinc-based alloy rods in accordance with ASTM A780-80 for "Repair of Damaged Hot-Dip Galvanized Coatings." Approved products are Galvalloy as manufactured by Metalloy Products Company, P.O. Box No. 3093, Terminal Annex, Los Angeles, California, and Welco Gal-Viz Galvanizing Alloy, as manufactured by Thermocote Welco, Highway 161, York Road, Kings Mountain, North Carolina. Locally, both products are available from Welder Supplies Limited, 25 McPhillips Street, Winnipeg.

### **3.6 Welding Consumables**

Welding consumables for all processes shall be certified by the manufacturer to be complying with the requirements of CSA Standard W59-M1984 and the following Specifications:

- a) Manual shielded metal arc welding (SMAW):

All electrodes shall be basic-type electrodes conforming to CSA W48.1-M1991 or W48.3-M1982, classification E480XX, or imperial equivalent.

b) Gas metal arc welding (GMAW):

All electrodes shall conform to CSA W48.4-M1980, classification ER480S-X, or imperial equivalent.

c) Flux cored arc welding (FCAW):

All electrodes shall conform to CSA W48.5-M1982, classification E480XT-X or imperial equivalent. Electrodes shall be controlled by hydrogen (CH) designation.

d) Submerged arc welding (SAW):

All electrodes shall conform to CSA W48.6-M1980, classification F480X-EXXX or imperial equivalent.

e) Shielding gas shall be welding grade carbon-dioxide with a guaranteed dew point of  $-46^{\circ}\text{C}$ .

f) All electrodes, wires, and fluxes used shall be of a classification requiring a minimum impact of 27 joules at  $-18^{\circ}\text{C}$ .

The proposed welding procedures and welding consumable certificates shall be submitted to the Engineer for approval at least two (2) days prior to the scheduled commencement of any fabrication.

### **3.7 Connection Bolts**

Connection bolts shall be ASTM A325 high strength bolts each with one grade DH nut and one hardened washer, all hot-dip galvanized.

The galvanized nuts shall be overtapped to the minimum amount required for fastener assembly. The nuts shall be lubricated with a lubricant containing a visible dye. The lubricant shall be clean and dry to the touch.

### **3.8 Hardware for Handhole Covers**

Hardware for handhole covers shall be in accordance with ASTM A276 Type 316 stainless steel.

### **3.9 Miscellaneous Materials**

Miscellaneous material incidental to this work shall be as approved by the Engineer.

## **4. CONSTRUCTION METHODS**

### **4.1 General Requirements**

a) Holes in the base plates shall be oversized by 6 mm.

b) Adequate venting and drainage holes shall be provided in enclosed sections for hot-dip galvanizing. The galvanizing facilities shall be consulted regarding the size and location of these holes. Holes shall be provided by drilling not burning.

- c) Prior to fabrication, the dimensional limitations on the size and shape imposed by the galvanizing facilities shall be determined for hot-dip galvanizing all individual components of the traffic signal and pedestrian corridor standards.

## **4.2 Fabrication**

All fabrication shall be carried out in accordance with this Specification and the Contract Drawings, as well as AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaries, and Traffic Signals - 1994, plus all subsequent revisions.

The punching of identification marks on the members will not be allowed, except as specified herein.

Any damage to members during fabrication shall be drawn to the attention of the Engineer in order that the Engineer may approve remedial measures.

All portions of the work shall be neatly finished. Shearing, cutting, clipping, and machining shall be done neatly and accurately. Finished members shall be true to line, free from twists, bends, sharp corners, and edges.

Cut edges shall be true and smooth and free from excessive burrs or ragged breaks. Re-entrant cuts shall be avoided wherever possible. If used, they shall be filleted by drilling prior to cutting.

All holes shall be provided by drilling not burning. All holes shall be free of burrs and rough edges.

## **4.3 Welding**

Welding shall be in accordance with CSA W59, "Welded Steel Construction."

All seams shall be continuously welded and free from any slag and splatter. Longitudinal welds shall be a minimum of 70% penetration, except those within 200 mm of baseplates, flanges, end openings, access openings, and circumferential welds, which shall be 100% penetration. All circumferential groove welds shall be 100% penetration, and where circumferential welds are used at a butt joint, an internal backup strip shall be provided.

Longitudinal seam welds in davit arms and extensions shall be located at the bottom of the horizontal members. Only one longitudinal seam weld is permitted in each member.

All welds shall be ground smooth and flush with the adjacent surface prior to hot-dip galvanizing.

## **4.4 Surface Preparation and Cleaning**

Surface preparation and cleaning of materials prior to hot-dip galvanizing shall be in accordance with CSA G164 and SSPC Specification SP:6, "Commercial Blast Cleaning," unless otherwise specified herein. The Contractor shall ensure that all individual components of the traffic signal and pedestrian corridor standards are blast cleaned prior to pickling to achieve the minimum zinc coating mass of 600 g/m<sup>2</sup>. All welding and provision of holes is to be completed prior to surface preparation and cleaning, except where shown on the Drawings.

The sandblasting and cleaning of all components shall be done in the shop.

After the fabricated components have been sandblasted and cleaned, an inspection agency appointed by the Department will carry out a visual inspection of the components in the shop before they are shipped to the galvanizing plant.

## **4.5 Hot-Dip Galvanizing**

### **4.5.1 General**

The hot-dip galvanizing plant shall be a Regular Member of the American Galvanizers Association, Inc. and certified to CSA G164.

All outside surfaces and interior surfaces of all individual components of the traffic signal and pedestrian corridor standards shall be hot-dip galvanized in accordance with the requirements of this Specification.

The galvanizing coating on outside surfaces of the structures shall be generally smooth and free of blisters, lumpiness and runs. In particular, the outside surfaces of the bottom 2.5 m of the vertical support members shall have a smooth finish equal to the finish on hot-dipped galvanized handrails.

In addition to the provision of corrosion protection by the galvanized coating, the aesthetic appearance of the structure after hot-dip galvanizing will also be a criteria in the acceptance or rejection of the galvanized coating. The galvanized coating on the entire structure shall have a uniform "silver" colour and lustre. Galvanizing with parts of the structure having dull grey coating or streaks or mottled appearance will not be acceptable. If the galvanizing is rejected for aesthetic reasons, the Contractor shall rectify the appearance by applying spray-on molten zinc metallizing with 85/15 zinc/aluminum alloy. The metallizing shall be carried out in the shop before the structure is installed.

To prevent problems with aesthetic appearance of structures after hot-dip galvanizing, the Contractor shall be responsible for ensuring that the silicon content in the steel used for fabricating the structures is controlled within 0 to 0.03%.

Minor defects in the galvanizing coating shall be repaired in accordance with Section 4.5.2 of this Specification. The Engineer shall be consulted before repairs are made. Use of cold applied spray-on galvanizing will not be permitted and will be cause for rejection.

Other defects and contaminants in the galvanizing coating, such as heavy dross protrusions, flux inclusions and ash inclusions shall be grounds for rejection of the galvanizing coating system.

The Contractor shall verify the thickness of galvanized coatings as directed by the Contract Administrator.

All threaded couplings shall be rethreaded after the sign structures have been hot-dip galvanized.

The structures shall be stored on timber blocking after hot-dip galvanizing.

### **4.5.2 Repair of Damaged Galvanizing**

All areas of damaged galvanizing shall be repaired by touch-up galvanizing.



Surfaces to receive touch-up galvanizing shall be cleaned using a wire brush, a light grinding action, or mild blasting to remove loose scale, rust, paint, grease, dirt, or other contaminants. Preheat the surface to 315°C and wire brush the surface during preheating. Rub the cleaned preheated area with the repair stick to deposit an evenly distributed layer of zinc alloy. Spread the alloy with a wire brush, spatula, or similar tool. Touch-up galvanizing shall be blended into existing galvanizing of surrounding surfaces and shall be buffed and polished if required to match the surrounding surfaces. Care shall be taken to not overheat surfaces beyond 400°C and to not apply direct flame to the alloy rods.

## **5. IDENTIFICATION**

Each mating flange of davit-arm type standards shall be identified with the appropriate identification stock code number (as indicated on the Specification sheet) and the date of manufacture. This shall be stamped on the bottom side of each flange.

## **6. QUALITY CONTROL**

### **6.1 General**

All workmanship and all materials furnished and supplied under this Specification are subject to close and systematic inspection and testing by the Department, including all operations from the selection and production of materials, through to final acceptance of the work. The Contractor shall be wholly responsible for the control of all operations incidental thereto notwithstanding any inspection approval that may have been previously given. The Department reserves the right to reject any materials or works that are not in accordance with the requirements of this Specification.

The Contractor shall be responsible for making a thorough inspection of materials to be supplied under this Contract. All material shall be free of surface imperfections and other defects.

### **6.2 Welding Qualifications**

The Contractor shall produce evidence that the plant has recently been fully approved by the C.W.B. to the requirements of CSA W47.1 Division 2.1 for welding of steel structures.

Approved welding procedures shall be submitted to the Engineer prior to fabrication of any steel items.

### **6.3 Inspection**

#### **6.3.1 General**

The Department will appoint an inspection agency to carry out inspections and testing of work in this Specification. The inspection agency shall report to the Department based on plant inspections of welds, material, fabrication procedures, quality control, mill test certificates, etc. All inspection costs will be borne by the Department. The inspections will include the following:

- a) Inspection of all material and proposed fabrication procedures prior to the start of manufacturing.
- b) Inspection of all fabricated components prior to hot-dip galvanizing.

- c) A final inspection following application of hot-dip galvanizing, prior to shipment from the manufacturer's plant.

The inspection agency shall carry out the following welding inspections and testing:

- a) Circumferential Welded Splices

100% of circumferential welds used to join pole sections together shall be inspected. Inspection shall be performed by radiography or ultrasonics, or by destructive tests acceptable to the Engineer. Only one time repair of circumferential welds is allowed without written permission of the Engineer.

- b) Longitudinal Seam Welds

100% of full penetration welds and a random 25% of partial penetration welds of longitudinal seams shall be inspected. Full penetration weld inspections shall be performed by radiography or ultrasonics. In addition, partial penetration welds may be inspected by magnetic particle. Both types of weld may be tested by destructive methods acceptable to the Engineer.

- c) Base Connection and Flange Plate Connection Welds

A random 25% of all base connection and flange plate connection welds shall be inspected. Full penetration weld inspection may be performed by radiography or ultrasonics. Fillet welds may be inspected by magnetic particle. Both types of weld may be tested by destructive methods acceptable to the Engineer. Only one time repair of base connection or flange plate connection welds is allowed without written permission of the Engineer.

Welds that are found by any of the inspection methods to be inadequate and unsatisfactory shall be repaired in accordance with CSA W59 and then retested. The cost of the repairs and the cost of the retest shall be paid for by the Contractor.

No repair shall be made until agreed to by the Engineer.

#### **6.4 Unacceptable Work**

Any welding work found to be unacceptable shall be corrected in accordance with CSA W59.

No repair shall be made until agreed to by the Engineer.

### **7. DELIVERY**

Standards and component parts shall be delivered F.O.B. Warehouse Stores, 1550 Dublin Avenue, Winnipeg, Manitoba.

Non-metallic strapping shall be used to secure groups of standards for delivery.

Standards shall be inspected by the Director of Traffic Engineering or his representative upon receipt, before acceptance by this Department.

The Director of Traffic Engineering shall be informed 48 hours in advance of the anticipated delivery date.

**8. GUARANTEE**

The Supplier shall guarantee all material against defects in quality or workmanship for a period of one year after final acceptance by the Department.

**9. METHOD OF MEASUREMENT**

Fabrication of pedestrian corridor and traffic signal standards will be measured on a unit basis, per standard. The number of standards to be paid for shall be the total number of standards fabricated in accordance with this Specification and accepted by the Engineer.

**10. BASIS OF PAYMENT**

Fabrication of pedestrian corridor and traffic signal standards will be paid for at the Contract Unit Price per standard for the "Items of Work" listed below, measured as specified herein, which price shall be payment in full for supplying all materials and performing all operations herein described, and all other items incidental to the work included in this Specification.

Items of Work

Fabrication of Standards

- a) Medium Series Davit Standards - Type 3

**MANITOBA HIGHWAYS AND TRANSPORTATION  
TRAFFIC ENGINEERING  
SPECIFICATION FOR MEDIUM SERIES COMBINATION  
TRAFFIC SIGNAL  
AND PEDESTRIAN CORRIDOR/LUMINAIRE DAVIT STANDARDS**

## 1. DESCRIPTION

This Specification covers the fabrication and delivery of medium series traffic signal/pedestrian corridor/luminaire davit standards.

Standards are intended to support one to two 5-section 300 mm traffic signal heads, made of aluminum, complete with standard backboards, or one internally illuminated pedestrian corridor fixtures, and one street blade signs. Medium series combination standards are intended only for one single head luminaire installation.

## 2. STRUCTURE CONFIGURATIONS

### 2.1 General

Items forming part of this Specification include Component Nos.:

E-016D Extension Straight Stub  
E-016E Luminaire Davit Arm (single luminaire installations)  
E-016J Arm Extension - Medium Series Davit  
E-016K Combination Stub - Medium Series Davit

The details shown on the Drawings shall not be changed unless approved in writing by the Engineer. Care shall be taken to ensure flange connections remain interchangeable.

### 2.2 Type of Standards

Standards shall be as follows:

Type	Use	Arm Lengths (m)
Medium Series Combination Luminaire Davit Standards (Type 4)	Traffic Signal/Luminaire	5.0, 6.0, 7.5
	Pedestrian Corridor	5.5, 7.0

Davit arm height (loaded) shall be 6400 mm  $\pm$  50 mm above the base plate, measured at the end of the arm. The davit arm angle (loaded) shall not be less than 92° from vertical.

All extension arms shall be one piece without any flanges, except where the arm is attached to the vertical member.

Each tubular component shall be fabricated in one piece.

### **3. MATERIALS**

#### **3.1 General**

The Contractor shall be responsible for the supply, safe storage, and handling of all materials set forth in this Specification.

All materials used for fabrication of traffic signal and pedestrian corridor standards shall be new, previously unused material.

#### **3.2 Handling and Storage of Materials**

All materials shall be handled in a careful and workmanshiplike manner, to the satisfaction of the Engineer. Storage of materials shall be in accordance with the requirements of CSA Standard CAN3 A23.1.8-M77, Storage of Materials, except as otherwise specified herein.

#### **3.3 Structural Steel**

Structural steel for items with 3 mm (11 ga) thick shaft material shall be in accordance with CSA G40.21 Grade 350W. All other items shall be minimum Grade 300W material. For purposes of hot-dip galvanizing, the silicon content in the steel shall be controlled within 0 to 0.03%.

The Supplier is advised that copies of mill test certificates showing the chemical and physical properties of all structural steel to be supplied under this Specification must be submitted to the Engineer. The mill test certificates shall be submitted prior to commencement of product fabrication for acceptance by the Engineer.

Steel shall not be acceptable unless the mill test certificate states the grade to be 350 MPa (50 ksi) and 300 MPa (44 ksi) minimum yield for the applicable items. Lower grade steel shall not be acceptable (despite favourable published mill test yield results), and items fabricated without steel certification shall be rejected.

All costs resulting from any changes or due to failure to have submissions reviewed shall be borne by the Supplier.

#### **3.4 Hot-Dip Galvanizing**

Hot-dip galvanizing shall be in accordance with CSA G164 to a net minimum retention of 600 g/m<sup>2</sup>.

#### **3.5 Galvanizing Touch-up**

Galvanizing touch-up and shall be done with self-fluxing, low-temperature, zinc-based alloy rods in accordance with ASTM A780-80 for "Repair of Damaged Hot-Dip Galvanized Coatings." Approved products are Galvalloy as manufactured by Metalloy Products Company, P.O. Box No. 3093, Terminal Annex, Los Angeles, California, and Welco Gal-Viz Galvanizing Alloy, as manufactured by Thermocote Welco, Highway 161, York Road, Kings Mountain, North Carolina. Locally, both products are available from Welder Supplies Limited, 25 McPhillips Street, Winnipeg.

### **3.6 Welding Consumables**

Welding consumables for all processes shall be certified by the manufacturer to be complying with the requirements of CSA Standard W59-M1984 and the following Specifications:

a) Manual shielded metal arc welding (SMAW):

All electrodes shall be basic-type electrodes conforming to CSA W48.1-M1991 or W48.3-M1982, classification E480XX, or imperial equivalent.

b) Gas metal arc welding (GMAW):

All electrodes shall conform to CSA W48.4-M1980, classification ER480S-X, or imperial equivalent.

c) Flux cored arc welding (FCAW):

All electrodes shall conform to CSA W48.5-M1982, classification E480XT-X or imperial equivalent. Electrodes shall be controlled by hydrogen (CH) designation.

d) Submerged arc welding (SAW):

All electrodes shall conform to CSA W48.6-M1980, classification F480X-EXXX or imperial equivalent.

e) Shielding gas shall be welding grade carbon-dioxide with a guaranteed dew point of  $-46^{\circ}\text{C}$ .

f) All electrodes, wires, and fluxes used shall be of a classification requiring a minimum impact of 27 joules at  $-18^{\circ}\text{C}$ .

The proposed welding procedures and welding consumable certificates shall be submitted to the Engineer for approval at least two (2) days prior to the scheduled commencement of any fabrication.

### **3.7 Connection Bolts**

Connection bolts shall be ASTM A325 high strength bolts each with one grade DH nut and one hardened washer, all hot-dip galvanized.

The galvanized nuts shall be overtapped to the minimum amount required for fastener assembly. The nuts shall be lubricated with a lubricant containing a visible dye. The lubricant shall be clean and dry to the touch.

### **3.8 Hardware for Handhole Covers**

Hardware for handhole covers shall be in accordance with ASTM A276 Type 316 stainless steel.

### **3.9 Miscellaneous Materials**

Miscellaneous material incidental to this work shall be as approved by the Engineer.

## **4. CONSTRUCTION METHODS**

#### **4.1 General Requirements**

- a) Holes in the base plates shall be oversized by 6 mm.
- b) Adequate venting and drainage holes shall be provided in enclosed sections for hot-dip galvanizing. The galvanizing facilities shall be consulted regarding the size and location of these holes. Holes shall be provided by drilling not burning.
- c) Prior to fabrication, the dimensional limitations on the size and shape imposed by the galvanizing facilities shall be determined for hot-dip galvanizing all individual components of the traffic signal and pedestrian corridor standards.

#### **4.2 Fabrication**

All fabrication shall be carried out in accordance with this Specification and the Contract Drawings, as well as AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaries, and Traffic Signals - 1994, plus all subsequent revisions.

The punching of identification marks on the members will not be allowed, except as specified herein.

Any damage to members during fabrication shall be drawn to the attention of the Engineer in order that the Engineer may approve remedial measures.

All portions of the work shall be neatly finished. Shearing, cutting, clipping, and machining shall be done neatly and accurately. Finished members shall be true to line, free from twists, bends, sharp corners, and edges.

Cut edges shall be true and smooth and free from excessive burrs or ragged breaks. Re-entrant cuts shall be avoided wherever possible. If used, they shall be filleted by drilling prior to cutting.

All holes shall be provided by drilling not burning. All holes shall be free of burrs and rough edges.

#### **4.3 Welding**

Welding shall be in accordance with CSA W59, "Welded Steel Construction."

All seams shall be continuously welded and free from any slag and splatter. Longitudinal welds shall be a minimum of 70% penetration, except those within 200 mm of baseplates, flanges, end openings, access openings, and circumferential welds, which shall be 100% penetration. All circumferential groove welds shall be 100% penetration, and where circumferential welds are used at a butt joint, an internal backup strip shall be provided.

Longitudinal seam welds in davit arms and extensions shall be located at the bottom of the horizontal members. Only one longitudinal seam weld is permitted in each member.

All welds shall be ground smooth and flush with the adjacent surface prior to hot-dip galvanizing.

#### **4.4 Surface Preparation and Cleaning**

Surface preparation and cleaning of materials prior to hot-dip galvanizing shall be in accordance with CSA G164 and SSPC Specification SP:6, "Commercial Blast Cleaning," unless otherwise specified herein. The Contractor shall ensure that all individual components of the traffic signal and pedestrian corridor standards are blast cleaned prior to pickling to achieve the minimum zinc coating mass of 600 g/m<sup>2</sup>. All welding and provision of holes is to be completed prior to surface preparation and cleaning, except where shown on the Drawings.

The sandblasting and cleaning of all components shall be done in the shop.

After the fabricated components have been sandblasted and cleaned, an inspection agency appointed by the Department will carry out a visual inspection of the components in the shop before they are shipped to the galvanizing plant.

## **4.5 Hot-Dip Galvanizing**

### **4.5.1 General**

The hot-dip galvanizing plant shall be a Regular Member of the American Galvanizers Association, Inc. and certified to CSA G164.

All outside surfaces and interior surfaces of all individual components of the traffic signal and pedestrian corridor standards shall be hot-dip galvanized in accordance with the requirements of this Specification.

The galvanizing coating on outside surfaces of the structures shall be generally smooth and free of blisters, lumpiness and runs. In particular, the outside surfaces of the bottom 2.5 m of the vertical support members shall have a smooth finish equal to the finish on hot-dipped galvanized handrails.

In addition to the provision of corrosion protection by the galvanized coating, the aesthetic appearance of the structure after hot-dip galvanizing will also be a criteria in the acceptance or rejection of the galvanized coating. The galvanized coating on the entire structure shall have a uniform "silver" colour and lustre. Galvanizing with parts of the structure having dull grey coating or streaks or mottled appearance will not be acceptable. If the galvanizing is rejected for aesthetic reasons, the Contractor shall rectify the appearance by applying spray-on molten zinc metallizing with 85/15 zinc/aluminum alloy. The metallizing shall be carried out in the shop before the structure is installed.

To prevent problems with aesthetic appearance of structures after hot-dip galvanizing, the Contractor shall be responsible for ensuring that the silicon content in the steel used for fabricating the structures is controlled within 0 to 0.03%.

Minor defects in the galvanizing coating shall be repaired in accordance with Section 4.5.2 of this Specification. The Engineer shall be consulted before repairs are made. Use of cold applied spray-on galvanizing will not be permitted and will be cause for rejection.

Other defects and contaminants in the galvanizing coating, such as heavy dross protrusions, flux inclusions and ash inclusions shall be grounds for rejection of the galvanizing coating system.

The Contractor shall verify the thickness of galvanized coatings as directed by the Contract Administrator.

All threaded couplings shall be rethreaded after the sign structures have been hot-dip galvanized.



The structures shall be stored on timber blocking after hot-dip galvanizing.

#### **4.5.2 Repair of Damaged Galvanizing**

All areas of damaged galvanizing shall be repaired by touch-up galvanizing.

Surfaces to receive touch-up galvanizing shall be cleaned using a wire brush, a light grinding action, or mild blasting to remove loose scale, rust, paint, grease, dirt, or other contaminants. Preheat the surface to 315°C and wire brush the surface during preheating. Rub the cleaned preheated area with the repair stick to deposit an evenly distributed layer of zinc alloy. Spread the alloy with a wire brush, spatula, or similar tool. Touch-up galvanizing shall be blended into existing galvanizing of surrounding surfaces and shall be buffed and polished if required to match the surrounding surfaces. Care shall be taken to not overheat surfaces beyond 400°C and to not apply direct flame to the alloy rods.

### **5. IDENTIFICATION**

Each mating flange of davit-arm type standards shall be identified with the appropriate identification stock code number (as indicated on the Specification sheet) and the date of manufacture. This shall be stamped on the bottom side of each flange.

### **6. QUALITY CONTROL**

#### **6.1 General**

All workmanship and all materials furnished and supplied under this Specification are subject to close and systematic inspection and testing by the Department, including all operations from the selection and production of materials, through to final acceptance of the work. The Contractor shall be wholly responsible for the control of all operations incidental thereto notwithstanding any inspection approval that may have been previously given. The Department reserves the right to reject any materials or works that are not in accordance with the requirements of this Specification.

The Contractor shall be responsible for making a thorough inspection of materials to be supplied under this Contract. All material shall be free of surface imperfections and other defects.

#### **6.2 Welding Qualifications**

The Contractor shall produce evidence that the plant has recently been fully approved by the C.W.B. to the requirements of CSA W47.1 Division 2.1 for welding of steel structures.

Approved welding procedures shall be submitted to the Engineer prior to fabrication of any steel items.

#### **6.3 Inspection**

##### **6.3.1 General**

The Department will appoint an inspection agency to carry out inspections and testing of work in this Specification. The inspection agency shall report to the Department based on plant inspections of welds, material, fabrication procedures, quality control, mill test certificates, etc. All inspection costs will be borne by the Department. The inspections will include the following:

- a) Inspection of all material and proposed fabrication procedures prior to the start of manufacturing.
- b) Inspection of all fabricated components prior to hot-dip galvanizing.
- c) A final inspection following application of hot-dip galvanizing, prior to shipment from the manufacturer's plant.

The inspection agency shall carry out the following welding inspections and testing:

a) **Circumferential Welded Splices**

100% of circumferential welds used to join pole sections together shall be inspected. Inspection shall be performed by radiography or ultrasonics, or by destructive tests acceptable to the Engineer. Only one time repair of circumferential welds is allowed without written permission of the Engineer.

b) **Longitudinal Seam Welds**

100% of full penetration welds and a random 25% of partial penetration welds of longitudinal seams shall be inspected. Full penetration weld inspections shall be performed by radiography or ultrasonics. In addition, partial penetration welds may be inspected by magnetic particle. Both types of weld may be tested by destructive methods acceptable to the Engineer.

c) **Base Connection and Flange Plate Connection Welds**

A random 25% of all base connection and flange plate connection welds shall be inspected. Full penetration weld inspection may be performed by radiography or ultrasonics. Fillet welds may be inspected by magnetic particle. Both types of weld may be tested by destructive methods acceptable to the Engineer. Only one time repair of base connection or flange plate connection welds is allowed without written permission of the Engineer.

Welds that are found by any of the inspection methods to be inadequate and unsatisfactory shall be repaired in accordance with CSA W59 and then retested. The cost of the repairs and the cost of the retest shall be paid for by the Contractor.

No repair shall be made until agreed to by the Engineer.

**6.4 Unacceptable Work**

Any welding work found to be unacceptable shall be corrected in accordance with CSA W59.

No repair shall be made until agreed to by the Engineer.

**7. DELIVERY**

Standards and component parts shall be delivered F.O.B. Warehouse Stores, 1550 Dublin Avenue, Winnipeg, Manitoba.

Non-metallic strapping shall be used to secure groups of standards for delivery.

Standards shall be inspected by the Director of Traffic Engineering or his representative upon receipt, before acceptance by this Department.

The Director of Traffic Engineering shall be informed 48 hours in advance of the anticipated delivery date.

**8. GUARANTEE**

The Supplier shall guarantee all material against defects in quality or workmanship for a period of one year after final acceptance by the Department.

**9. METHOD OF MEASUREMENT**

Fabrication of pedestrian corridor and traffic signal standards will be measured on a unit basis, per standard. The number of standards to be paid for shall be the total number of standards fabricated in accordance with this Specification and accepted by the Engineer.

## **10. BASIS OF PAYMENT**

Fabrication of pedestrian corridor and traffic signal standards will be paid for at the Contract Unit Price per standard for the "Items of Work" listed below, measured as specified herein, which price shall be payment in full for supplying all materials and performing all operations herein described, and all other items incidental to the work included in this Specification.

### Items of Work

#### Fabrication of Standards

- a) Medium Series Combination - Traffic Signal/Pedestrian Corridor/Luminaire Davit Standards - Type 4

**MANITOBA HIGHWAYS AND TRANSPORTATION  
TRAFFIC ENGINEERING  
SPECIFICATION FOR COMBINATION  
TRAFFIC SIGNAL/ADVANCE TRAFFIC SIGNAL/LUMINAIRE  
CANTILEVER STANDARDS**

## 1. DESCRIPTION

This Specification covers the fabrication and delivery of combination traffic signal/ advance traffic signal/luminaire cantilever standards.

Standards are intended to support one to three 5-section 300 mm traffic signal heads, made of aluminum, complete with standard backboards and one street blade sign, or one advance signal sign and one to three 3.0 m luminaire arms.

## 2. STRUCTURE CONFIGURATIONS

### 2.1 General

Items forming part of this Specification include Component Nos.:

E-016D Extension Straight Stub  
E-016E Luminaire Davit Arm (single luminaire installation)  
E-016L Luminaire Extension Shaft (multiple luminaire installation)  
E-016R Cantilever Arm Extension (advance signal sign)  
E-016S Cantilever Arm Extension (traffic signals)  
E-016T Hydro Luminaire Adaptor (multiple luminaire installations)  
E-016W6.8 m Vertical Shaft

The details shown on the Drawings shall not be changed unless approved in writing by the Engineer. Care shall be taken to ensure flange connections remain interchangeable.

### 2.2 Type of Standards

Standards shall be as follows:

Type	Use	Arm Lengths (m)
Combination Luminaire Cantilever Standard (Type 6)	Advance Signal	7.5, 9.0, 10.5, 15.0
Combination Luminaire Cantilever Standard (Type 7)	Traffic Signal	7.5, 9.0, 10.5, 15.0

Cantilever arm height (loaded) shall be 6500 mm  $\pm$  50 mm above the base plate, measured at the end of the arm. The Cantilever arm angle (loaded) shall be no less than 92° from vertical.

All extension arms shall be one piece without any flanges, except where the arm is attached to the vertical member.

Each tubular component shall be fabricated in one piece.

### **3. MATERIALS**

#### **3.1 General**

The Contractor shall be responsible for the supply, safe storage, and handling of all materials set forth in this Specification.

All materials used for fabrication of traffic signal and pedestrian corridor standards shall be new, previously unused material.

#### **3.2 Handling and Storage of Materials**

All materials shall be handled in a careful and workmanshiplike manner, to the satisfaction of the Engineer. Storage of materials shall be in accordance with the requirements of CSA Standard CAN3 A23.1.8-M77, Storage of Materials, except as otherwise specified herein.

#### **3.3 Structural Steel**

Structural steel for items with 3 mm (11 ga) thick shaft material shall be in accordance with CSA G40.21 Grade 350W. All other items shall be minimum Grade 300W material. For purposes of hot-dip galvanizing, the silicon content in the steel shall be controlled within 0 to 0.03%.

The Supplier is advised that copies of mill test certificates showing the chemical and physical properties of all structural steel to be supplied under this Specification must be submitted to the Engineer. The mill test certificates shall be submitted prior to commencement of product fabrication for acceptance by the Engineer.

Steel shall not be acceptable unless the mill test certificate states the grade to be 350 MPa (50 ksi) and 300 MPa (44 ksi) minimum yield for the applicable items. Lower grade steel shall not be acceptable (despite favourable published mill test yield results), and items fabricated without steel certification shall be rejected.

All costs resulting from any changes or due to failure to have submissions reviewed shall be borne by the Supplier.

#### **3.4 Hot-Dip Galvanizing**

Hot-dip galvanizing shall be in accordance with CSA G164 to a net minimum retention of 600 g/m<sup>2</sup>.

#### **3.5 Galvanizing Touch-up**

Galvanizing touch-up and shall be done with self-fluxing, low-temperature, zinc-based alloy rods in accordance with ASTM A780-80 for "Repair of Damaged Hot-Dip Galvanized Coatings." Approved products are Galvalloy as manufactured by Metalloy Products Company, P.O. Box No. 3093, Terminal Annex, Los Angeles, California, and Welco Gal-Viz Galvanizing Alloy, as manufactured by Thermocote Welco, Highway 161, York Road, Kings Mountain, North Carolina. Locally, both products are available from Welder Supplies Limited, 25 McPhillips Street, Winnipeg.

#### **3.6 Welding Consumables**

Welding consumables for all processes shall be certified by the manufacturer to be complying with the requirements of CSA Standard W59-M1984 and the following Specifications:

a) Manual shielded metal arc welding (SMAW):

All electrodes shall be basic-type electrodes conforming to CSA W48.1-M1991 or W48.3-M1982, classification E480XX, or imperial equivalent.

b) Gas metal arc welding (GMAW):

All electrodes shall conform to CSA W48.4-M1980, classification ER480S-X, or imperial equivalent.

c) Flux cored arc welding (FCAW):

All electrodes shall conform to CSA W48.5-M1982, classification E480XT-X or imperial equivalent. Electrodes shall be controlled by hydrogen (CH) designation.

d) Submerged arc welding (SAW):

All electrodes shall conform to CSA W48.6-M1980, classification F480X-EXXX or imperial equivalent.

e) Shielding gas shall be welding grade carbon-dioxide with a guaranteed dew point of  $-46^{\circ}\text{C}$ .

f) All electrodes, wires, and fluxes used shall be of a classification requiring a minimum impact of 27 joules at  $-18^{\circ}\text{C}$ .

The proposed welding procedures and welding consumable certificates shall be submitted to the Engineer for approval at least two (2) days prior to the scheduled commencement of any fabrication.

### **3.7 Connection Bolts**

Connection bolts shall be ASTM A325 high strength bolts each with one grade DH nut and one hardened washer, all hot-dip galvanized.

The galvanized nuts shall be overtapped to the minimum amount required for fastener assembly. The nuts shall be lubricated with a lubricant containing a visible dye. The lubricant shall be clean and dry to the touch.

### **3.8 Hardware for Handhole Covers**

Hardware for handhole covers shall be in accordance with ASTM A276 Type 316 stainless steel.

### **3.9 Miscellaneous Materials**

Miscellaneous material incidental to this work shall be as approved by the Engineer.

## **4. CONSTRUCTION METHODS**

### **4.1 General Requirements**

- a) Holes in the base plates shall be oversized by 6 mm.
- b) Adequate venting and drainage holes shall be provided in enclosed sections for hot-dip galvanizing. The galvanizing facilities shall be consulted regarding the size and location of these holes. Holes shall be provided by drilling not burning.
- c) Prior to fabrication, the dimensional limitations on the size and shape imposed by the galvanizing facilities shall be determined for hot-dip galvanizing all individual components of the traffic signal and pedestrian corridor standards.

## **4.2 Fabrication**

All fabrication shall be carried out in accordance with this Specification and the Contract Drawings, as well as AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaries, and Traffic Signals - 1994, plus all subsequent revisions.

The punching of identification marks on the members will not be allowed, except as specified herein.

Any damage to members during fabrication shall be drawn to the attention of the Engineer in order that the Engineer may approve remedial measures.

All portions of the work shall be neatly finished. Shearing, cutting, clipping, and machining shall be done neatly and accurately. Finished members shall be true to line, free from twists, bends, sharp corners, and edges.

Cut edges shall be true and smooth and free from excessive burrs or ragged breaks. Re-entrant cuts shall be avoided wherever possible. If used, they shall be filleted by drilling prior to cutting.

All holes shall be provided by drilling not burning. All holes shall be free of burrs and rough edges.

## **4.3 Welding**

Welding shall be in accordance with CSA W59, "Welded Steel Construction."

All seams shall be continuously welded and free from any slag and splatter. Longitudinal welds shall be a minimum of 70% penetration, except those within 200 mm of baseplates, flanges, end openings, access openings, and circumferential welds, which shall be 100% penetration. All circumferential groove welds shall be 100% penetration, and where circumferential welds are used at a butt joint, an internal backup strip shall be provided.

Longitudinal seam welds in horizontal supports shall be located at the bottom of the horizontal members. Only one longitudinal seam weld is permitted in each member.

All welds shall be ground smooth and flush with the adjacent surface prior to hot-dip galvanizing.

## **4.4 Surface Preparation and Cleaning**

Surface preparation and cleaning of materials prior to hot-dip galvanizing shall be in accordance with CSA G164 and SSPC Specification SP:6, "Commercial Blast Cleaning," unless otherwise specified herein. The Contractor shall ensure that all individual components of the traffic signal and pedestrian corridor standards are blast cleaned prior to pickling to achieve the minimum zinc coating mass of 600



g/m<sup>2</sup>. All welding and provision of holes is to be completed prior to surface preparation and cleaning, except where shown on the Drawings.

The sandblasting and cleaning of all components shall be done in the shop.

After the fabricated components have been sandblasted and cleaned, an inspection agency appointed by the Department will carry out a visual inspection of the components in the shop before they are shipped to the galvanizing plant.

## **4.5 Hot-Dip Galvanizing**

### **4.5.1 General**

The hot-dip galvanizing plant shall be a Regular Member of the American Galvanizers Association, Inc. and certified to CSA G164.

All outside surfaces and interior surfaces of all individual components of the traffic signal and pedestrian corridor standards shall be hot-dip galvanized in accordance with the requirements of this Specification.

The galvanizing coating on outside surfaces of the structures shall be generally smooth and free of blisters, lumpiness and runs. In particular, the outside surfaces of the bottom 2.5 m of the vertical support members shall have a smooth finish equal to the finish on hot-dipped galvanized handrails.

In addition to the provision of corrosion protection by the galvanized coating, the aesthetic appearance of the structure after hot-dip galvanizing will also be a criteria in the acceptance or rejection of the galvanized coating. The galvanized coating on the entire structure shall have a uniform "silver" colour and lustre. Galvanizing with parts of the structure having dull grey coating or streaks or mottled appearance will not be acceptable. If the galvanizing is rejected for aesthetic reasons, the Contractor shall rectify the appearance by applying spray-on molten zinc metallizing with 85/15 zinc/aluminum alloy. The metallizing shall be carried out in the shop before the structure is installed.

To prevent problems with aesthetic appearance of structures after hot-dip galvanizing, the Contractor shall be responsible for ensuring that the silicon content in the steel used for fabricating the structures is controlled within 0 to 0.03%.

Minor defects in the galvanizing coating shall be repaired in accordance with Section 4.5.2 of this Specification. The Engineer shall be consulted before repairs are made. Use of cold applied spray-on galvanizing will not be permitted and will be cause for rejection.

Other defects and contaminants in the galvanizing coating, such as heavy dross protrusions, flux inclusions and ash inclusions shall be grounds for rejection of the galvanizing coating system.

The Contractor shall verify the thickness of galvanized coatings as directed by the Contract Administrator.

All threaded couplings shall be rethreaded after the sign structures have been hot-dip galvanized.

The structures shall be stored on timber blocking after hot-dip galvanizing.

### **4.5.2 Repair of Damaged Galvanizing**

All areas of damaged galvanizing shall be repaired by touch-up galvanizing.

Surfaces to receive touch-up galvanizing shall be cleaned using a wire brush, a light grinding action, or mild blasting to remove loose scale, rust, paint, grease, dirt, or other contaminants. Preheat the surface to 315°C and wire brush the surface during preheating. Rub the cleaned preheated area with the repair stick to deposit an evenly distributed layer of zinc alloy. Spread the alloy with a wire brush, spatula, or similar tool. Touch-up galvanizing shall be blended into existing galvanizing of surrounding surfaces and shall be buffed and polished if required to match the surrounding surfaces. Care shall be taken to not overheat surfaces beyond 400°C and to not apply direct flame to the alloy rods.

## **5. IDENTIFICATION**

Each mating flange of cantilever type standards shall be identified with the appropriate identification stock code number (as indicated on the Specification sheet) and the date of manufacture. This shall be stamped on the bottom side of each flange.

## **6. QUALITY CONTROL**

### **6.1 General**

All workmanship and all materials furnished and supplied under this Specification are subject to close and systematic inspection and testing by the Department, including all operations from the selection and production of materials, through to final acceptance of the work. The Contractor shall be wholly responsible for the control of all operations incidental thereto notwithstanding any inspection approval that may have been previously given. The Department reserves the right to reject any materials or works that are not in accordance with the requirements of this Specification.

The Contractor shall be responsible for making a thorough inspection of materials to be supplied under this Contract. All material shall be free of surface imperfections and other defects.

### **6.2 Welding Qualifications**

The Contractor shall produce evidence that the plant has recently been fully approved by the C.W.B. to the requirements of CSA W47.1 Division 2.1 for welding of steel structures.

Approved welding procedures shall be submitted to the Engineer prior to fabrication of any steel items.

### **6.3 Inspection**

#### **6.3.1 General**

The Department will appoint an inspection agency to carry out inspections and testing of work in this Specification. The inspection agency shall report to the Department based on plant inspections of welds, material, fabrication procedures, quality control, mill test certificates, etc. All inspection costs will be borne by the Department. The inspections will include the following:

- a) Inspection of all material and proposed fabrication procedures prior to the start of manufacturing.
- b) Inspection of all fabricated components prior to hot-dip galvanizing.

- c) A final inspection following application of hot-dip galvanizing, prior to shipment from the manufacturer's plant.

The inspection agency shall carry out the following welding inspections and testing:

- a) Circumferential Welded Splices

100% of circumferential welds used to join pole sections together shall be inspected. Inspection shall be performed by radiography or ultrasonics, or by destructive tests acceptable to the Engineer. Only one time repair of circumferential welds is allowed without written permission of the Engineer.

- b) Longitudinal Seam Welds

100% of full penetration welds and a random 25% of partial penetration welds of longitudinal seams shall be inspected. Full penetration weld inspections shall be performed by radiography or ultrasonics. In addition, partial penetration welds may be inspected by magnetic particle. Both types of weld may be tested by destructive methods acceptable to the Engineer.

- c) Base Connection and Flange Plate Connection Welds

A random 25% of all base connection and flange plate connection welds shall be inspected. Full penetration weld inspection may be performed by radiography or ultrasonics. Fillet welds may be inspected by magnetic particle. Both types of weld may be tested by destructive methods acceptable to the Engineer. Only one time repair of base connection or flange plate connection welds is allowed without written permission of the Engineer.

Welds that are found by any of the inspection methods to be inadequate and unsatisfactory shall be repaired in accordance with CSA W59 and then retested. The cost of the repairs and the cost of the retest shall be paid for by the Contractor.

No repair shall be made until agreed to by the Engineer.

#### **6.4 Unacceptable Work**

Any welding work found to be unacceptable shall be corrected in accordance with CSA W59.

No repair shall be made until agreed to by the Engineer.

### **7. DELIVERY**

Standards and component parts shall be delivered F.O.B. Warehouse Stores, 1550 Dublin Avenue, Winnipeg, Manitoba.

Non-metallic strapping shall be used to secure groups of standards for delivery.

Standards shall be inspected by the Director of Traffic Engineering or his representative upon receipt, before acceptance by this Department.

The Director of Traffic Engineering shall be informed 48 hours in advance of the anticipated delivery date.

**8. GUARANTEE**

The Supplier shall guarantee all material against defects in quality or workmanship for a period of one year after final acceptance by the Department.

**9. METHOD OF MEASUREMENT**

Fabrication of combination cantilever standards will be measured on a unit basis, per standard. The number of standards to be paid for shall be the total number of standards fabricated in accordance with this Specification and accepted by the Engineer.

**10. BASIS OF PAYMENT**

Fabrication of combination cantilever standards will be paid for at the Contract Unit Price per standard for the "Items of Work" listed below, measured as specified herein, which price shall be payment in full for supplying all materials and performing all operations herein described, and all other items incidental to the work included in this Specification.

Items of Work

Fabrication of Standards

- a) Combination Advance Traffic Signal/Luminaire Cantilever Standards - Type 6
- b) Combination Traffic Signal/Luminaire Cantilever Standards - Type 7

**MANITOBA HIGHWAYS AND TRANSPORTATION  
TRAFFIC ENGINEERING  
SPECIFICATION FOR HEAVY SERIES  
TRAFFIC SIGNAL  
AND PEDESTRIAN CORRIDOR DAVIT STANDARDS**

**1. DESCRIPTION**

This Specification covers the fabrication and delivery of heavy series traffic signal and pedestrian corridor davit standards.

Standards are intended to support one to three 5-section 300 mm traffic signal heads, made of aluminum, complete with standard backboards, or one internally illuminated pedestrian corridor fixtures, and one street blade signs.

**2. STRUCTURE CONFIGURATIONS**

**2.1 General**

Items forming part of this Specification include Component Nos.:

E-016M          Stub - Heavy Series Davit  
E-016Q Arm Extension - Heavy Series Davit

The details shown on the Drawings shall not be changed unless approved in writing by the Engineer. Care shall be taken to ensure flange connections remain interchangeable.

**2.2 Type of Standards**

Standards shall be as follows:

Type	Use	Arm Lengths (m)
Heavy Series Davit (Type 9)	Traffic Signal	9.0, 10.5
	Pedestrian Corridor	9.0, 10.5

Davit arm height (loaded) shall be 6400 mm  $\pm$  50 mm, above the base plate, measured at the end of the arm. The davit arm angle loaded shall not be less than 92° from vertical.

All extension arms shall be one piece without any flanges, except where the arm is attached to the vertical member.

Each tubular component shall be fabricated in one piece.

**3. MATERIALS**

**3.1 General**

The Contractor shall be responsible for the supply, safe storage, and handling of all materials set forth in this Specification.

All materials used for fabrication of traffic signal and pedestrian corridor standards shall be new, previously unused material.

### **3.2 Handling and Storage of Materials**

All materials shall be handled in a careful and workmanshiplike manner, to the satisfaction of the Engineer. Storage of materials shall be in accordance with the requirements of CSA Standard CAN3 A23.1.8-M77, Storage of Materials, except as otherwise specified herein.

### **3.3 Structural Steel**

Structural steel shall be in accordance with CSA G40.21 Grade 300W. For purposes of hot-dip galvanizing, the silicon content in the steel shall be controlled within 0 to 0.03%.

The Supplier is advised that copies of mill test certificates showing the chemical and physical properties of all structural steel to be supplied under this Specification must be submitted to the Engineer. The mill test certificates shall be submitted prior to commencement of product fabrication for acceptance by the Engineer.

Steel shall not be acceptable unless the mill test certificate states the grade to be 300 MPa (44 ksi) minimum yield. Lower grade steel shall not be acceptable (despite favourable published mill test yield results), and items fabricated without steel certification shall be rejected.

All costs resulting from any changes or due to failure to have submissions reviewed shall be borne by the Supplier.

### **3.4 Hot-Dip Galvanizing**

Hot-dip galvanizing shall be in accordance with CSA G164 to a net minimum retention of 600 g/m<sup>2</sup>.

### **3.5 Galvanizing Touch-up**

Galvanizing touch-up and shall be done with self-fluxing, low-temperature, zinc-based alloy rods in accordance with ASTM A780-80 for "Repair of Damaged Hot-Dip Galvanized Coatings." Approved products are Galvalloy as manufactured by Metalloy Products Company, P.O. Box No. 3093, Terminal Annex, Los Angeles, California, and Welco Gal-Viz Galvanizing Alloy, as manufactured by Thermocote Welco, Highway 161, York Road, Kings Mountain, North Carolina. Locally, both products are available from Welder Supplies Limited, 25 McPhillips Street, Winnipeg.

### **3.6 Welding Consumables**

Welding consumables for all processes shall be certified by the manufacturer to be complying with the requirements of CSA Standard W59-M1984 and the following Specifications:

a) Manual shielded metal arc welding (SMAW):

All electrodes shall be basic-type electrodes conforming to CSA W48.1-M1991 or W48.3-M1982, classification E480XX, or imperial equivalent.

b) Gas metal arc welding (GMAW):

All electrodes shall conform to CSA W48.4-M1980, classification ER480S-X, or imperial equivalent.

- c) Flux cored arc welding (FCAW):  
All electrodes shall conform to CSA W48.5-M1982, classification E480XT-X or imperial equivalent. Electrodes shall be controlled by hydrogen (CH) designation.
- d) Submerged arc welding (SAW):  
All electrodes shall conform to CSA W48.6-M1980, classification F480X-EXXX or imperial equivalent.
- e) Shielding gas shall be welding grade carbon-dioxide with a guaranteed dew point of -46°C.
- f) All electrodes, wires, and fluxes used shall be of a classification requiring a minimum impact of 27 joules at -18°C.

The proposed welding procedures and welding consumable certificates shall be submitted to the Engineer for approval at least two (2) days prior to the scheduled commencement of any fabrication.

### **3.7 Connection Bolts**

Connection bolts shall be ASTM A325 high strength bolts each with one grade DH nut and one hardened washer, all hot-dip galvanized.

The galvanized nuts shall be overtapped to the minimum amount required for fastener assembly. The nuts shall be lubricated with a lubricant containing a visible dye. The lubricant shall be clean and dry to the touch.

### **3.8 Hardware for Handhole Covers**

Hardware for handhole covers shall be in accordance with ASTM A276 Type 316 stainless steel.

### **3.9 Miscellaneous Materials**

Miscellaneous material incidental to this work shall be as approved by the Engineer.

## **4. CONSTRUCTION METHODS**

### **4.1 General Requirements**

- a) Holes in the base plates shall be oversized by 6 mm.
- b) Adequate venting and drainage holes shall be provided in enclosed sections for hot-dip galvanizing. The galvanizing facilities shall be consulted regarding the size and location of these holes. Holes shall be provided by drilling not burning.
- c) Prior to fabrication, the dimensional limitations on the size and shape imposed by the galvanizing facilities shall be determined for hot-dip galvanizing all individual components of the traffic signal and pedestrian corridor standards.

### **4.2 Fabrication**

All fabrication shall be carried out in accordance with this Specification and the Contract Drawings, as well as AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaries, and Traffic Signals - 1994, plus all subsequent revisions.

The punching of identification marks on the members will not be allowed, except as specified herein.

Any damage to members during fabrication shall be drawn to the attention of the Engineer in order that the Engineer may approve remedial measures.

All portions of the work shall be neatly finished. Shearing, cutting, clipping, and machining shall be done neatly and accurately. Finished members shall be true to line, free from twists, bends, sharp corners, and edges.

Cut edges shall be true and smooth and free from excessive burrs or ragged breaks. Re-entrant cuts shall be avoided wherever possible. If used, they shall be filleted by drilling prior to cutting.

All holes shall be provided by drilling not burning. All holes shall be free of burrs and rough edges.

#### **4.3 Welding**

Welding shall be in accordance with CSA W59, "Welded Steel Construction."

All seams shall be continuously welded and free from any slag and splatter. Longitudinal welds shall be a minimum of 70% penetration, except those within 200 mm of baseplates, flanges, end openings, access openings, and circumferential welds, which shall be 100% penetration. All circumferential groove welds shall be 100% penetration, and where circumferential welds are used at a butt joint, an internal backup strip shall be provided.

Longitudinal seam welds in davit arms and extensions shall be located at the bottom of the horizontal members. Only one longitudinal seam weld is permitted in each member.

All welds shall be ground smooth and flush with the adjacent surface prior to hot-dip galvanizing.

#### **4.4 Surface Preparation and Cleaning**

Surface preparation and cleaning of materials prior to hot-dip galvanizing shall be in accordance with CSA G164 and SSPC Specification SP:6, "Commercial Blast Cleaning," unless otherwise specified herein. The Contractor shall ensure that all individual components of the traffic signal and pedestrian corridor standards are blast cleaned prior to pickling to achieve the minimum zinc coating mass of 600 g/m<sup>2</sup>. All welding and provision of holes is to be completed prior to surface preparation and cleaning, except where shown on the Drawings.

The sandblasting and cleaning of all components shall be done in the shop.

After the fabricated components have been sandblasted and cleaned, an inspection agency appointed by the Department will carry out a visual inspection of the components in the shop before they are shipped to the galvanizing plant.

#### **4.5 Hot-Dip Galvanizing**

##### **4.5.1 General**

The hot-dip galvanizing plant shall be a Regular Member of the American Galvanizers Association, Inc. and certified to CSA G164.



All outside surfaces and interior surfaces of all individual components of the traffic signal and pedestrian corridor standards shall be hot-dip galvanized in accordance with the requirements of this Specification.

The galvanizing coating on outside surfaces of the structures shall be generally smooth and free of blisters, lumpiness and runs. In particular, the outside surfaces of the bottom 2.5 m of the vertical support members shall have a smooth finish equal to the finish on hot-dipped galvanized handrails.

In addition to the provision of corrosion protection by the galvanized coating, the aesthetic appearance of the structure after hot-dip galvanizing will also be a criteria in the acceptance or rejection of the galvanized coating. The galvanized coating on the entire structure shall have a uniform "silver" colour and lustre. Galvanizing with parts of the structure having dull grey coating or streaks or mottled appearance will not be acceptable. If the galvanizing is rejected for aesthetic reasons, the Contractor shall rectify the appearance by applying spray-on molten zinc metallizing with 85/15 zinc/aluminum alloy. The metallizing shall be carried out in the shop before the structure is installed.

To prevent problems with aesthetic appearance of structures after hot-dip galvanizing, the Contractor shall be responsible for ensuring that the silicon content in the steel used for fabricating the structures is controlled within 0 to 0.03%.

Minor defects in the galvanizing coating shall be repaired in accordance with Section 4.5.2 of this Specification. The Engineer shall be consulted before repairs are made. Use of cold applied spray-on galvanizing will not be permitted and will be cause for rejection.

Other defects and contaminants in the galvanizing coating, such as heavy dross protrusions, flux inclusions and ash inclusions shall be grounds for rejection of the galvanizing coating system.

The Contractor shall verify the thickness of galvanized coatings as directed by the Contract Administrator.

All threaded couplings shall be rethreaded after the sign structures have been hot-dip galvanized.

The structures shall be stored on timber blocking after hot-dip galvanizing.

#### **4.5.2 Repair of Damaged Galvanizing**

All areas of damaged galvanizing shall be repaired by touch-up galvanizing.

Surfaces to receive touch-up galvanizing shall be cleaned using a wire brush, a light grinding action, or mild blasting to remove loose scale, rust, paint, grease, dirt, or other contaminants. Preheat the surface to 315°C and wire brush the surface during preheating. Rub the cleaned preheated area with the repair stick to deposit an evenly distributed layer of zinc alloy. Spread the alloy with a wire brush, spatula, or similar tool. Touch-up galvanizing shall be blended into existing galvanizing of surrounding surfaces and shall be buffed and polished if required to match the surrounding surfaces. Care shall be taken to not overheat surfaces beyond 400°C and to not apply direct flame to the alloy rods.

### **5. IDENTIFICATION**

Each mating flange of davit-arm type standards shall be identified with the appropriate identification stock code number (as indicated on the Specification sheet) and the date of manufacture. This shall be stamped on the bottom side of each flange.

## **6. QUALITY CONTROL**

### **6.1 General**

All workmanship and all materials furnished and supplied under this Specification are subject to close and systematic inspection and testing by the Department, including all operations from the selection and production of materials, through to final acceptance of the work. The Contractor shall be wholly responsible for the control of all operations incidental thereto notwithstanding any inspection approval that may have been previously given. The Department reserves the right to reject any materials or works that are not in accordance with the requirements of this Specification.

The Contractor shall be responsible for making a thorough inspection of materials to be supplied under this Contract. All material shall be free of surface imperfections and other defects.

### **6.2 Welding Qualifications**

The Contractor shall produce evidence that the plant has recently been fully approved by the C.W.B. to the requirements of CSA W47.1 Division 2.1 for welding of steel structures.

Approved welding procedures shall be submitted to the Engineer prior to fabrication of any steel items.

### **6.3 Inspection**

#### **6.3.1 General**

The Department will appoint an inspection agency to carry out inspections and testing of work in this Specification. The inspection agency shall report to the Department based on plant inspections of welds, material, fabrication procedures, quality control, mill test certificates, etc. All inspection costs will be borne by the Department. The inspections will include the following:

- a) Inspection of all material and proposed fabrication procedures prior to the start of manufacturing.
- b) Inspection of all fabricated components prior to hot-dip galvanizing.
- c) A final inspection following application of hot-dip galvanizing, prior to shipment from the manufacturer's plant.

The inspection agency shall carry out the following welding inspections and testing:

- a) Circumferential Welded Splices

100% of circumferential welds used to join pole sections together shall be inspected. Inspection shall be performed by radiography or ultrasonics, or by destructive tests acceptable to the Engineer. Only one time repair of circumferential welds is allowed without written permission of the Engineer.

b) Longitudinal Seam Welds

100% of full penetration welds and a random 25% of partial penetration welds of longitudinal seams shall be inspected. Full penetration weld inspections shall be performed by radiography or ultrasonics. In addition, partial penetration welds may be inspected by magnetic particle. Both types of weld may be tested by destructive methods acceptable to the Engineer.

c) Base Connection and Flange Plate Connection Welds

A random 25% of all base connection and flange plate connection welds shall be inspected. Full penetration weld inspection may be performed by radiography or ultrasonics. Fillet welds may be inspected by magnetic particle. Both types of weld may be tested by destructive methods acceptable to the Engineer. Only one time repair of base connection or flange plate connection welds is allowed without written permission of the Engineer.

Welds that are found by any of the inspection methods to be inadequate and unsatisfactory shall be repaired in accordance with CSA W59 and then retested. The cost of the repairs and the cost of the retest shall be paid for by the Contractor.

No repair shall be made until agreed to by the Engineer.

**6.4 Unacceptable Work**

Any welding work found to be unacceptable shall be corrected in accordance with CSA W59.

No repair shall be made until agreed to by the Engineer.

**7. DELIVERY**

Standards and component parts shall be delivered F.O.B. Warehouse Stores, 1550 Dublin Avenue, Winnipeg, Manitoba.

Non-metallic strapping shall be used to secure groups of standards for delivery.

Standards shall be inspected by the Director of Traffic Engineering or his representative upon receipt, before acceptance by this Department.

The Director of Traffic Engineering shall be informed 48 hours in advance of the anticipated delivery date.

**8. GUARANTEE**

The Supplier shall guarantee all material against defects in quality or workmanship for a period of one year after final acceptance by the Department.

**9. METHOD OF MEASUREMENT**

Fabrication of heavy series pedestrian corridor and traffic signal standards will be measured on a unit basis, per standard. The number of standards to be paid for shall be the total number of standards fabricated in accordance with this Specification and accepted by the Engineer.

**10. BASIS OF PAYMENT**

Fabrication of heavy series pedestrian corridor and traffic signal standards will be paid for at the Contract Unit Price per standard for the “Items of Work” listed below, measured as specified herein, which price shall be payment in full for supplying all materials and performing all operations herein described, and all other items incidental to the work included in this Specification.

Items of Work

Fabrication of Standards

- a) Heavy Series Davit Standards - Type 9

**MANITOBA HIGHWAYS AND TRANSPORTATION  
TRAFFIC ENGINEERING  
SPECIFICATION FOR HEAVY SERIES COMBINATION  
TRAFFIC SIGNAL/PEDESTRIAN CORRIDOR/LUMINAIRE  
DAVIT STANDARDS**

**1. DESCRIPTION**

This Specification covers the fabrication and delivery of traffic signal/pedestrian corridor/luminaire davit standards.

Standards are intended to support one to three 5-section 300 mm traffic signal heads, made of aluminum, complete with standard backboards, or one internally illuminated pedestrian corridor fixtures, and one street blade signs, and one to three 3.0 m luminaire arms.

**2. STRUCTURE CONFIGURATIONS****2.1 General**

Items forming part of this Specification include Component Nos.:

E-016D Extension Straight Stub  
E-016E Luminaire Davit Arm (single luminaire installations)  
E-016L Luminaire Extension Shaft (multiple luminaire installations)  
E-016N Combination Stub - Heavy Series Davit  
E-016V Arm Extension - Heavy Series Combination Davit  
E-016T Hydro Luminaire Adaptor (multiple luminaire installations)

The details shown on the Drawings shall not be changed unless approved in writing by the Engineer. Care shall be taken to ensure flange connections remain interchangeable.

**2.2 Type of Standards**

Standards shall be as follows:

<b>Type</b>	<b>Use</b>	<b>Arm Lengths (m)</b>
Heavy Series Combination Luminaire Davit Standards (Type 10)	Traffic Signal/Luminaire	9.0, 10.5
	Pedestrian Corridor	9.0, 10.5

Davit arm height (loaded) shall be 6400 mm  $\pm$  50 mm above the base plate, measured at the end of the arm. The davit arm angle (loaded) shall not be less than 92° from vertical.

All extension arms shall be one piece without any flanges, except where the arm is attached to the vertical member.

Each tubular component shall be fabricated in one piece.

### **3. MATERIALS**

#### **3.1 General**

The Contractor shall be responsible for the supply, safe storage, and handling of all materials set forth in this Specification.

All materials used for fabrication of traffic signal and pedestrian corridor standards shall be new, previously unused material.

#### **3.2 Handling and Storage of Materials**

All materials shall be handled in a careful and workmanshiplike manner, to the satisfaction of the Engineer. Storage of materials shall be in accordance with the requirements of CSA Standard CAN3 A23.1.8-M77, Storage of Materials, except as otherwise specified herein.

#### **3.3 Structural Steel**

Structural steel for items with 3 mm (11 ga) thick shaft material shall be in accordance with CSA G40.21 Grade 350W. All other items shall be minimum Grade 300W material. For purposes of hot-dip galvanizing, the silicon content in the steel shall be controlled within 0 to 0.03%.

The Supplier is advised that copies of mill test certificates showing the chemical and physical properties of all structural steel to be supplied under this Specification must be submitted to the Engineer. The mill test certificates shall be submitted prior to commencement of product fabrication for acceptance by the Engineer.

Steel shall not be acceptable unless the mill test certificate states the grade to be 350 MPa (50 ksi) and 300 MPa (44 ksi) minimum yield for the applicable item. Lower grade steel shall not be acceptable (despite favourable published mill test yield results), and items fabricated without steel certification shall be rejected.

All costs resulting from any changes or due to failure to have submissions reviewed shall be borne by the Supplier.

#### **3.4 Hot-Dip Galvanizing**

Hot-dip galvanizing shall be in accordance with CSA G164 to a net minimum retention of 600 g/m<sup>2</sup>.

#### **3.5 Galvanizing Touch-up**

Galvanizing touch-up shall be done with self-fluxing, low-temperature, zinc-based alloy rods in accordance with ASTM A780-80 for "Repair of Damaged Hot-Dip Galvanized Coatings." Approved products are Galvalloy as manufactured by Metalloy Products Company, P.O. Box No. 3093, Terminal Annex, Los Angeles, California, and Welco Gal-Viz Galvanizing Alloy, as manufactured by Thermocote Welco, Highway 161, York Road, Kings Mountain, North Carolina. Locally, both products are available from Welder Supplies Limited, 25 McPhillips Street, Winnipeg.

### **3.6 Welding Consumables**

Welding consumables for all processes shall be certified by the manufacturer to be complying with the requirements of CSA Standard W59-M1984 and the following Specifications:

a) Manual shielded metal arc welding (SMAW):

All electrodes shall be basic-type electrodes conforming to CSA W48.1-M1991 or W48.3-M1982, classification E480XX, or imperial equivalent.

b) Gas metal arc welding (GMAW):

All electrodes shall conform to CSA W48.4-M1980, classification ER480S-X, or imperial equivalent.

c) Flux cored arc welding (FCAW):

All electrodes shall conform to CSA W48.5-M1982, classification E480XT-X or imperial equivalent. Electrodes shall be controlled by hydrogen (CH) designation.

d) Submerged arc welding (SAW):

All electrodes shall conform to CSA W48.6-M1980, classification F480X-EXXX or imperial equivalent.

e) Shielding gas shall be welding grade carbon-dioxide with a guaranteed dew point of  $-46^{\circ}\text{C}$ .

f) All electrodes, wires, and fluxes used shall be of a classification requiring a minimum impact of 27 joules at  $-18^{\circ}\text{C}$ .

The proposed welding procedures and welding consumable certificates shall be submitted to the Engineer for approval at least two (2) days prior to the scheduled commencement of any fabrication.

### **3.7 Connection Bolts**

Connection bolts shall be ASTM A325 high strength bolts each with one grade DH nut and one hardened washer, all hot-dip galvanized.

The galvanized nuts shall be overtapped to the minimum amount required for fastener assembly. The nuts shall be lubricated with a lubricant containing a visible dye. The lubricant shall be clean and dry to the touch.

### **3.8 Hardware for Handhole Covers**

Hardware for handhole covers shall be in accordance with ASTM A276 Type 316 stainless steel.

### **3.9 Miscellaneous Materials**

Miscellaneous material incidental to this work shall be as approved by the Engineer.

## **4. CONSTRUCTION METHODS**

#### **4.1 General Requirements**

- a) Holes in the base plates shall be oversized by 6 mm.
- b) Adequate venting and drainage holes shall be provided in enclosed sections for hot-dip galvanizing. The galvanizing facilities shall be consulted regarding the size and location of these holes. Holes shall be provided by drilling not burning.
- c) Prior to fabrication, the dimensional limitations on the size and shape imposed by the galvanizing facilities shall be determined for hot-dip galvanizing all individual components of the traffic signal and pedestrian corridor standards.

#### **4.2 Fabrication**

All fabrication shall be carried out in accordance with this Specification and the Contract Drawings, as well as AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaries, and Traffic Signals - 1994, plus all subsequent revisions.

The punching of identification marks on the members will not be allowed, except as specified herein.

Any damage to members during fabrication shall be drawn to the attention of the Engineer in order that the Engineer may approve remedial measures.

All portions of the work shall be neatly finished. Shearing, cutting, clipping, and machining shall be done neatly and accurately. Finished members shall be true to line, free from twists, bends, sharp corners, and edges.

Cut edges shall be true and smooth and free from excessive burrs or ragged breaks. Re-entrant cuts shall be avoided wherever possible. If used, they shall be filleted by drilling prior to cutting.

All holes shall be provided by drilling not burning. All holes shall be free of burrs and rough edges.



### **4.3 Welding**

Welding shall be in accordance with CSA W59, "Welded Steel Construction."

All seams shall be continuously welded and free from any slag and splatter. Longitudinal welds shall be a minimum of 70% penetration, except those within 200 mm of baseplates, flanges, end openings, access openings, and circumferential welds, which shall be 100% penetration. All circumferential groove welds shall be 100% penetration, and where circumferential welds are used at a butt joint, an internal backup strip shall be provided.

Longitudinal seam welds in davit arms and extensions shall be located at the bottom of the horizontal members. Only one longitudinal seam weld is permitted in each member.

All welds shall be ground smooth and flush with the adjacent surface prior to hot-dip galvanizing.

### **4.4 Surface Preparation and Cleaning**

Surface preparation and cleaning of materials prior to hot-dip galvanizing shall be in accordance with CSA G164 and SSPC Specification SP:6, "Commercial Blast Cleaning," unless otherwise specified herein. The Contractor shall ensure that all individual components of the traffic signal and pedestrian corridor standards are blast cleaned prior to pickling to achieve the minimum zinc coating mass of 600 g/m<sup>2</sup>. All welding and provision of holes is to be completed prior to surface preparation and cleaning, except where shown on the Drawings.

The sandblasting and cleaning of all components shall be done in the shop.

After the fabricated components have been sandblasted and cleaned, an inspection agency appointed by the Department will carry out a visual inspection of the components in the shop before they are shipped to the galvanizing plant.

### **4.5 Hot-Dip Galvanizing**

#### **4.5.1 General**

The hot-dip galvanizing plant shall be a Regular Member of the American Galvanizers Association, Inc. and certified to CSA G164.

All outside surfaces and interior surfaces of all individual components of the traffic signal and pedestrian corridor standards shall be hot-dip galvanized in accordance with the requirements of this Specification.

The galvanizing coating on outside surfaces of the structures shall be generally smooth and free of blisters, lumpiness and runs. In particular, the outside surfaces of the bottom 2.5 m of the vertical support members shall have a smooth finish equal to the finish on hot-dipped galvanized handrails.

In addition to the provision of corrosion protection by the galvanized coating, the aesthetic appearance of the structure after hot-dip galvanizing will also be a criteria in the acceptance or rejection of the galvanized coating. The galvanized coating on the entire structure shall have a uniform "silver" colour and lustre. Galvanizing with parts of the structure having dull grey coating or streaks or mottled appearance will not be acceptable. If the galvanizing is rejected for aesthetic reasons, the Contractor

shall rectify the appearance by applying spray-on molten zinc metallizing with 85/15 zinc/aluminum alloy. The metallizing shall be carried out in the shop before the structure is installed.

To prevent problems with aesthetic appearance of structures after hot-dip galvanizing, the Contractor shall be responsible for ensuring that the silicon content in the steel used for fabricating the structures is controlled within 0 to 0.03%.

Minor defects in the galvanizing coating shall be repaired in accordance with Section 4.5.2 of this Specification. The Engineer shall be consulted before repairs are made. Use of cold applied spray-on galvanizing will not be permitted and will be cause for rejection.

Other defects and contaminants in the galvanizing coating, such as heavy dross protrusions, flux inclusions and ash inclusions shall be grounds for rejection of the galvanizing coating system.

The Contractor shall verify the thickness of galvanized coatings as directed by the Contract Administrator.

All threaded couplings shall be rethreaded after the sign structures have been hot-dip galvanized.

The structures shall be stored on timber blocking after hot-dip galvanizing.

#### **4.5.2 Repair of Damaged Galvanizing**

All areas of damaged galvanizing shall be repaired by touch-up galvanizing.

Surfaces to receive touch-up galvanizing shall be cleaned using a wire brush, a light grinding action, or mild blasting to remove loose scale, rust, paint, grease, dirt, or other contaminants. Preheat the surface to 315°C and wire brush the surface during preheating. Rub the cleaned preheated area with the repair stick to deposit an evenly distributed layer of zinc alloy. Spread the alloy with a wire brush, spatula, or similar tool. Touch-up galvanizing shall be blended into existing galvanizing of surrounding surfaces and shall be buffed and polished if required to match the surrounding surfaces. Care shall be taken to not overheat surfaces beyond 400°C and to not apply direct flame to the alloy rods.

### **5. IDENTIFICATION**

Each mating flange of davit-arm type standards shall be identified with the appropriate identification stock code number (as indicated on the Specification sheet) and the date of manufacture. This shall be stamped on the bottom side of each flange.

## **6. QUALITY CONTROL**

### **6.1 General**

All workmanship and all materials furnished and supplied under this Specification are subject to close and systematic inspection and testing by the Department, including all operations from the selection and production of materials, through to final acceptance of the work. The Contractor shall be wholly responsible for the control of all operations incidental thereto notwithstanding any inspection approval that may have been previously given. The Department reserves the right to reject any materials or works that are not in accordance with the requirements of this Specification.

The Contractor shall be responsible for making a thorough inspection of materials to be supplied under this Contract. All material shall be free of surface imperfections and other defects.

### **6.2 Welding Qualifications**

The Contractor shall produce evidence that the plant has recently been fully approved by the C.W.B. to the requirements of CSA W47.1 Division 2.1 for welding of steel structures.

Approved welding procedures shall be submitted to the Engineer prior to fabrication of any steel items.

### **6.3 Inspection**

#### **6.3.1 General**

The Department will appoint an inspection agency to carry out inspections and testing of work in this Specification. The inspection agency shall report to the Department based on plant inspections of welds, material, fabrication procedures, quality control, mill test certificates, etc. All inspection costs will be borne by the Department. The inspections will include the following:

- a) Inspection of all material and proposed fabrication procedures prior to the start of manufacturing.
- b) Inspection of all fabricated components prior to hot-dip galvanizing.
- c) A final inspection following application of hot-dip galvanizing, prior to shipment from the manufacturer's plant.

The inspection agency shall carry out the following welding inspections and testing:

#### **a) Circumferential Welded Splices**

100% of circumferential welds used to join pole sections together shall be inspected. Inspection shall be performed by radiography or ultrasonics, or by destructive tests acceptable to the Engineer. Only one time repair of circumferential welds is allowed without written permission of the Engineer.

#### **b) Longitudinal Seam Welds**

100% of full penetration welds and a random 25% of partial penetration welds of longitudinal seams shall be inspected. Full penetration weld inspections shall be performed by radiography

or ultrasonics. In addition, partial penetration welds may be inspected by magnetic particle. Both types of weld may be tested by destructive methods acceptable to the Engineer.

c) **Base Connection and Flange Plate Connection Welds**

A random 25% of all base connection and flange plate connection welds shall be inspected. Full penetration weld inspection may be performed by radiography or ultrasonics. Fillet welds may be inspected by magnetic particle. Both types of weld may be tested by destructive methods acceptable to the Engineer. Only one time repair of base connection or flange plate connection welds is allowed without written permission of the Engineer.

Welds that are found by any of the inspection methods to be inadequate and unsatisfactory shall be repaired in accordance with CSA W59 and then retested. The cost of the repairs and the cost of the retest shall be paid for by the Contractor.

No repair shall be made until agreed to by the Engineer.

**6.4 Unacceptable Work**

Any welding work found to be unacceptable shall be corrected in accordance with CSA W59.

No repair shall be made until agreed to by the Engineer.

**7. DELIVERY**

Standards and component parts shall be delivered F.O.B. Warehouse Stores, 1550 Dublin Avenue, Winnipeg, Manitoba.

Non-metallic strapping shall be used to secure groups of standards for delivery.

Standards shall be inspected by the Director of Traffic Engineering or his representative upon receipt, before acceptance by this Department.

The Director of Traffic Engineering shall be informed 48 hours in advance of the anticipated delivery date.

**8. GUARANTEE**

The Supplier shall guarantee all material against defects in quality or workmanship for a period of one year after final acceptance by the Department.

**9. METHOD OF MEASUREMENT**

Fabrication of heavy series combination traffic signal/pedestrian corridor/luminaire davit standards will be measured on a unit basis, per standard. The number of standards to be paid for shall be the total number of standards fabricated in accordance with this Specification and accepted by the Engineer.

**10. BASIS OF PAYMENT**

Fabrication of heavy series combination traffic signal/pedestrian corridor/luminaire davit standards will be paid for at the Contract Unit Price per standard for the "Items of Work" listed below, measured as specified herein, which price shall be payment in full for supplying all materials and performing all operations herein described, and all other items incidental to the work included in this Specification.

Items of Work

Fabrication of Standards

- a) Heavy Series Combination - Traffic Signal/Pedestrian Corridor/Luminaire Davit Standards - Type 10.

**MANITOBA HIGHWAYS AND TRANSPORTATION  
TRAFFIC ENGINEERING  
SPECIFICATION FOR CONSTRUCTION OF CAST-IN-PLACE  
CONCRETE PILE FOUNDATIONS**

**1. DESCRIPTION**

This Specification covers all excavation, disposal of surplus and unsuitable material, supply and placement of concrete, site restoration, and other work required for the construction of cast-in-place concrete pile foundations for traffic signal and pedestrian corridor standards.

**2. MATERIALS**

**2.1 Handling and Storage of Materials**

All materials shall be handled and stored in a careful and workmanlike manner, to the satisfaction of the Engineer. Storage of materials shall be in accordance with CSA Standard CAN3-A23.1 "Storage of Materials," except as otherwise specified herein.

**2.2 Testing and Approval**

All materials supplied under this Specification shall be subject to inspection and testing by the Engineer or by the Testing Laboratory designated by the Engineer. There shall be no charge to the Owner for any materials taken by the Engineer for testing purposes.

All materials shall conform to CSA Standard CAN3-A23.1.

All testing of materials shall conform to CSA Standard CAN3-A23.2.

**2.3 Cement**

Cement shall be Type 50, Sulphate-Resistant Cement, conforming to the requirements of CSA Standard CAN3-A5.

**2.4 Supplementary Cementing Materials**

Use of pozzolans, fly ash, or silica fume will not be permitted for use in structural concrete supplied under this Specification.

**2.5 Water**

Water used for mixing concrete shall be clean and free from injurious amounts of oil, acid, alkali, organic matter, or other deleterious substances. It shall be equal to potable water in physical and chemical properties.

**2.6 Aggregates**

If required, the Contractor shall furnish in writing to the Engineer, the location of the sources where aggregate will be obtained, in order that same may be inspected and tentatively approved by the Engineer. Changes in the source of aggregate supply during the course of the Contract will not be permitted without notification in writing to and the expressed approval of the Engineer.

(a) Fine Aggregate

Fine aggregate shall consist of sand having clean, hard, strong, durable, uncoated grains; free from injurious amounts of dust, soft or flaking particles, shale, alkali, organic matter, loam, or other deleterious substances.

Fine aggregate shall be well-graded throughout and shall conform to the following grading requirements:

Gradation of Fine Aggregates	
<u>Canadian Metric Sieve Size</u>	<u>Percent of Total Dry Weight Passing Each Sieve</u>
10,000	100%
5,000	95% - 100%
2,500	80% - 100%
1,250	50% - 90%
630	25% - 65%
315	10% - 35%
160	2% - 10%
80	0% - 3%

(b) Coarse Aggregate (40 mm Nominal)

Coarse aggregate shall conform to the requirements of CAN3-A23.1, Section 5, Aggregates. Coarse aggregate shall be clean and free from alkali, organic, or other deleterious matter, shall have an absorption not exceeding 3 percent, and shall conform to the following gradation requirements:

Gradation of 40 mm Coarse Aggregate	
<u>Canadian Metric Sieve Size</u>	<u>Percent of Total Dry Weight Passing Each Sieve</u>
56,000	100%
40,000	95% - 100%
20,000	30% - 70%
10,000	10% - 30%
5,000	0% - 5%

## **2.7 Admixtures**

No admixtures other than air-entraining agent and water-reducing agent shall be used without the written authorization of the Engineer, unless otherwise specified in these Specifications. It shall be the Contractor's responsibility to ensure that any admixture is compatible with all other constituent materials.

## **2.8 Reinforcing Steel**

Reinforcing steel shall be deemed to include all reinforcing bars, tie-bars, and dowels.

All reinforcing steel shall conform to the requirements of CSA Standard G30.18, Grade 400 W, Billet-Steel Bars for Concrete Reinforcement.

## **2.9 Anchor Bolts, Nuts, and Washers**

Anchor bolts, nuts, and washers will be supplied by the Department and set by the Contractor.

## **2.10 Anchor Bolt Setting Templates**

The top setting template will be loaned to the Contractor by the Department. The bottom setting template shall be fabricated from CSA Grade 300 W and ASTM A53 Grade B, Schedule 40 material.

## **2.11 Hot-Dip Galvanizing**

Hot-dip galvanizing shall be in accordance with CSA G164 to the net retention of 600 g/m<sup>2</sup>.

## **2.12 Conduit**

The conduit shall be 50 mm plastic pipe and shall include all incidentals, including watertight splice connections, where applicable.

## **2.13 Concrete Mix Design**

Proportioning of fine aggregate, coarse aggregate, cement, water, and air entraining agent shall be such as yield concrete having the required strength and workability as follows:

- i) Minimum Compressive Strength at 28 days = 35 MPa
- ii) Maximum Water/Cement Ratio = 0.45
- iii) Minimum Cement Content = 340 kg/m<sup>3</sup>
- iv) Slump = 80 ± 20 mm
- v) Aggregate: 40 mm nominal
- vi) Air Content: 4.0 to 7.0 percent
- vii) Cement - Type 50 Sulphate Resistant Cement

Should compatible superplastizing admixtures be approved by the Engineer, the slump after addition of the superplasticizer shall be 170 ± 40.

## **2.14 Non-shrink Grout**



Grout as specified hereinafter shall be used for the construction of grout pads under heavy-series traffic signal and traffic corridor structure base plates.

Grout pads are not required under light-series traffic signal and pedestrian corridor structure base plates.

Non-shrink grout shall consist of a pre-mixed non-metallic non-shrink grout. Approved products are:

- 1) M-Bed Standard grout by Sternson Ltd.
- 2) CPD Non-shrink grout by Master Builders
- 3) Set Non-shrink grout by Master Buildings
- 4) Caprock VLT Mortar by Cappar Ltd. for cold weather construction (0°C to -20°C)

The grout shall be of a consistency suitable for the application intended, as approved by the Contract Administrator.

### **3. EQUIPMENT**

All equipment shall be of a type approved by the Engineer and shall be kept in good working order.

### **4. CONSTRUCTION METHODS**

#### **4.1 Commencing Work**

The Contractor shall notify the Project Supervisor at least three working days prior to commencing work at any of the locations listed.

#### **4.2 Scheduling of Work**

Construction operations and sequence shall be subject to the approval of the Engineer.

Where services of other Contractors or Agencies are required, in connection with the satisfactory execution of the work, the Contractor shall notify all parties involved.

No extra compensation will be paid to the Contractor for any inconvenience or extra expense incurred as a result of delay by others.

#### **4.3 Traffic Control**

The Contractor shall provide traffic control in accordance with the latest edition of the Department's "Specifications for Traffic Control."

The Department will supply the Contractor with sufficient Sign Stands, Signs, Traffic Cones, and Traffic Vests, in accordance with Level 1 of the Traffic Control Specification. These traffic control devices shall be returned to the Department on completion of the contract. The Contractor shall pay for devices which are not returned or which are considered by the Engineer to be unsuitable for return.

#### **4.4 Location and Alignment of Piles**

Piles shall be placed in the positions shown on the Drawings and as directed by the Engineer in the field.

The deviation of the axis of any finished pile shall not differ by more than 1 percent from the vertical.

Minor deviations from the Drawings may be required in the field where unknown underground obstructions are encountered. The Contractor shall not make any changes without the approval of the Engineer.

#### **4.5 Buried Utilities**

The Contractor shall exercise extreme caution when constructing the pile foundations in the vicinity of existing buried utilities. The Contractor shall be responsible for obtaining the exact location of the buried utilities from the appropriate Utility Authority prior to installing the piles.

The proposed locations of the pile foundations may be changed by the Engineer if they interfere with the buried utilities.

The Contractor shall be responsible for all costs that may be incurred for repair/rectification of any damage caused to the existing buried utilities as a result of the Contractor's operations in constructing cast-in-place concrete piles, as determined by the Engineer.

#### **4.6 Restoration of Adjacent Property**

The restoration of existing concrete sidewalks/medians and curbs, as well as boulevard median, paving stone, or sodding, required as shown on the Drawings, will be incidental to the construction of cast-in-place concrete pile foundations, and no separate payment will be made.

Sidewalk or median concrete paving shall be saw cut at least 300 mm all around from the edge of pile and restored flush with adjacent surface level after the new pile has been installed. A pile isolation joint shall be provided in accordance with Plan No. MISC-3.

During the course of the work, the Contractor shall keep the workplace in a neat and tidy condition, satisfactory to the Engineer. The Contractor shall, upon the completion of the work, remove all temporary structures and clean away all rubbish, surplus, and waste material remaining on or about the workplace, satisfactory to the Engineer.

If these requirements are not met, the Engineer shall give notice requiring the Contractor to remedy the situation. Should the Contractor fail to remedy the situation within 48 hours of receipt of this notice, the Engineer shall cause the situation to be remedied at the expense of the Contractor.

#### **4.7 Excavation**

Excavations for piles shall be made with equipment designed to remove a core of the diameter shown on the Drawings.

Upon reaching the required elevation, the bottom of the bore shall be cleaned and, if called for, belled out to the required dimensions and elevations as shown on the Drawings or as directed by the Engineer in the field.

All excavated material from the piles shall be promptly hauled from the site to an approved disposal area as located by the Contractor.

Upon completion of the belling out and cleaning out of the bottom to the satisfaction of the Engineer, the reinforcement and anchor bolts shall be set in place and the concrete poured immediately. Under no circumstances shall a hole be left to stand open after boring without adequate protection and safety to persons and property.

If any hole is condemned because of caving, it shall be filled with lean-mix concrete and a new hole bored as near as possible to the location shown on the Drawings. Payment will not be made for condemned piles.

#### **4.8 Sleeving**

Timber or steel sleeving shall be used to temporarily line the bore to prevent bulging or caving of the walls and to protect men at work in the bore.

The sleeving shall be designed by the Contractor and constructed to resist all forces that may tend to distort it.

The sleeving shall be withdrawn as the concrete is placed in the bore. The sleeving shall extend at least 1 m below the top of the freshly deposited concrete at all times.

The clearance between the face of the bore hole and the sleeving shall not exceed 75 mm.

#### **4.9 Inspection of Bores**

Concrete shall not be placed in a bore until the bore has been inspected and approved by the Engineer.

The Contractor shall have suitable lights available for the inspection of each bore throughout its entire length.

All improperly set sleeving, bore, bell, or bottom shall be corrected to the satisfaction of the Engineer.

#### **4.10 Placing Reinforcing Steel**

Reinforcement shall be:

- i) placed in accordance with the details shown on the Drawings
- ii) rigidly fastened together, and
- iii) lowered into the bore intact before concrete is placed.

Spacers shall be utilized to properly locate the reinforcing steel cage in the bore.

#### **4.11 Installing Anchor Bolts**

The anchor bolts, nuts, and washers will be supplied by the Department and installed by the Contractor.

The anchor bolts shall be aligned with the setting templates matching the bolt holes in the structure base plate as specified below. The setting templates shall be held in place by the nuts supplied with the anchor bolts.

Placement of anchor bolts without the steel setting templates shall not be permitted.

The setting templates shall be as follows:

#### **Top Setting Template**

- Temporary steel template loaned to the Contractor by the Department.
- After completion of concrete pile foundation works, the Contractor shall clean the template by sandblasting and return it to the Department.
- If the template is damaged during construction due to negligence, the Contractor shall be responsible for supplying a new 10 mm thick steel template to the Department at his own expense.

#### **Bottom Setting Template**

- Permanent hot-dip galvanized steel assembly fabricated from CSA G40.21 Grade 300 W and ASTM A53 Grade B, Schedule 40 pipe material in accordance with the details shown on the Drawings.
- Required only for anchor bolts 51 mm diameter in size.

The threaded portion of the anchor bolts projecting above the concrete surface shall be coated with oil, before the concrete is poured, to minimize the fouling of threads splattered by concrete residue.

The installation of anchor bolts, and supply and installation of setting templates will be considered incidental to the Work of this Specification. The Contractor should include the cost of these items in the construction of concrete pile foundation works.

### **4.12 Installation of Conduits**

The supply and installation of plastic conduits will be considered incidental to the Work of this Specification. The Contractor should include the cost of this item in the construction of concrete pile foundation works.

Four plastic conduits shall be installed in each base as shown on the Drawings. The conduits shall enter 900 mm minimum below ground level and shall protrude through the centre of the concrete base. Conduits installed as spares shall be plugged at each end and protected to ensure future accessibility.

### **4.13 Forms**

The top 600 mm of the piles shall be formed with tubular forms (Sonotube).

The forms shall be sufficiently rigid to prevent lateral or vertical distortions from the loading environment to which they shall be subjected. Forms shall be set to the design grades, lines, and dimensions, as shown on the Drawings.

### **4.14 Placing Concrete**

Care shall be taken to ensure that anchor bolts are vertically aligned and that anchor bolts and conduits are properly positioned prior to placement of concrete.

Concrete shall not have a free fall of more than 1.5 m and shall be placed so that the aggregates will not separate or segregate. The concrete shall be vibrated throughout the entire length of the pile. If vibrating the full length is not possible and if approved by the Engineer, the concrete may be superplasticized as specified and vibrated for the top 1.5 m.

Concrete shall be placed to the elevations as shown on the Drawings.

The shaft and bell shall be free of water prior to placing of concrete. Concrete shall not be placed in or through water unless authorized by the Engineer. In the event that tremie concrete is allowed by the Engineer, the concrete shall be placed as specified herein.

#### **4.15 Tremie Concrete**

The shaft of the pile shall be pumped clear of water so that the bottom can be cleaned. Pumping shall then be stopped and water shall be allowed to come into the bore until a state of equilibrium is reached. Concrete shall then be placed by means of a tremie pipe. The tremie pipe shall have a diameter at least eight times the maximum size of aggregate. The tremie pipe shall have a suitable gate in the bottom to prevent water from entering the pipe. The bottom of the pipe shall be maintained below the surface of the freshly placed concrete. The pipe shall be capable of being raised or lowered quickly in order to control the flow of concrete.

Tremie concrete shall only be poured up to the level directed by the Engineer. Pumps shall then be lowered into the bore and the excess water pumped out. The laitance that forms on top of the tremie shall then be removed and the remainder of the concrete shall be placed in the dry.

#### **4.16 Protection of Newly Placed Concrete**

Freshly placed concrete shall be protected with a tarpaulin or other approved means.

#### **4.17 Curing Concrete**

The top of the freshly finished concrete piles shall be covered and kept moist immediately following finishing operations and shall be maintained at above 10°C for at least three (3) consecutive days thereafter.

Concrete shall be protected from the harmful effects of sunshine, drying winds, surface dripping or running water, vibration, and mechanical shock. Concrete shall be protected from freezing until at least twenty-four hours after the end of the curing period.

Changes in temperature of the concrete shall be uniform and gradual and shall not exceed 3° in one hour or 20° in twenty-four hours.

#### **4.18 Form Removal**

Forms shall not be removed for a period of at least 24 hours after the concrete has been placed. Removal of forms shall be done in a manner to avoid damage to, or spalling of, the concrete.

The minimum strength of concrete in place for safe removal of forms shall be 20 MPa.

#### **4.19 Patching of Formed Surfaces**

Immediately after forms around top of pile have been removed, but before any repairing or surface finishing is started, the concrete surface shall be inspected by the Engineer. Any repair of surface finishing started before this inspection may be rejected and required to be removed.

All formed concrete surfaces shall have bolts, ties, struts, and all other timber or metal parts not specifically required for construction purposes cut back fifty (50) mm from the surface before patching.

#### **4.20 Cold Weather Concreting**

Protection of concrete shall be considered incidental to its placement. The temperature of the concrete shall be maintained at or above 10°C for a minimum of three (3) days or till the concrete has reached a minimum compressive strength of 20 MPa, by whatever means are necessary. Concrete damaged as a result of inadequate protection against weather conditions shall be removed and replaced by the Contractor at his own expense. Concrete allowed to freeze prior to the three (3) days will be rejected.

#### **4.21 Grout Pads**

When directed by the Engineer, the Contractor shall install grout pads between the base plate and pile.

Standards equipped with breakaway safety bases do not require grout pads.

Grout pads shall be installed after the traffic signal and/or pedestrian corridor standards are erected.

The concrete pile foundation shall be sound and all surfaces to be in contact with the grout shall be entirely free of oil, grease, laitance, curing compounds, and other deleterious substances.

The bottom surface of the base plates, which are to be in direct contact with the grout, shall be thoroughly cleaned immediately before grouting.

The surface of concrete pile foundation shall be washed clean, then saturated with water for 24 hours prior to installation of non-shrink grout. The concrete shall be covered with saturated burlap and running a soaker hose or flooding the surface shall be carried out for satisfactory results, as directed by the Engineer.

Grout shall be mixed according to the procedures recommended by the manufacturer. Carefully read all mixing information on the package and the latest literature. If in doubt about mixing procedures, call the manufacturer.

The consistency of the grout will vary with the amount of water added. Use this flexibility. Add the minimum water recommended by the manufacturer before adding the grout.

Forming is not required to place the grout.

The placement of grout shall be rapid and continuous so as to avoid cold joints under the base plate. Grout must not be placed in layers. All grouting should take place from one side to the other to avoid trapping air. The grout shall be packed underneath the base plate, eliminating all voids, and ensuring full contact between the base plate and the grout pad. The top of the grout pad shall be sloped away from the base plate to prevent standing water.

The fresh grout shall be cured using an approved curing compound conforming to CSA Standard CAN3-A23.1.

## **5. QUALITY CONTROL**

All workmanship and all materials furnished and supplied under this Specification are subject to close and systematic inspection and testing by the Engineer, including all operations from the selection and production of materials, through to final acceptance of the Work. The Contractor shall be wholly responsible for the control of all operations incidental thereto notwithstanding any inspection or approval that may have been previously given. The Engineer reserves the right to reject any materials or Works that are not in accordance with the requirements of this Specification.

## **6. METHOD OF MEASUREMENT**

### **6.1 Construction of Cast-in-Place Concrete Pile Foundations**

The construction of cast-in-place concrete pile foundations complete with grout pads will be measured on a unit basis for each type of pile. The number of foundations to be paid for shall be the total number of foundations of each type constructed in accordance with this Specification and accepted by the Engineer.

## **7. BASIS OF PAYMENT**

### **7.1 Construction of Cast-in-Place Concrete Pile Foundations**

The construction of cast-in-place concrete pile foundations will be paid for at the Contract Unit Price per unit for the "Items of Work," listed herebelow, measured as specified herein, which price shall be payment in full for supplying all materials and performing all operations described herein and all other items incidental to the Work included in this Specification.

#### Items of Work

##### Construction of C.I.P. Concrete Pile Foundations

- a) Type F1
- b) Type F2
- c) Type F3
- d) Type F4
- e) Type F5

**MANITOBA HIGHWAYS AND TRANSPORTATION  
TRAFFIC ENGINEERING  
SPECIFICATION FOR CONCRETE PILE FOUNDATION REPAIR WORKS**

**1. DESCRIPTION**

The Work covered under this item shall cover all concreting operations related to concrete pile foundation repair works in accordance with this Specification and as shown on the Drawings.

The Work to be done by the Contractor under this Specification shall include the furnishing of all superintendence, overhead, labour, materials, equipment, tools, supplies, and all things necessary for and incidental to the satisfactory performance and completion of all Works as hereinafter specified.

**2. MATERIALS**

**2.1 General**

The Contractor shall be responsible for the supply, safe storage, and handling of all materials set forth in this Specification.

**2.2 Handling and Storage of Materials**

All materials shall be handled and stored in a careful and workmanlike manner, to the satisfaction of the Engineer. Storage of materials shall be in accordance with CSA Standard CAN3-A23.1, "Storage of Materials," except as otherwise specified herein.

**2.3 Testing and Approval**

All materials supplied under this Specification shall be subject to inspection and testing by the Engineer or by the Testing Laboratory designated by the Engineer. There shall be no charge to the Province for any materials taken by the Engineer for testing purposes.

All materials shall conform to CSA Standard CAN3-A23.1.

All testing of materials shall conform to CSA Standard CAN3-23.2.

**2.4 Cement**

Cement shall be Type 50, Sulphate Resistant Cement, conforming to the requirements of CSA Standard CAN3-A5.

**2.5 Supplementary Cementing Materials**

Use of pozzolans, fly ash, or silica fume will not be permitted for use in structural concrete supplied under this Specification

**2.6 Water**

Water used for mixing concrete shall be clean and free from injurious amounts of oil, acid, alkali, organic matter, or other deleterious substances. It shall be equal to potable water in physical and chemical properties.

**2.7 Aggregate**



The Contractor shall furnish in writing to the Engineer, the location of the sources where aggregate will be obtained, in order that same may be inspected and tentatively approved by the Engineer. Changes in the source of aggregate supply during the course of the Contract will not be permitted without notification in writing to and the expressed approval of the Engineer.

Aggregates for major spalling and/or damage, and construction of pile extensions shall be as follows:

(a) Fine Aggregate

Fine aggregate shall consist of sand having clean, hard, strong, durable, uncoated grains; free from injurious amounts of dust, soft or flaking particles, shale, alkali, organic matter, loam, or other deleterious substances.

Fine aggregate shall be well-graded throughout and shall conform to the following grading requirements:

Gradation of Fine Aggregate	
Canadian Metric <u>Sieve Size</u>	Percent of Total Dry <u>Weight Passing Each Sieve</u>
10,000	100%
5,000	95% - 100%
2,500	80% - 100%
1,250	50% - 90%
630	25% - 65%
315	10% - 35%
160	2% - 10%
80	0% - 3%

(b) Coarse Aggregate (20 mm Nominal)

Standard coarse aggregate shall consist of natural gravel, crushed stone, or other approved materials of similar characteristics, having clean, hard, strong, durable uncoated particles, free from injurious amounts of soft, friable, thin, elongated, or laminated pieces, alkali, organic, or other deleterious matter. Coarse aggregate shall be well graded throughout and shall conform to the grading requirements in the following table.

Gradation of 20 mm Coarse Aggregate	
Canadian Metric <u>Sieve Size</u>	Percent of Total Dry <u>Weight Passing Each Sieve</u>
28,000	100%
20,000	90% - 100%
10,000	25% - 60%
5,000	0% - 10%
2,500	0% - 5%

**2.8 Admixtures**

No admixtures other than air-entraining agent shall be used without the written authorization of the Engineer, unless otherwise specified in these Specifications. It shall be the Contractor's responsibility to ensure that any admixture is compatible with all other constituent materials.

(a) Air-Entraining Agent

The air-entraining agent shall conform to the requirements of CSA Standard CAN3-A266.1 and shall produce a satisfactory air-void system and an air content within the ranges specified in CSA Standard A23.1 for each class of concrete.

(b) Water-Reducing Agent

If the Engineer authorizes the use of a water-reducing agent, it shall be Type WN and shall conform to the requirements of CSA Standard CAN3-A266.2.

(c) Superplasticizing Agent

If the Engineer authorizes the use of a superplasticizing agent, the superplasticizing agent shall conform to the requirements of CSA Standard CAN3-A266.5 and CAN3-A266.6. The agent shall be free of chlorides and shall not affect the air-entraining agent's ability to produce a satisfactory air-void system.

(d) Other Admixtures

No other admixtures will be authorized for use in Portland Cement Concrete, unless authorized in writing by the Engineer.

## **2.9 Latex Bonding Agent**

Latex bonding agent shall be ACRL-STIX or SCP Concrete Bonding Agent, as supplied by Specialty Construction Products, or equal as approved by the Engineer.

## **2.10 Flexible Joint Sealant**

Flexible joint sealant for all horizontal, vertical, and sloping joints shall be guaranteed non-staining grey polyurethane, approved by the Engineer, and applied in strict accordance with the manufacturer's instructions, including appropriate primers.

Approved products are Vulkum 116 by Mameco; Sonolastic NP1 by Sonneborne; RC-1 by Permapol; and Sikaflex by Sika; or equal as approved by the Engineer.

## **2.11 Fibre Joint Filler**

Fibre joint filler shall be rotproof and of the preformed, non-extruding type, made with a bituminous fibre, such as "Flexcell," and shall conform to the requirements of ASTM, Standard D1751 or equal as approved by the Engineer.

## **2.12 Cement Slurry Bonding Grout**

Cement slurry bonding grout shall be a mixture of 1 part cement and 1 part sand, mixed with enough water and latex bonding agent (mixed in equal parts) to allow the slurry mixture to be brushed onto existing concrete surfaces.

## **2.13 Non-shrink Grout**

Grout as specified hereinafter shall be used for the grouting of all reinforcing steel dowels and for the construction of grout pads under base plates where required.

Non-shrink grout shall consist of a pre-mixed non-metallic non-shrink grout. Approved products are:

- 1) M-Bed Standard grout by Sternson Ltd.
- 2) CPD Non-shrink grout by Master Builders
- 3) Set Non-shrink grout by Master Buildings
- 4) Caprock VLT Mortar by Cappar Ltd. for cold weather construction (0°C to -20°C)

The grout shall be of a consistency suitable for the application intended, as approved by the Engineer.

#### **2.14 Concrete Cure and Protection System**

Concrete cure and protection system shall be Horsey Set WDE (water-dispersed epoxy), made by Watson Bowman Acme, as supplied by G.D. Johnston Ltd., or equal as approved by the Engineer.

#### **2.15 Reinforcing Steel**

Reinforcing steel shall be deemed to include all reinforcing bars, tie-bars, and dowels.

All reinforcing steel shall conform to the requirements of CSA Standard G30.18, Grade 400W, Billet-Steel Bars for Concrete Reinforcement.

#### **2.16 Anchor Bolt Extension and Accessories**

Anchor bolt extensions, nuts, washers, and lock washers shall be in accordance with CSA G40.21 Grade 300W hot-dip galvanized and shall match the size of existing anchor bolts. Each extension shall come with two heavy hex nuts, two heavy washers, and one lock hex nut in accordance with Drawing AB2.

Couplings shall be hot-dip galvanized conforming to ASTM A108 CDT 1045 steel, (High Tensile Steel). Couplings shall be stop-type to assure exact engagement of bolts on both ends and threads shall fit existing anchor bolts. An approved product is Williams C2T coupling.

Existing anchor bolts shall be field measured by the Contractor prior to ordering couplings and extensions to ensure a proper fit.

#### **2.17 Miscellaneous Materials**

Miscellaneous materials shall be of the type specified on the Drawings or approved by the Engineer.

### **3.0 CONCRETE MIX DESIGN**

#### **3.1 General**

The concrete for construction of pile extensions or repairs shall be batched at a concrete batch plant.

The concrete shall achieve a minimum compressive strength of 20 MPa at three days before the traffic signal structure is reinstalled and a minimum compressive strength of 35 MPa at 28 days.

### **3.2 Concrete Requirements for Ready-Mix Batching**

Proportioning of fine aggregate, coarse aggregate, cement, water, and air entraining agent shall be such as to yield concrete having the required strength and workability as follows:

- i) Minimum Compressive Strength at 28 days = 35 MPa
- ii) Maximum Water/Cement Ratio = 0.45
- iii) Minimum Cement Content = 360 kg/m<sup>3</sup>
- iv) Slump = 80 mm ± 30 mm
- v) Aggregate: 20 mm nominal standard aggregate
- vi) Air Content: 5.0 to 8.0 percent for both fresh concrete and the hardened concrete
- vii) Cement - Type 50 sulphate resistant

### **4.0 EQUIPMENT**

All equipment shall be of a type approved by the Engineer and shall be kept in good working order.

### **5.0 CONSTRUCTION METHODS**

The following repair works related to existing concrete pile foundations at designated traffic signal structure sites are covered under this Specification.

- a) Construction of pile extensions.
- b) Repair of major spalling and/or damage.

The Contractor should include the cost of removing and restoring the existing concrete/asphalt sidewalk paving or sodding or soil surface, as required, in the total cost of the respective repairs as no separate payment will be made for this Work.

The Contractor is advised that the removal, temporary storage, and reinstallation of the existing traffic signal structures, including related electrical work will be done by the Department of Highways forces unless otherwise specified.

### **5.2 Concrete Removals for Pile Extensions or Repairs**

Generally, the Work involves the removal of designated grout pads and deteriorated concrete from the top of piles down to sound concrete. The minimum concrete removal shall be 300 mm for piles requiring repairs and 25 mm for piles requiring extensions. The areas requiring removal shall be as marked in the field by the Engineer. The details shown on the Drawings do not necessarily represent the exact size of the required repairs. The perimeter of all concrete identified for removal shall be saw-cut a minimum of 20 mm after removal to sound concrete is complete.

### **5.3 Installing Reinforcing Steel into Existing Concrete**

Dowels which are to be anchored into existing concrete shall be installed in pre-drilled holes, as shown on the Drawings and grouted in place to the correct grade and alignment. Coring of holes will not be permitted. In the event that existing reinforcing steel bars are hit during the drilling operations, that hole shall be abandoned and a new hole shall be drilled nearby to the correct depth. All abandoned holes shall be filled with non-shrink grout.

All holes shall be thoroughly cleaned prior to installation of dowel bars.

Care shall be taken not to disturb until the grout has set properly. Any dowels which are found to be loose shall be removed and reinstalled properly to the satisfaction of the Engineer. After the Engineer has approved the installation of the dowels, the reinforcing steel shall be placed to clearances as shown on the Drawings and shall be positively tied at all intersections.

#### **5.4 Placing Concrete**

The Engineer must be notified at least 24 hours prior to concrete placing so that an adequate inspection may be made of formwork, shoring, reinforcement and related works. Placement without required prior notification will not be allowed.

Equipment for mixing or conveying concrete shall be thoroughly flushed with clean water before and after each pour. Water used for this purpose shall be discharged outside the forms.

Concrete shall be conveyed from the mixer to the place of final deposit by methods that will prevent segregation and a marked change in consistency.

Tubular forms for concrete placement shall be sufficiently rigid to prevent lateral or vertical distortions from the loading environment to which they shall be subjected. Forms shall be set to the design grades, lines, and dimensions, as required. Care shall be taken to ensure that anchor bolts and extensions are vertically aligned. The anchor bolt extensions shall be aligned with a template matching the bolt holes in the existing base plate. The setting template shall be held in place by the top and bottom nuts of the anchor bolts. Size of conduit extensions shall match the existing conduits.

The threaded portion of the anchor bolts shall be coated with oil before the concrete is poured, to minimize the fouling of threads splattered by concrete residue.

All concrete, during and immediately after deposition, shall be consolidated by mechanical vibrations so that the concrete is thoroughly worked around the reinforcement, around embedded items, and into the corners of forms; eliminating all air or stone pockets that may cause honeycombing, pitting, or planes of weakness.

Floating shall begin when the water sheen has disappeared. The top surface of the pile shall then be consolidated with hand floats. Concrete surfaces after floating shall have a uniform, smooth, granular texture and shall be perfectly level.

#### **5.5 Protection of Newly Placed Concrete**

Newly placed concrete threatened with damage by rain, snow, fog or mist shall be protected with a tarpaulin or other approved means.

#### **5.6 Concrete Curing**

Freshly finished concrete shall be covered and kept moist by means of wet polyester blankets immediately following finishing operations and shall be maintained at above 10°C for at least three (3) consecutive days thereafter.

After the finishing is completed, the surface shall be covered with a minimum of a single layer of clean, damp polyester blanket.

Concrete shall be protected from the harmful effects of sunshine, drying winds, surface dripping, or running water, vibration, and mechanical shock. Concrete shall be protected from freezing until at least twenty-four hours after the end of the curing period.

Changes in temperature of the concrete shall be uniform and gradual and shall not exceed 3° in one hour or 20° in twenty-four hours.

Immediately after stripping and patching, formed surfaces shall receive an application of the approved concrete cure and protection system in accordance with the manufacturer's instructions.

### **5.7 Form Removal**

Forms shall not be removed for a period of at least 24 hours after the concrete has been placed. Removal of forms shall be done in a manner to avoid damage to, or spalling of, the concrete.

The minimum strength of concrete in place for safe removal of forms shall be 20 MPa.

Field-cured test specimens, representative of the in-place concrete being stripped will be tested, to verify the concrete strength.

### **5.8 Patching of Formed Surfaces**

Immediately after forms have been removed, but before any repairing or surface finishing is started, the concrete surface shall be inspected by the Engineer. Any repair of surface finishing started before this inspection may be rejected and required to be removed.

All formed concrete surfaces shall have bolts, ties, struts, and all other timber or metal parts not specifically required for construction purposes cut back fifty (50) mm from the surface before patching.

Minor surface defects caused by honeycomb, air pockets greater than 5 mm in diameter, and voids left by strutting, and tie holes shall be repaired by removing the defective concrete to sound concrete, dampening the area to be patched and then applying patching mortar. A slurry grout consisting of water and cement, shall be well-brushed onto the area to be patched. When the slurry grout begins to lose the water sheen, the patching mortar shall be applied. It shall be struck-off slightly higher than the surface and left for one hour before final finishing to permit initial shrinkage of the patching mortar and it shall be touched up until it is satisfactory to the Engineer. The patch shall be cured as specified in this Specification, and the final colour shall match the surrounding concrete.

### **5.9 Cold Weather Concreting**

Protection of concrete shall be considered incidental to its placement. The temperature of the concrete shall be maintained at or above 10°C for a minimum of three (3) days or till the concrete has reached a minimum compressive strength of 20 MPa, by whatever means are necessary. Concrete damaged as a result of inadequate protection against weather conditions shall be removed and replaced by the Contractor at his own expense. Also, concrete allowed to freeze prior to the three (3) days will not be accepted for payment.

### **5.10 Restoration of Adjacent Property**

Restoration of concrete or asphalt sidewalk/median paving, or sodding or ground, adjacent to existing concrete piles, shall not be carried out until the Engineer has accepted the concrete pile foundation repair work. Backfill material under concrete paving shall be compacted to minimum 95 percent Standard Proctor Dry Density.

### **5.11 Reinstallation of Traffic Signal Structures**

The traffic signal structures will be reinstalled by Department of Highways forces unless otherwise specified. The concrete repairs/extensions shall cure a minimum of three (3) days as approved by the Engineer prior to reinstallation of the traffic signal structures.

## **5.12 Grout Pads**

Standards equipped with breakaway safety bases do not require grout pads.

Grout pads shall be constructed under the heavy series traffic signal and/or pedestrian corridor standards.

Non-shrink grout as specified shall be mixed in accordance with the manufacturer's instructions. The grout shall be packed underneath the base plate, eliminating all voids, and ensuring full contact between the base plate and the grout pad. The top of the grout pad shall be sloped away from the base plate to prevent standing water.

The fresh grout shall be cured using an approved curing compound conforming to CSA Standard CAN3-A23.1.

## **6. QUALITY CONTROL**

All workmanship and all materials furnished and supplied under this Specification are subject to close and systematic inspection and testing by the Engineer, including all operations from the selection and production of materials, through to final acceptance of the Work. The Contractor shall be wholly responsible for the control of all operations incidental thereto notwithstanding any inspection or approval that may have been previously given. The Engineer reserves the right to reject any materials or Works that are not in accordance with the requirements of this Specification.

The Contractor shall be responsible for making a thorough inspection of materials to be supplied under this Contract. All material shall be free of surface imperfections and other defects.

## **7.0 METHOD OF MEASUREMENT**

### **7.1 Construction of Concrete Pile Extensions**

The construction of concrete pile extensions will be measured on a unit basis. The units to be paid for shall be the total number of pile extensions constructed in accordance with this Specification and accepted by the Engineer, as computed from measurements made by the Engineer.

### **7.2 Repair of Concrete Pile Foundations**

The repair of concrete pile foundations will be measured on a unit basis. The units to be paid for shall be the total number of pile foundations repaired in accordance with this Specification and accepted by the Engineer, as computed from measurements made by the Engineer.

## **8.0 BASIS OF PAYMENT**

### **8.1 Construction of Concrete Pile Extensions**

The construction of concrete pile extensions will be paid for at the Contract Unit Price per unit for "Construction of Concrete Pile Extensions," measured as specified herein, which price shall be payment in full for supplying all materials and performing all operations described herein and all other items incidental to the Work included in this Specification.

## **8.2 Repair of Concrete Pile Foundations**

The repair of concrete pile foundations will be paid for at the Contract Unit Price per unit for “Repair of Concrete Pile Foundations,” measured as specified herein, which price shall be payment in full for supplying all materials and performing all operations described herein and all other items incidental to the Work included in this Specification.