

PART E
SPECIFICATIONS

PART E - SPECIFICATIONS

GENERAL

E1. APPLICABLE SPECIFICATIONS, STANDARD DETAILS AND DRAWINGS

E1.1 *The City of Winnipeg Standard Construction Specifications* in its entirety, whether or not specifically listed on Form B: Prices, shall apply to the Work.

E1.1.1 *The City of Winnipeg Standard Construction Specifications* is available in Adobe Acrobat (.pdf) format on the Information Connection page at The City of Winnipeg, Corporate Finance, Materials Management Division internet site at <http://www.winnipeg.ca/matmgt>.

E1.1.2 The version in effect three (3) Business Days before the Submission Deadline shall apply.

E1.1.3 Further to GC:2.4(d), Specifications included in the Bid Opportunity shall govern over *The City of Winnipeg Standard Construction Specifications*.

E1.2 The following Drawings are applicable to the Work:

<u>Drawing No.</u>	<u>Drawing</u>
OHSS-04-01	Cover Sheet
OHSS-04-02	Site Locations
OHSS-04-03	Description of Works
OHSS-04-04	Miscellaneous Details, Sheet 1 of 3
OHSS-04-05	Miscellaneous Details, Sheet 2 of 3
OHSS-04-06	Miscellaneous Details, Sheet 3 of 3
OHSS-04-07	New Cantilever Sign Structure Fabrication Details

E2. REFURBISHMENT OF STEEL OVERHEAD SIGN SUPPORT STRUCTURES

E2.1 Description

The Work covered under this item shall include all operations related to the refurbishment of existing steel overhead sign support structures at various locations throughout the City of Winnipeg, 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 supply of all materials, and the furnishing of all superintendence, overhead, labour, equipment, tools, supplies and all other things necessary for and incidental to the satisfactory performance and completion of all Work as hereinafter specified.

E2.2 Materials

E2.2.1 General

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

E2.2.2 Handling and Storage of Materials

All materials shall be handled in a careful and workmanlike manner, to the satisfaction of the Contract Administrator. Storage of materials shall be in accordance with the requirements of CSA Standard CAN3 A23.1.8, "Storage of Materials," except as otherwise specified herein.

E2.2.3 Structural Steel

Structural steel shall be in accordance with CSA G40.21 Grade 300W or Grade 350W as indicated on the Drawings.

E2.2.4 Flange Bolts, Nuts, and Washers

All sign support structures being refurbished shall be provided with new flange bolts, nuts, and washers in accordance with ASTM A325 hot-dip galvanized.

E2.2.5 Nuts and Washers for Existing Anchor Bolts

All existing anchor bolts for refurbished sign support structures shall be provided with new nuts and washers in accordance with CSA G40.21 Grade 300W hot-dip galvanized.

E2.2.6 Fasteners for Existing Sign Mounting Brackets

All existing sign mounting brackets being refurbished shall be provided with new fasteners in accordance with ASTM A276 Type 316 stainless steel.

E2.2.7 Hardware for Handhole Covers

Hardware for new handhole covers shall be in accordance with ASTM A276 Type 316 stainless steel. Anti-tamper cup washers shall be fabricated in accordance with CSA G40.21 Grade 300W hot-dip galvanized.

E2.2.8 Electrical Couplings

The couplings shall be 25 mm diameter, 14 kN electrical half couplings made from ASTM A53 Schedule 40 steel pipe.

E2.2.9 Hot-Dip Galvanizing

All hot-dip galvanizing shall be in accordance with CSA G164 for a minimum net retention of 600 g/m².

E2.2.10 Galvanizing Touch-up and Field-Applied Galvanizing

Field-applied galvanizing, to touch-up damaged hot-dip galvanizing on-site and to galvanize field welds, 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. For anchor bolts, a zinc-rich cold galvanizing compound, with 97 percent pure zinc, shall be used. An approved product is SPRAYON, Manufactured by SPRAYON Products, Bedford Heights, Ohio.

E2.2.11 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 Contract Administrator for his approval at least two (2) days prior to the scheduled commencement of any fabrication.

E2.2.12 Non-Shrink Grout

Grout for construction of grout pads under sign structure base plates 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 Builders
- 4) Caprock VLT Mortar by Cappar Ltd. for cold weather construction (0° to -20°C)

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

E2.2.13 Concrete Corrosion Inhibitor Protection System

Concrete corrosion inhibitor protection system for exposed surface of existing concrete pile foundations shall be MCI 2020 by Cortec Corporation, or equal as approved by the Contract Administrator.

E2.2.14 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.

E2.3 Equipment

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

E2.4 Construction Methods

E2.4.1 Full Refurbishment

The full refurbishment of existing steel overhead sign support structures involves the following works. The Contractor should include the cost of all items required for the full refurbishment in the total lump sum price for each structure per site as no separate payment will be made for individual items.

- a) Traffic control at each site.
- b) Removal of existing steel overhead sign support structures, including removal of sign panels and/or internally illuminated sign boxes. All components shall be properly labelled and numbered.
- c) Temporary removal and immediate reinstallation of any existing aluminium traffic barrier rail components (adjacent to the sign structures), which may be necessary to facilitate the removal of the structures. Reinstallation of traffic barrier rail components shall be carried out with new stainless steel fasteners.
- d) Supply, installation, and maintenance of a barricade over the concrete pile foundation at each site, while the structure is in the shop for refurbishment. Barricades shall be approximately 1.0 m high x 1.5 m long and shall be placed so that pedestrian and vehicle traffic is not affected.
- e) Transportation of sign structures, including all existing steel sign mounting brackets to the Contractor's fabrication shop.
- f) Delivery of sign panels to the City of Winnipeg Traffic Services Branch, at 421 Osborne Street, for refurbishment. Contact Mr. Jean Belair (986-5840) to arrange a suitable delivery time.

- g) Delivery of sign boxes and existing light fixtures to the City of Winnipeg Traffic Signals Branch at 821 Elgin Avenue, for refurbishment. Contact Mr. Bob Chochinov (986-4198) to arrange a suitable delivery time.
- h) Surface preparation and cleaning of sign structures and existing sign mounting brackets.
- i) Provision of a sign structure identification number.
- j) Supply and installation of electrical couplings for only those sign structures where power supply will be maintained.
- k) Field plug welding and grinding to fill existing tapped holes at bases of vertical members and other locations as directed by the Contract Administrator.
- l) All sign structures taken to the shop shall be provided with new hot-dip galvanized handhole covers complete with stainless steel hardware.
- m) Hot-dip galvanizing of sign structures.
- n) Concrete pile foundation refurbishment.
- o) Pick-up refurbished sign panels from Traffic Services and refurbished sign boxes from Traffic Signals, and reinstallation of same on refurbished sign structures. Note that new sign plates may replace illuminated sign boxes at structures to be de-energized.
- p) At designated sign structures indicated on the Drawings, electrical work involving new wiring in refurbished sign structures will be carried out by Traffic Signals in the Contractor's yard. After hot-dip galvanizing, the Contractor shall store the structures individually in the yard (i.e., according to Structure Identification Number) on wood blocking at least 300 mm above the ground surface to facilitate the electrical work. All snow, etc. on the sign structures shall be cleaned by the Contractor, when required by Traffic Signals to do the electrical work.
- q) Reinstallation of refurbished sign structures, complete with refurbished sign panels/boxes and new wiring. Reinstallation shall be coordinated with Traffic Signals, who will do the electrical work in the field at designated sign structure locations shown on the Drawings.
- r) Construction of new grout pads under all sign structure bases.

E2.4.2 Additional Repair Work or Miscellaneous Works

In addition to Works included in the full refurbishment of all sign structures, the following repair work or miscellaneous works shall be carried out for designated sign structures as indicated on the Drawings and as directed by the Contract Administrator in writing during the construction:

- a) Structural steel repairs by welding.
- b) Repair of defective welds.
- c) Vertical member butt splice repair, complete with new base plate, as shown on the Drawings, or replacement of vertical member in lieu of a butt splice repair.

- d) Vertical member sleeve repair as shown on the Drawings.
- e) Vertical member modification as shown on the Drawings.
- f) Removal and disposal of existing overhead sign support structures.
- g) Removal of existing overhead sign support structures to storage.
- h) Structural modifications of existing overhead sign support structures.
- i) Construction of concrete pile extensions (see E3.).
- j) Repair of major spalling and/or damage at the top of existing concrete piles (see E3.).
- k) Abandoning of existing concrete pile foundations and site restoration including extension of underground conduit from the existing foundation to the new foundation where indicated on the Drawings (see E3.).

E2.4.3 Work by City of Winnipeg Traffic Services and Traffic Signals

The City of Winnipeg Traffic Services and Traffic Signals Branches will also be carrying out other work related to the refurbishment of overhead sign support structures. This work may coincide with the Contractor's execution of the Work, and it will be the Contractor's responsibility to cooperate to the fullest extent with City staff. In addition to the Contract Administrator, the following persons may be contacted by the Contractor for scheduling and coordinating this work:

Traffic Services - Mr. Jean Belair, Phone: 986-5840
Traffic Signals - Mr. Bob Chochinov, Phone: 986-4198

Work by Traffic Services Branch will include the following:

- a) Supply and installation of temporary sign posts as required.
- b) Refurbishment of sign panels, including the supply and installation of new aluminum tee brackets.
- c) Supply of lexan facing material to Traffic Signals for refurbishment of sign boxes.
- d) Supply of new sign plates at location to be de-energized.

The Traffic Signals Branch will carry out the following electrical work:

- a) Temporarily disconnect the power supply to each sign structure site, including taping and safe protection of exposed wiring protruding from the pile foundations after the structure has been removed by the Contractor.
- b) Permanently de-energize the power supply to the sign structures at designated locations.
- c) Refurbishment of sign boxes, including overhaul of electrical components as required and installation of new lexan facing material.

- d) Supply and installation of new wiring in refurbished sign structures, including light fixtures on sign panels. This work will be done in the Contractor's yard. Note new wiring will not be provided for structures at locations to be de-energized.
- e) Supply and installation of new ground rods at the sign structure locations as required.
- f) Reconnecting the wiring after the structures are reinstalled by the Contractor, including new wiring from the sign structure base to the power source as required.
- g) Re-energizing the electrical power supply to the sign structures at designated locations.

E2.4.4 Removal of Sign Support Structures

The existing sign support structures shall be removed on a Sunday, unless otherwise permitted by the Contract Administrator.

Prior to dismantling a sign structure, the Contractor shall identify to the Contract Administrator any damaged or missing components and hardware or any other discrepancies and damage not indicated on the Drawings.

The Contractor shall remove the existing sign support structures carefully without damaging the existing anchor bolts and adjacent property. The horizontal and vertical support members shall be dismantled and placed on timber blocking on a flat-bed truck and transported to the shop. All existing wiring inside the members shall be removed.

E2.4.5 Removal of Internally Illuminated Sign Boxes

The Contractor shall remove the existing internally illuminated sign boxes and components and deliver them to City of Winnipeg Traffic Signals. All sign boxes shall be properly tagged with the respective structure identification number.

Existing sign mounting brackets for the sign boxes shall be removed, cleaned, and hot-dip galvanized at the Contractor's shop.

Any damage to the sign boxes that has not been identified as existing prior to removal shall be repaired by Traffic Signals at the Contractor's expense.

E2.4.6 Removal of Sign Panels for Refurbishment

The Contractor shall remove the existing sign panels and deliver all components to City of Winnipeg Traffic Services. The existing light fixtures and conduits shall be removed and delivered to Traffic Signals.

The existing steel sign mounting brackets for the sign panels shall be removed and taken to the Contractor's shop for hot-dip galvanizing.

Any damage to the sign panels that has not been identified prior to removal will be repaired by Traffic Services at the Contractor's expense.

E2.4.7 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 10 "Near White Metal Blast

Cleaning." The Contractor shall ensure that all exterior and interior surfaces of vertical support members of sign structures are blast cleaned, as specified, prior to pickling to achieve the minimum zinc coating mass of 600 g/m².

The sandblasting and cleaning of sign structures shall be done in the shop.

After the sign structures have been sandblasted and cleaned, the Contract Administrator will carry out a visual inspection of the structures in the shop. If no structural steel repairs or vertical member modifications are required, the Contractor shall transport the structures to the galvanizing plant.

Structural steel repair materials including vertical member butt splices, sleeve repairs, modifications or replacement members, shall also have surface preparation as noted above before hot-dip galvanizing.

E2.4.8 Vertical Member Butt Splice Repairs, Sleeve Repairs, or Modifications

(a) General

Butt splice repairs, sleeve repairs, and vertical member modifications shall be carried out on sign structures listed for such repairs in the Description of Works on the Drawings and in accordance with the details shown for such work on the Drawings, or as otherwise directed by the Contract Administrator.

In lieu of providing a butt splice or sleeve repair, the Contractor has the option of replacing the entire vertical member. Replacement vertical members shall be detailed to match the existing member, complete with any modifications as shown on the butt splice or sleeve repair details. Replacement vertical members shall be paid for as a butt splice repair or sleeve repair as applicable.

(b) Shop Drawings

If the Contractor proposes to use fabrication details for structural steel repair work that are different from the Contract Drawings, Shop Drawings shall be provided to the Contract Administrator for approval at least seven (7) days prior to scheduled commencement of fabrication.

The Shop Drawings shall indicate all necessary dimensions for fabrication and installation as well as shop welding and field welding requirements for the steel sign structures.

The Contractor is advised that this is a metric project. All dimensions and member sizes shall be shown in metric units (SI) on the Shop Drawings. Any Shop Drawings that do not conform with this requirement will be rejected.

E2.4.9 Welding

Welding of steel structures shall be in accordance with CSA W59.

All seams shall be continuously welded and free from any slag and splatter. Longitudinal welds shall be a minimum of 60% penetration, except those within 300 mm of baseplates, flanges, 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 top of the horizontal members.

All welds shall be ground smooth and flush with the adjacent surface.

E2.4.10 Structural Steel Repairs and Modifications by Welding

Structural steel repairs at dents and punctures in the posts of overhead sign support structures shall be carried out by shop welding unless otherwise directed by the Contract Administrator.

The use of existing overhead sign support structures currently in storage will be as follows: Sign structures shall be picked up at the specified yard. Cut members to meet required lengths. Refurbish structures. Add base plate and flange plate to vertical post. Add flange plate to horizontal arm. Addition of base plates and flange plates shall be in accordance with details shown on the Drawings. The base plate and bolt pattern of the vertical post shall be such that they fit the existing bolt pattern at the site. The Contractor shall notify the Contract Administrator if any discrepancies are encountered with the existing structures in storage to be modified for installing on existing anchor bolts.

The Contract Administrator will carry out a visual inspection of each sign structure after it is sandblasted and mark the limits of repair work at damaged areas. The repairs shall be carried out in accordance with the details shown on the Drawings. No repair work shall be carried out unless authorized in writing by the Contract Administrator.

All sharp edges on welds and patching plates shall be removed by grinding before final sandblasting at the repaired areas and shipping the structure for hot-dip galvanizing. All structural steel repair work must be accepted by the Contract Administrator prior to hot-dip galvanizing.

Field plug welding and grinding to fill existing tapped holes at bases of vertical members and other locations as directed by the Contract Administrator will be incidental to full refurbishment and no additional payment will be made.

E2.4.11 Repair of Defective Welds

All existing welds shall be visually inspected by the Contract Administrator.

Defective welds, as revealed by shop inspections, shall be corrected by removing and replacing the entire weld. The defective welds shall be removed by chipping or machining, oxygen cutting shall not be used. Before rewelding, the joint shall be inspected by the Contract Administrator to assure that all of the defective welds have been removed. The new welds shall be sized to match existing.

Superficial weld defects at non-critical locations may be repaired by grinding or beading the weld as required and as approved by the Contract Administrator.

Repair of defective welds shall be considered incidental to refurbishment of the steel overhead sign structure with no additional payment except for those welds within 200 mm of base plates, flange connections, and circumferential butt welds for which payment will be made.

E2.4.12 Sign Structure Identification Number

Each sign structure taken to the shop shall be provided with a "raised" structure identification number with a welding electrode in accordance with the details shown on the Drawings. The sign structure identification number shall be placed before hot-dip galvanizing. Provision of the structure identification number will be incidental to the Work of this Specification.

E2.4.13 Electrical Coupling

A 25 mm 14 kN half coupling shall be installed on the vertical support and in the back of the horizontal support in the middle of each sign box location of each sign structure in accordance with details shown on the Drawings. This will only be required where the power supply will be maintained. The holes for the couplings shall be provided by drilling and not by burning. Coupling holes shall be free of burrs and rough edges. All other unused holes shall be filled by plug welding and ground smooth.

The couplings shall be rethreaded after the sign structure has been hot-dip galvanized.

E2.4.14 Handhole Cover

All sign structures being refurbished shall be provided with new hot-dip galvanized handhole covers, complete with stainless steel hardware in accordance with the details shown on the Drawings.

E2.4.15 Hot-Dip Galvanizing

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

All outside surfaces of the overhead sign support structures, as well as the interior surfaces of all vertical support members of the overhead sign support structures, shall be hot-dip galvanized in accordance with the requirements of this Specification.

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

The galvanizing coating on outside surfaces of overhead sign support 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 reinstalled.

Minor defects in the galvanizing coating shall be repaired in accordance with the next section "Field-Applied Touch-up Galvanizing" of this Specification. The Contract

Administrator 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.

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

E2.4.16 Field-Applied Touch-up Galvanizing

Any areas of damaged galvanizing on the sign support structures are to receive field-applied 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. Field-applied 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 heat surfaces beyond 400°C and to not apply direct flame to the alloy rods.

E2.4.17 Concrete Pile Foundation Refurbishment

Refurbishment of existing concrete pile foundations shall be carried out at all site locations where the sign structures have been removed for refurbishment.

Pile refurbishment shall be carried out in accordance with the details shown on the Drawings and as specified herein.

The existing anchor bolts shall be thoroughly cleaned by sandblasting and completely coated with two coats of the approved zinc-rich cold galvanizing compound. After installation of the anchor bolt nuts, the anchor bolts shall be coated a third time.

Pile foundation refurbishment will be considered incidental to the sign structure refurbishment works, and no separate payment will be made.

E2.4.18 Concrete Pile Foundation Repairs

Prior to reinstallation of the refurbished sign structure, concrete pile foundation repairs shall be carried out in accordance with E3., "Concrete Pile Foundation Repairs Works," or new pile foundation construction shall be carried out in accordance with E5., "New Cast-in-place Concrete Pile Foundation," as shown on the Drawings, and as directed by the Contract Administrator.

E2.4.19 Re-installation of Refurbished Sign Support Structures

The refurbished sign support structures shall be reinstalled on a Sunday unless otherwise permitted by the Contract Administrator. The refurbished structures shall be lifted and

secured with nylon ropes or other approved methods. Use of steel chains and steel hooks against hot-dip galvanized surfaces will not be permitted. The structures shall be placed on timber blocking during their transportation to the site.

Each existing anchor bolt shall be provided with two new galvanized nuts and washers; one nut and washer below the base plate for levelling the structure, and one nut and washer above the base plate for anchoring the structure. The anchor bolts shall have a projection of 25 mm above the anchoring nuts. There shall be provision for 50 mm thick grout pad under the base plate. Half thickness levelling nuts may be used for existing anchor bolts where it is not possible to achieve the minimum specified projection above the anchoring nut.

The horizontal and vertical members of the refurbished sign support structures shall be connected with new galvanized steel high strength structural bolts.

The provision of new anchor bolt nuts, new flange bolts, and sign bracket connection bolts, etc. will be incidental to sign structure refurbishment works.

The Contractor shall ensure that the anchoring nuts of the anchor bolts and bolted connections are tightened according to the "turn-of-nut" method of the AASHTO Code.

The Contractor shall coordinate the reinstallation of refurbished sign structures with Traffic Signals who will carry out the field electrical work.

E2.4.20 Reinstallation of Sign Panels/Boxes/Plates

The Contractor shall be responsible for picking up and reinstalling the sign panels, sign boxes, and sign plates.

E2.4.21 Grout Pads

New grout pads shall be constructed under sign structure bases incidental to sign structure refurbishment works.

E2.4.22 Removal and Disposal of Existing Overhead Sign Support Structures

The location of existing overhead sign support structures designated for disposal will be indicated on the Drawings. Such structures could either be currently in service and located at the site or they could be out of service and in storage at the bridge yards.

The existing sign support structures currently in service shall be removed on a Sunday, unless otherwise permitted by the Contract Administrator. If the structures are currently in storage, the Contractor shall give at least 48 hours notice to the Contract Administrator to make arrangements with the City Bridge Inspector for access to the storage yard.

The Contractor shall remove the existing sign support structures carefully without damaging the existing anchor bolts and adjacent property. The Contractor shall remove the existing internally illuminated sign boxes, complete with the sign mounting brackets and components and deliver them to City of Winnipeg Traffic Signals. All sign boxes shall be properly tagged with the respective structure identification number.

The Contractor shall transport the structures to the disposal facility and sell the material for scrap.

Under no circumstances will the Contractor be permitted to reuse the material from structures designated for disposal into any City of Winnipeg project.

The Contractor will be required to reimburse the City of Winnipeg by crediting the Contract for any scrap value of the disposed material.

E2.4.23 Removal of Existing Overhead Sign Support Structures to Storage

The location of existing overhead sign support structures designated for storage will be indicated on the Drawings. Such structures are currently in service and located at the site.

The existing sign support structures currently in service shall be removed on a Sunday, unless otherwise permitted by the Contract Administrator. All structures designated for storage shall be transported to the City Bridge Yard (849 Ravelston Avenue West), or the City Traffic Signals Yard (821 Elgin Avenue), as indicated on the Drawings during normal weekday working hours. The Contractor shall give at least 48 hours notice to the Contract Administrator to make arrangements for access to the respective storage yard. The structure components shall be placed on suitable timber blocking, supplied by the Contractor, at a location designated by the City representative of the respective storage yard.

The Contractor shall remove the existing sign support structures carefully without damaging the existing anchor bolts and adjacent property. The Contractor shall remove the existing internally illuminated sign boxes, complete with the sign mounting brackets and components and deliver them to City of Winnipeg Traffic Signals Branch. All sign boxes shall be properly tagged with the respective structure identification number.

E2.4.24 Structural Modifications of Existing Overhead Sign Support Structures

Structural modifications to existing overhead sign support structures shall be carried out in the Contractor's shop as indicated on the Drawings.

The removal of existing structures designated for structural modifications and the pick-up and loading of existing structures from the storage yard and delivery to the Contractor's shop as well as installation at the site after completion of the modification work will be considered incidental to the work item of this Specification and the Contractor should include these costs in his bid price for this item.

E2.4.25 Removal of Existing Steel Screw Anchor Foundations to Storage

The existing steel screw anchor foundations designated for removal will be indicated on the Drawings. The screw anchor shall be removed and transported to the City Bridge Yard. The equipment used to remove the anchor shall be capable of supplying the necessary rotational moment (torque) so the whole 3.7 m long anchor comes out of the ground in one piece. The equipment shall include the correct Kelly Bar Adapter and Drive Wrench to fit the existing screw anchor. The anchor shall be removed after removing the existing sign structure.

Restoration of site and adjacent property will be incidental to removal of steel screw anchor.

E2.5 Quality Control

E2.5.1 General

All workmanship and all materials furnished and supplied under this Specification are subject to close and systematic inspection and testing by the Contract Administrator, 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 Contract Administrator 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.

E2.5.2 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 Contract Administrator prior to fabrication of any steel items.

E2.5.3 Testing

In addition to the Contractor's own quality control testing of all materials, welding procedures and steel fabrication will be inspected by the Contract Administrator to ascertain compliance with the Specifications and Drawings.

The Contractor shall hire a testing agency certified by the Canadian Welding Bureau to carry out the following shop fabrication inspection and testing of repairs before the overhead sign support structures are approved ready for installation of coating system:

- (1) Radiographic inspection of 100 percent of full penetration sections of longitudinal seam welds and circumferential butt welds.
- (2) Magnetic particle inspection of a random 10 percent of partial penetration sections of longitudinal seam welds.

The Contractor shall provide the Contract Administrator with certified results of the above inspections.

All welds shall be visually inspected by the Contract Administrator.

The inspector shall have access to all of the fabricator's normal quality control records for this Contract, specified herein.

Weld inspection will be carried out in accordance with the requirements of CSA W59.

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 Contract Administrator.

E2.5.4 Unacceptable Work

Any Work found to be unacceptable shall be corrected in accordance with CSA W59-1989, Clause 5.10.

No repair shall be made until agreed to by the Contract Administrator.

E2.6 Measurement and Payment

E2.6.1 Refurbishment of Existing Steel Overhead Sign Support Structures

Refurbishment of existing steel overhead sign structures will not be measured and will be paid for at the Contract Lump Sum Price per structure per site for the "Items of Work" listed here below for existing sign structure refurbishment in accordance with this Specification and accepted by the Contract Administrator.

Items of Work:

Full Refurbishment of Existing Steel Overhead Sign Support Structures

- a) Cantilever Structures
 - i) Structure No. S649 – Pembina Highway Northbound, Second Structure North of University Crescent
- b) Bridge Structures
 - i) Structure No. S651 – Pembina Highway Southbound, South of Plaza Drive
 - ii) Structure No. S652 – Pembina Highway Northbound, North of Chancellor Drive
 - iii) Structure No. S659 – Bishop Grandin Boulevard Westbound, Third Structure East of Pembina Highway

E2.6.2 Structural Steel Repairs by Welding

Structural steel repairs by welding will be measured on a length basis and will be paid for at the Contract Unit Price per linear centimetre of weld for "Structural Steel Repairs by Welding," in accordance with this Specification, accepted and measured by the Contract Administrator.

E2.6.3 Repair of Defective Welds

Repair of defective welds will be measured on a length basis and will be paid for at the Contract Unit Price per linear centimetre of weld for "Repair of Defective Welds," in accordance with this Specification, accepted and measured by the Contract Administrator.

E2.6.4 Vertical Member Butt Splice Repairs, complete with New Base Plates

Vertical member butt splice repairs complete with new base plates will be measured on a unit basis per vertical support per structure and will be paid for at the Contract Unit Price per butt splice for "Vertical Member Butt Splice Repairs, complete with New Base Plates," in accordance with this Specification, accepted and measured by the Contract Administrator.

E2.6.5 Vertical Member Sleeve Repairs

Vertical member sleeve repairs will be measured on a unit basis per vertical support per structure and will be paid for at the Contract Unit Price per sleeve repair for "Vertical Member Sleeve Repairs," in accordance with this Specification, accepted and measured by the Contract Administrator.

E2.6.6 Vertical Member Modifications

Vertical member modifications will be measured on a unit basis per vertical support per structure and will be paid for at the Contract Unit Price per member modification for "Vertical Member Modifications," in accordance with this Specification, accepted and measured by the Contract Administrator.

E2.6.7 Removal of Existing Overhead Sign Support Structures to Storage

Removal of existing overhead sign support structures to storage will not be measured and will be paid for at the Contract Lump Sum Price per structure per site for the "Items of Work" listed here below for sign structures removed to storage in accordance with this Specification and accepted by the Contract Administrator.

Items of Work:

Removal of Existing Overhead Sign Support Structures to Storage

None required.

E2.6.8 Removal and Disposal of Existing Overhead Sign Support Structures

Removal and disposal of existing overhead sign support structures will not be measured and will be paid for at the Contract Lump Sum Price per structure per site for the "Items of Work" listed here below for sign structures removed and disposed in accordance with this Specification and accepted by the Contract Administrator.

Items of Work:

Removal and Disposal of Existing Overhead Sign Support Structures

None required.

E2.6.9 Credit for Scrap Value of Disposed Steel Material

Scrap value of disposed steel material for designated existing overhead sign support structures will not be measured and will be charged for at the Contract Lump Sum Amount (Credit) for "Credit for Scrap Value of Disposed Steel Material" in accordance with this Specification and accepted by the Contract Administrator.

E2.6.10 Structural Modifications of Existing Overhead Sign Support Structures

Structural modifications of existing overhead sign support structures will not be measured and will be paid for at the Contract Lump Sum Price per structure per site for the "Items of Work" listed here below for sign structures modified in accordance with this Specification and accepted by the Contract Administrator.

Items of Work:

Structural Modifications of Existing Overhead Sign Support Structures

None required.

E2.6.11 Removal of Existing Steel Screw Anchor Foundation to Storage

Removal of existing steel screw anchor foundations to storage will not be measured and will be paid for at the Contract Lump Sum Price per structure per site for the "Items of Work" listed herebelow for screw anchor removal in accordance with this Specification and accepted by the Contract Administrator.

Items of Work:

Removal of Existing Steel Screw Anchor Foundations to Storage

None required.

E3. CONCRETE PILE FOUNDATION REPAIR WORKS

E3.1 General

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.

E3.2 Materials

E3.2.1 General

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

E3.2.2 Handling and Storage of Materials

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

E3.2.3 Testing and Approval

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

E3.2.4 Cement

Cement shall be Type GU, general use hydraulic cement, conforming to the requirements of CSA A3001-03.

E3.2.5 Supplementary Cementing Materials

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

E3.2.6 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.

E3.2.7 Aggregate

The Contractor shall furnish in writing to the Contract Administrator, the location of the sources where aggregate will be obtained, in order that same may be inspected and tentatively approved by the Contract Administrator. 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 Contract Administrator.

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 Sieve Size	Percent of Total Dry Weight Passing Each Sieve
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 Sieve Size	Percent of Total Dry Weight Passing Each Sieve
28,000	100%
20,000	90% - 100%
10,000	25% - 60%
5,000	0% - 10%
2,500	0% - 5%

(c) Coarse Aggregate (13 mm Nominal)

Coarse aggregate for on-site batching shall be 100 percent crushed granite, clean and free from alkali, organic, or other deleterious matter, shall have an adsorption not exceeding 3 percent, and shall conform to the following gradation requirements:

Gradation of 13 mm Coarse Aggregate	
Canadian Metric Sieve Size	Percent of Total Dry Weight Passing Each Sieve
20,000	100%
13,000	97% - 100%
10,000	40% - 90%
5,000	5% - 30%
80	0% - 1.5%

E3.2.8 Admixtures

No admixtures other than air-entraining agent shall be used without the written authorization of the Contract Administrator, 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 Contract Administrator 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 Contract Administrator 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 City Bridge Engineer.

E3.2.9 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 Contract Administrator.

E3.2.10 Flexible Joint Sealant

Flexible joint sealant for all horizontal, vertical, and sloping joints shall be guaranteed non-staining grey polyurethane, approved by the Contract Administrator, 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 Contract Administrator.

E3.2.11 Fibre Joint Filler

Fibre joint filler shall be rotproof and of the performed, 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 Contract Administrator.

E3.2.12 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.

E3.2.13 Non-shrink Grout

Grout as specified hereinafter shall be used for the grouting of all reinforcing steel dowels.

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.

E3.2.14 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 Contract Administrator.

E3.2.15 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 G30.12, Grade 400 MPa, Billet-Steel Bars for Concrete Reinforcement. All reinforcing steel shall be new deformed billet steel bars.

E3.2.16 Anchor Bolt Extension and Accessories

Anchor bolt extensions, nuts, and washers shall be in accordance with CSA G40.21 Grade 300W hot-dip galvanized and shall match the size of existing anchor bolts.

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.

E3.2.17 Miscellaneous Materials

Miscellaneous materials shall be of the type specified on the Drawings or approved by the Contract Administrator.

E3.3 Concrete Mix Design

E3.3.1 General

The concrete for repair of major spalling and/or damage, and construction of pile extensions may be batched on-site or at a concrete batch plant.

The concrete shall achieve a minimum compressive strength of 20 MPa before the sign structure is reinstalled and a minimum compressive strength of 35 MPa at 28 days.

E3.3.2 Mix Design for On-Site Batching

All on-site batched concrete shall be mixed in a portable, motorized concrete mixer capable of distributing constituent materials evenly throughout the mix.

Proportioning of Constituent Materials for 1/16 Cubic Yard Batch:

35 MPa Concrete Mix Design	
Proportioning of Constituent Materials for 1/16 Cubic Yard Batch:	
Crushed Granite Aggregate (13 mm nominal)	1 1/2 parts of volume
Sand	1 part by volume
Normal Portland Cement	1 part by volume
Water to obtain 50 mm Slump after Superplasticizing Agent is added	1 to 2 gallons
Air Entraining Agent (6 to 9% air) after Latex Bonding Agent is added	1 to 2 gallons as per Manufacturer's Instructions
Latex Bonding Agent	1 part bonding agent to 4 parts water

E3.3.3 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 = 340 kg/m³
- 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 10

E3.4 Equipment

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

E3.5 Construction Methods

E3.5.1 General

The following repair works related to existing concrete piles at designated sign structure sites are covered under this Specification.

- a) Repair of major spalling and/or damage at top of piles.
- b) Construction of pile extensions.
- c) Abandoning of existing concrete pile foundations.

The Contractor should include the cost of removing and restoring the existing concrete sidewalk paving or sodding or soil surface, if required, in the total cost of the respective repairs as no separate payment will be made for this Work.

E3.5.2 Repair of Major Spalling and/or Damage, and Construction of Pile Extensions

(a) Concrete Removals for Repair of Major Spalling and/or Damage

Generally, the Work involves the removal of designated deteriorated concrete from the top of piles down to sound concrete or a minimum 300 mm, whichever is greater. The areas requiring removal shall be as marked in the field by the Contract Administrator. 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.

(b) 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 Contract Administrator. After the Contract Administrator 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.

(c) Placing Concrete

The Contract Administrator 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.

(d) 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.

(e) 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 seven (7) 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.

(f) 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.

(g) 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 Contract Administrator. 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 Contract Administrator. The patch shall be cured as specified in this Specification, and the final colour shall match the surrounding concrete.

(h) 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.

(i) Restoration of Adjacent Property

Restoration of concrete sidewalk/median paving, or sodding or ground, adjacent to existing concrete piles, shall not be carried out until the Contract Administrator has accepted the concrete pile foundation repair work. Backfill material under concrete paving shall be compacted to minimum 95 percent Standard Proctor Dry Density. The restoration of existing concrete sidewalks/medians and curbs, as well as boulevard median, paving stone, or sodding required will be incidental to the construction of concrete pile extensions and no separate payment will be made.

E3.5.3 Abandoning of Existing Concrete Pile Foundations and Removal of Existing Miscellaneous Concrete Slabs

Existing concrete piles and miscellaneous concrete slabs shall be abandoned and removed at designated locations shown on the Drawings where the overhead sign support structures are being removed and the sites are being abandoned.

The existing piles being abandoned shall be cut down to 300 mm below existing paved surface or ground surface.

The existing piles, miscellaneous concrete slabs, including old anchor bolts, etc. shall be removed and all material hauled and disposed off-site.

If the existing pile being abandoned is located in a concrete sidewalk/median slab, the slab shall be saw cut at least 300 mm all around from the edge of the existing pile. After the pile has been cut down as required, the concrete sidewalk/median slab shall be stored flush with the adjacent surface level. The removal and restoration of concrete sidewalk/median slabs will be considered incidental to pile abandonment works at each

site and no separate payment will be made except at those designated sites where additional concrete sidewalk renewal and curb renewal is required.

If the existing pile being abandoned is located in grass boulevard/median, the site shall be restored with sod after the pile has been cut down. The restoration work will be considered incidental to the pile abandonment works at each site and no separate payment will be made.

E3.6 Quality Control

All workmanship and all materials furnished and supplied under this Specification are subject to close and systematic inspection and testing by the Contract Administrator, 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 Contract Administrator 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.

E3.7 Measurement and Payment

E3.7.1 Repair of Existing Concrete Pile Foundations

Repair of existing concrete pile foundations will not be measured and will be paid for at the Contract Lump Sum Price per pile per site for the "Items of Work" listed here below for piles repaired in accordance with this Specification and accepted by the Contract Administrator.

Items of Work:

Repair of Concrete Pile Foundations

None required.

E3.7.2 Construction of Concrete Pile Extensions

Construction of concrete pile extensions will not be measured and will be paid for at the Contract Lump Sum Price per pile per site for the "Items of Work" listed here below for pile extensions constructed in accordance with this Specification and accepted by the Contract Administrator.

Items of Work:

Construction of Concrete Pile Extensions

- a) Structure No. S651 – Pembina Highway Southbound, South of Plaza Drive (Median Pile)
- b) Structure No. S652 – Pembina Highway Northbound, North of Chancellor Drive (Median Pile)
- c) Structure No. S659 – Bishop Grandin Boulevard Westbound, Third Structure East of Pembina Highway (Boulevard Pile)

E3.7.3 Abandoning of Existing Concrete Pile Foundations

Abandoning of existing concrete pile foundations will not be measured and will be paid for at the Contract Lump Sum Price per site for the “Items of Work” listed here below for abandonment of piles in accordance with this Specification and accepted by the Contract Administrator.

Items of Work:

Abandoning of Existing Concrete Pile Foundations

None required.

E4. NEW STEEL OVERHEAD SIGN SUPPORT STRUCTURES

E4.1 Description

The Work covered under this item shall include all operations related to the supply, fabrication, delivery, and erection of new steel overhead sign support structures.

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 the Work as hereinafter specified.

E4.2 Materials

E4.2.1 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 overhead sign support structures shall be new, previously unused material.

E4.2.2 Handling and Storage of Materials

All materials shall be handled in a careful and workmanshiplike manner, to the satisfaction of the Contract Administrator. 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.

E4.2.3 Structural Steel

Structural steel for vertical shafts and horizontal members shall be in accordance with CSA Standard G40.21 M, Grade 350 W. For purposes of hot-dip galvanizing, the silicon content in the steel shall be controlled within 0 to 0.03%. All other structural steel shall be CSA Standard G40.21 M, Grade 300 W.

The Contractor 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 supplied to the Contract Administrator and be found acceptable prior to commencement of fabrication.

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 results), and items fabricated without steel certification shall be rejected.

E4.2.4 Flange Bolts, Nuts, and Washers

Flange bolts, nuts, and washers shall be in accordance with ASTM A325 hot-dip galvanized.

E4.2.5 Hardware for Handhole Covers

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

E4.2.6 Hot-Dip Galvanizing

All hot-dip galvanizing shall be in accordance with CSA G164 for a minimum net retention of 600 g/m².

E4.2.7 Galvanizing Touch-up and Field-Applied Galvanizing

Field-applied galvanizing, to touch-up damaged hot-dip galvanizing on-site and to galvanize field welds, 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.

E4.2.8 Anchor Bolts and Setting Template

Anchor bolts including nuts and washers, and setting template shall be in accordance with CSA G40.21 Grade 300W, hot-dip galvanized. Anchor bolts shall be supplied and paid for in accordance with Section 3.5, "New Cast-in-Place Concrete Pile Foundations."

E4.2.9 Non-shrink Grout

Grout as specified hereinafter shall be used for the construction of grout pads under sign structure base plates.

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 Builders
- 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.

E4.2.10 Sign Boxes/Plates

Sign boxes/plates will be supplied and installed by the City of Winnipeg Traffic Signals Branch.

E4.2.11 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 Contract Administrator for his approval at least two (2) days prior to the scheduled commencement of any fabrication.

E4.2.12 Miscellaneous Materials

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

E4.3 Equipment

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

E4.4 Construction Methods

E4.4.1 General Requirements

- a) Holes in the base plates shall be oversized by 6 mm, and provisions made for field erection must be accurate within plus or minus 13 mm between supports, without affecting final installation and load capacity.
- b) The base plates for the sign support structures shall be constructed to be fully compatible and mountable on the anchor bolts, provided in the foundations by the Contractor.
- c) Sufficient reinforced handholes and wiring holes shall be provided for lighting of the signs. All wiring holes shall have threaded couplings. All unused coupling holes shall be capped with a threaded galvanized plug.
- d) The sign support structure shall be so fabricated that erection can be achieved by means of bolted connections.
- e) Each sign structure shall be provided with a "raised" structure identification number with a welding electrode in accordance with the details shown on the Drawings. The sign structure identification number shall be placed before hot-dip galvanizing.
- f) 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.
- g) Prior to fabrication, the dimensional limitations on the size and shape imposed by the galvanizing facilities shall be determined for hot-dip galvanizing the sign structures.

E4.4.2 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 - 2001 - 4th Edition, plus all subsequent revisions.

The punching of identification marks on the members will not be allowed, except for the structure identification number.

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

Dimensions and fabrication details that control the field matching of parts shall receive very careful attention in order to avoid field adjustment.

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.

E4.4.3 Welding

Welding of steel structures 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 60% penetration, except those within 200 mm of baseplates, flanges, 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 top of the horizontal members.

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

E4.4.4 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:10, "Near White Metal Blast Cleaning," unless otherwise specified herein. The Contractor shall ensure that all exterior and interior surfaces of vertical support members of sign structures are blast cleaned prior to pickling to achieve the minimum zinc coating mass of 600 g/m². 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 sign structures shall be done in the shop.

After the sign structures have been sandblasted and cleaned, the Contract Administrator will carry out a visual inspection of the structures in the shop before they are shipped to the galvanizing plant.

E4.4.5 Hot-Dip Galvanizing

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

All outside surfaces of the overhead sign support structures, as well as the interior surfaces of all vertical support members of the overhead sign support structures, shall be hot-dip galvanized in accordance with the requirements of this Specification.

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

The galvanizing coating on outside surfaces of overhead sign support 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.

Minor defects in the galvanizing coating shall be repaired in accordance with Section 3.1.4.19 of this Specification. The Contract Administrator 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 sign structures shall be stored on timber blocking after hot-dip galvanizing.

E4.4.6 Installation of Sign Panels/Boxes/Plates

The Contractor will be responsible for installation of sign panels/boxes/plates.

E4.4.7 Delivery and Erection

The Contractor shall notify the Contract Administrator at least two (2) working days in advance of the anticipated delivery to the site and erection of the overhead sign support structures.

The sign structures shall be lifted and secured with nylon ropes or other approved methods. Use of steel chains and steel hooks against hot-dip galvanized surfaces will not be permitted. The structures shall be placed on timber blocking during their transportation to the site.

Each anchor bolt shall be provided with two galvanized nuts--one nut below the base plate for levelling the structure, and one nut above the base plate for anchoring the structure. The anchor bolts shall have a minimum projection of 25 mm above the anchoring nuts. There shall be provision for minimum 50 mm thick grout pad under the base plate.

The Contractor shall ensure that the anchoring nuts of the anchor bolts are tightened according to the "turn-of-nut" method of the AASHTO Code.

E4.4.8 Grout Pads

New grout pads shall be constructed under sign structure bases incidental to the work of this Specification.

E4.4.9 Field-Applied Touch-up Galvanizing

Any areas of damaged galvanizing on the sign structures shall receive field-applied 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. Field-applied 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.

E4.4.10 Structures Installed on Existing Pile Foundations

Pile foundations where new structures are to be installed shall be refurbished in accordance with E2., "Refurbishment of Steel Overhead Sign Support Structures," and shall be incidental to supply and installation of the new overhead sign structures.

E4.5 Quality Control

E4.5.1 General

All workmanship and all materials furnished and supplied under this Specification are subject to close and systematic inspection and testing by the Contract Administrator, 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 Contract Administrator 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.

E4.5.2 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 Contract Administrator prior to fabrication of any steel items.

E4.5.3 Testing

In addition to the Contractor's own quality control testing of all materials, welding procedures and steel fabrication will be inspected by the Contract Administrator to ascertain compliance with the Specifications and Drawings.

The Contractor shall hire a testing agency certified by the Canadian Welding Bureau to carry out the following shop fabrication inspection and testing before the overhead sign support structures are approved ready for installation of coating system:

- (1) Radiographic inspection of 100 percent of full penetration sections of longitudinal seam welds and circumferential butt welds.
- (2) Magnetic particle inspection of a random 10 percent of partial penetration sections of longitudinal seam welds.

The Contractor shall provide the Contract Administrator with certified results of the above inspections.

All welds shall be visually inspected by the Contract Administrator.

The inspector shall have access to all of the fabricator's normal quality control records for this Contract, specified herein.

Weld inspection will be carried out in accordance with the requirements of CSA W59.

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 Contract Administrator.

E4.5.4 Unacceptable Work

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

No repair shall be made until agreed to by the Contract Administrator.

E4.6 Measurement and Payment

E4.6.1 Supply and Installation of New Steel Overhead Sign Support Structures

Supply and installation of new steel overhead sign support structures will not be measured and will be paid for at the Contract Lump Sum Price per structure per site for the "Items of Work" listed here below for new steel overhead sign structures supplied and installed in accordance with this Specification and accepted by the Contract Administrator.

Items of Work:

New Steel Overhead Sign Support Structures

None required.

E5. NEW CAST-IN-PLACE CONCRETE PILE FOUNDATIONS

E5.1 Description

The Work covered under this Item shall include all concreting operations related to construction of cast-in-place concrete pile foundations 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.

E5.2 Materials

E5.2.1 General

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

E5.2.2 Handling and Storage of Materials

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

E5.2.3 Testing and Approval

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

E5.2.4 Cement

Cement shall be Type HS, high sulphate-resistant hydraulic cement, conforming to the requirements of CSA A3001-03.

E5.2.5 Supplementary Cementing Materials

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

E5.2.6 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.

E5.2.7 Aggregate

The Contractor shall furnish in writing to the Contract Administrator, the location of the sources where aggregate will be obtained, in order that same may be inspected and tentatively approved by the Contract Administrator. 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 Contract Administrator.

(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	
Canadian Metric Sieve Size	Percent of Total Dry Weight Passing Each Sieve
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	
Canadian Metric Sieve Size	Percent of Total Dry Weight Passing Each Sieve
56,000	100%
40,000	95% - 100%
20,000	30% - 70%
10,000	10% - 0%
5,000	0% - 5%

E5.2.8 Admixtures

No admixtures other than air-entraining agent shall be used without the written authorization of the Contract Administrator, 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.

E5.2.9 Concrete Cure and Protection System

Concrete cure and protection system for top 600 mm of pile 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 Contract Administrator.

E5.2.10 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 G30.12, Grade 400 MPa, Billet-Steel Bars for Concrete Reinforcement. All reinforcing steel shall be new deformed billet steel bars. All bars shall be hot-dip galvanized in accordance with CSA Standard G164 for a minimum net retention of 600 g/m².

E5.2.11 Anchor Bolts, Nuts, and Washers

Anchor bolts, nuts, and washers shall be in accordance with CSA Standard G40.21 Grade 300W, and shall be hot-dip galvanized full length in accordance with CSA G164 for a minimum net retention of 600 g/m², for the entire length of the anchor bolts. The threaded portion of the anchor bolts shall extend to the concrete surface. Anchor bolt supply and installation will be incidental to construction of concrete pile foundation and no separate payment will be made.

E5.2.12 Anchor Bolt Templates

Anchor bolt templates shall be CSA G40.21 Grade 300W, minimum 10 mm thick, and will be incidental to construction of new concrete pile foundation and no separate payment will be made.

E5.2.13 Miscellaneous Materials

Miscellaneous materials shall be of the type specified on the Drawings or approved by the Contract Administrator.

E5.3 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/m³
- iv) Slump = 80 mm \pm 30 mm
- v) Aggregate: 20 mm nominal

- vi) Air Content: 5.0 to 8.0 percent
- vii) Cement - Type 50

E5.4 Equipment

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

E5.5 Construction Methods

E5.5.1 Location and Alignment of Piles

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

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

E5.5.2 Buried Utilities

The Contractor shall exercise extreme caution when constructing the pile foundations in the vicinity of existing buried utilities. The Drawings show the approximate locations 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 Contract Administrator 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 Contract Administrator.

E5.5.3 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.

E5.5.4 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 Contract Administrator 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 Contract Administrator, 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 has been completed.

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.

E5.5.5 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.

E5.5.6 Inspection of Bores

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

The Contractor shall have available suitable light 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 Contract Administrator.

E5.5.7 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.

E5.5.8 Placing Anchor Bolts

The anchor bolts shall be aligned with a steel template matching the bolt holes in the sign structure base plate. The setting template shall be held in place by the top and bottom nuts of the anchor bolts. Extreme care shall be used in this operation. Placement of anchor bolts without the steel template will not be permitted.

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. The portion of anchor bolts projecting from the pile shall be fully threaded.

E5.5.9 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.

E5.5.10 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 2.0 m and shall be placed so that the aggregates will not separate or segregate. The slump of the concrete shall not exceed 110 mm. The concrete shall be vibrated throughout the entire length of the pile.

Concrete shall be placed to the elevations as shown on the Drawings. The top surface of the pile shall be finished smooth and even with a hand float.

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 Contract Administrator. In the event that tremie concrete is allowed by the Contract Administrator, the concrete shall be placed as specified herein.

E5.5.11 Tremie Concrete

The shaft of the pile shall be pumped clear of water so that the bottom can be cleaned and belled. 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 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 top of the bell or as the Contract Administrator directs. 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.

E5.5.12 Protection of Newly Placed Concrete

Newly laid concrete threatened with damage by rain, snow, fog, or mist shall be protected with a tarpaulin or other approved means.

E5.5.13 Curing Concrete

The top of the freshly finished concrete piles 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 seven (7) consecutive days thereafter.

After the finishing is completed, the surface shall be promptly 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 and application of the approved concrete cure and protection system in accordance with the manufacturer's instructions.

E5.5.14 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.

E5.5.15 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 Contract Administrator. 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 Contract Administrator. The patch shall be cured as specified in this Specification, and the final colour shall match the surrounding concrete.

E5.5.16 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.

E5.6 Quality Control

All workmanship and all materials furnished and supplied under this Specification are subject to close and systematic inspection and testing by the Contract Administrator, 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 Contract Administrator 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.

E5.7 Measurement and Payment

E5.7.1 Construction of New Cast-in-Place Concrete Pile Foundations

Construction of new cast-in-place concrete pile foundations including supply and installation of anchor bolts and steel template will not be measured and will be paid for at the Contract Lump Sum Price per pile per site for the "Items of Work" listed here below for concrete piles constructed in accordance with this Specification and accepted by the Contract Administrator.

Items of Work:

Construction of New Cast-in-Place Concrete Pile Foundations

None required.