

CW 3620 – INSTALLATION OF UNDERGROUND TRAFFIC SIGNAL SERVICES

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CW 3620 – INSTALLATION OF UNDERGROUND TRAFFIC SIGNAL SERVICES**1. DESCRIPTION****1.1 General**

- .1 This Specification covers the removal of pavement material, capping for temporary restoration of pavement, concrete bases, service boxes, installation of underground conduit, ground rods, cutovers, saw cutting, installation and sealing of vehicle detector loops and related underground works for traffic control devices. It includes disposal of surplus and unsuitable material and placement of backfill material where traffic signal works are required.

1.2 Definitions

- .1 Boring – means making a hole in undisturbed ground by auger or Hydro-Vac.
- .2 Capping – means a temporary patch as defined by the Streets Cuts Manual, published by Streets Engineering Division, Public Works Department, City of Winnipeg.
- .3 Conduit Repair – means replacing a section of damaged conduit with a section of new conduit.
- .4 Conduit Stubs – means short sections (typically less than 10 metres) of installed conduit, and are plugged at each end for future use. Stubs always terminate in a base, service box, manhole, or aboveground service at one end, with the other termination underground for future connection. They are a provision for future conduit extensions and connections.
- .5 Cutover – means doing a cut between an old pole or base to a new pole or base for the purpose of coupling new conduit to other new or existing conduit.
- .6 Hydro-Vac – means to use high pressure water to cut the soil and vacuum to remove the soil.
- .7 Lead-in Conduit – means the conduit that houses vehicle detector loop cabling at the point where the cabling passed under or through the concrete curb.
- .8 Miscellaneous Slabs – means existing miscellaneous concrete slabs removed and reinstalled for grade revisions or improving their condition in the same location. This includes median slabs, monolithic median slabs, safety median slabs, sidewalk, bullnose and monolithic curb and sidewalk.
- .9 Oakum – means loose hemp or jute fibre in a rope form.
- .10 Pavement Material – means includes all rigid material (i.e. asphalt, Portland cement concrete, un-shrinkable fill, and concrete etc.) comprising the street pavement, or other paved surfaces, such as sidewalks or curbs, in the right-of-way.
- .11 Soil Material – means all material encountered within the limits of the work and not specifically defined in "Pavement Material". This means that all material shall be deemed to be "Soil Material" if removed from excavations including compacted granular material that comprises a portion of the structure of the road but is not included in "Pavement Material".

- .12 Standby Time – means wait time until others complete required work tasks on the Site before the Work by the Contractor may resume.
- .13 Street Pavement – means the areas of asphalt or concrete pavement that comprise the driving lanes for traffic. The area shall include all turning lanes, merging lanes, intersections or other areas built for the purpose of vehicular traffic.

1.3 Referenced Standard Constructions Specifications

- .1 CW 1130 – Site Requirements
- .2 CW 2030 – Excavation, Bedding and Backfill
- .3 CW 2160 – Concrete Underground Structures
- .4 CW 3110 – Sub-Grade, Sub-Base and Baser Course Construction
- .5 CW 3230 – Full-Depth Patching of Existing Pavement Slabs and Joints
- .6 CW 3235 – Renewal of Existing Miscellaneous Slabs
- .7 CW 3240 – Renewal of Existing Curbs
- .8 CW 3250 – Joint and Crack Maintenance
- .9 CW 3310 – Portland Cement Concrete Pavement Works
- .10 CW 3335 – Installation of Interlocking Paving Stones on a Lean Concrete Base
- .11 CW 3410 – Asphaltic Concrete Pavement Works

1.4 Referenced Standard Details

- .1 Dimensional details of underground traffic signals installations at specified locations will be shown on the Drawings and shall be established in conformance with the typical installations shown in Standard Details indicated below.

<u>DRAWING DESCRIPTION</u>	<u>DRAWING NO.</u>
Controller Base	SD-300
Pedestal Base	SD-302
Terminal Pedestal Base	SD-304
Signal Pole Base – Type A	SD-310
Signal Pole Base – Type D	SD-312
Signal Pole Base – Type G	SD-313
Signal Pole Base – Type J	SD-314
Signal Pole Base – Type L	SD-315
Top Ring Form for Standard Duty Traffic Signal Pole Base	SD-316
Top Ring Form for Medium Duty Davit Pole Base	SD-317
Signal Pole Base – General Alignment to Roadway	SD-318
Service Box – Cast in Place	SD-320
Service Box – Pre-Cast	SD-322
Vehicle Detector Loops - Saw Cut in Concrete	SD-330
Vehicle Detector Loops - Saw Cut in Asphalt	SD-332
Vehicle Detector Loops - Pre-Formed	SD-334
Polyethylene Conduit Joint	SD-340
Beddings and Backfills for Underground Traffic Signal Works	SD-342

2 MATERIALS

2.1 Limestone Backfill Material

.1 Supply limestone backfill material in accordance with CW 2030, Type 2 material in Table 2030.1 - Grading Requirements for Imported Backfill.

2.2 Drainage Material for Service Box

.1 Supply drainage material for service boxes that shall consist of sound, hard, washed stone, free from organic material and meeting the following gradation requirements:

TABLE CW 3620.1 – Drainage Material Grading Requirements

CANADIAN METRIC SIEVE SIZE	PERCENT OF TOTAL DRY WEIGHT PASSING EACH SIEVE
40 000	100%
25 000	50% - 80%
20 000	5% - 20%
12 500	0% - 5%
80	0% - 3%

.2 Soundness

Drainage material when subjected to five cycles of the soundness test will have a weighted loss of not more than 13% in accordance with ASTM Standard C88, Test for soundness of Aggregates by Use of Magnesium Sulphate.

.3 Abrasion

Drainage material when subjected to the abrasion test will have a loss of not more than 30% when tested in accordance with grading A of ASTM C131, Test for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

2.3 Sand

.1 Supply sand in accordance with CW 2030, Table 2030.1 – Grading Requirements for Imported Backfill.

2.4 Concrete for Bases and Service Boxes

- .1 Supply concrete for bases and service boxes in accordance with CW 2160, Table CW 2160.1 Design Requirements for Concrete Used for Underground Structures, for Type A Structures (monolithic sewers and reinforced structures).

2.5 Materials for Pavement, Miscellaneous Slabs, and Curb Restoration

- .1 Supply materials for concrete pavement restoration in accordance with Section 5 of CW 3230.
- .2 Supply materials for miscellaneous concrete slabs in accordance with Section 2 of CW 3235.
- .3 Supply materials for concrete curb restoration in accordance with Section 2 of CW 3240.
- .4 Supply materials for paving stones on a lean concrete base in accordance with Section 5 of CW 3335.
- .5 Supply materials for asphalt pavement in accordance with Sections 5, 6, and 7 of CW 3410.

2.6 Cement Stabilized Fill

- .1 Supply cement stabilized fill in accordance with Type C in Table 2160.1, of CW 2160.

2.7 Bonding Grout

- .1 Supply bonding grout in accordance with Section 5.4.12 of CW 3310

2.8 Suitable Site Excavated Material

- .1 Suitable site excavated material shall be free of organic matter, rubble, stones, or other unsuitable material. Suitable excavated material shall be approved for use by the Contract Administrator before being accepted for use as backfill.

2.9 Sealant for Vehicle Detector Loops

- .1 Supply sealant for vehicle detector loops in accordance with CW 3250.

2.10 City Supplied Materials

- .1 The following materials for underground traffic signals installations will be supplied by the City as required at no cost to the contractor.
 - (a) Polyethylene conduit
 - (b) Conduit coupling pipe and gear clamps
 - (c) Plastic conduit plugs
 - (d) Anchor bolts and nuts
 - (e) Eyebolts and nuts
 - (f) Master anchor bolt templates
 - (g) Ground rods, ground cables and clamps
 - (h) Twine
 - (i) Cast in place service box frames and covers
 - (j) Pre-cast service boxes
 - (k) Base covers
 - (l) Pre-formed detector loop staples
- .2 Use master anchor bolt templates provided by the City and top ring forms provided by the contractor, for all bases constructed under the provisions of this specification. Clean the templates and forms at the end of the Contract. Return the templates to the City. Clean the templates and forms as directed by the Contract Administrator.
- .3 All other materials referred to in this Specification shall be supplied by the Contractor.

2.11 Top Ring Form

- .1 Supply Top Ring Form in accordance with SD-316 and SD-317.

2.12 Approved Products

- .1 Use only those materials listed as Approved Products for Surface Works in the City of Winnipeg, found on the City of Winnipeg, Materials Management Web site at:
<http://www.winnipeg.ca/matmgt/spec/>

3 CONSTRUCTION METHODS**3.1 General**

- .1 Construct all work as shown on the Drawings or as directed by the Contract Administrator.
- .2 Minor deviations from Standard Details may be required in the field where unknown underground obstructions are encountered. The Contractor shall not deviate from the Drawings or standard details without prior approval by the Contract Administrator.

3.2 Removal of Street Pavement Material and Miscellaneous Slabs

- .1 Break and remove pavement material as necessary for traffic signal appurtenances.
- .2 For street pavement, remove as much pavement material as necessary to facilitate adequate room for installation of traffic signals appurtenances. The removal area shall be uniform, rectangular and parallel to the nearest edge or joint. If the area left is less than 1000mm in width to the nearest joint or edge, remove all pavement material to the nearest joint or edge.
- .3 For miscellaneous slabs, remove as much pavement material as necessary to facilitate adequate room for installation of traffic signals appurtenances. The removal area shall be uniform, rectangular and parallel to the nearest edge or joint. If the area left is less than 600mm in width to the nearest joint or edge, remove all concrete to the nearest joint or edge.
- .4 Excavate in accordance with SD-342 and in accordance with the Drawings or as directed by the Contract Administrator.
- .5 Disposal of material shall be in accordance with Section 3.4 and 3.5 of CW 1130.

3.3 Excavation of Soil Material

- .1 Excavate to a maximum depth of 1.5 meters in accordance with the Drawings or as directed by the Contract Administrator.
- .2 Excavate soil material as necessary for traffic signal appurtenances.
- .3 Ensure the bottom of the excavation is smooth, free from depressions, lumps and protruding objects.
- .4 Remove unsuitable material from bottom of excavation as directed by the Contract Administrator.
- .5 Disposal of material shall be in accordance with Section 3.4 and 3.5 of CW 1130.

3.4 Backfill General

- .1 Place sand backfill as the bottom layer of all trenched excavations. Sand is placed to a depth of 200 millimetres over the full width of the area of excavation. Install plastic conduit so it is vertically and horizontally centred in the sand backfill.
- .2 Place the sand bottom layer of backfill so that the in situ ground in the excavated area is covered and the conduit is protected from ridges, bumps or other features that may cause damage to the conduit.
- .3 Place conduit in accordance with Section 3.11 of this specification.
- .4 Place sand backfill on top of conduit in such a manner that the conduit is not bent or kinked.
- .5 Tamp sand firmly from the sides of the conduit, down and under the conduit.

3.4.1 Class A Backfill under Street Pavement

- .1 Install Backfill Class A in accordance with SD-342. Use Class A backfill materials in any cut excavation that in whole or in part extends under any street pavement. This includes any street pavement that is under construction or is proposed for construction, or in other areas as directed by the Contract Administrator.
- .2 Place and compact sand to 95% Standard Proctor.
- .3 Place cement stabilized fill.
- .4 Match the elevation of the bottom of the adjacent pavement to the top of the cement stabilized fill.

3.4.2 Class B Backfill under Miscellaneous Slabs

- .1 Install Class B Backfill the excavation in accordance with SD-342. Use Class B backfill materials in any excavated area which does not require Class A cut backfill materials.
- .2 Place and compact sand to 95% Standard Proctor.
- .3 Backfill with Type 2 limestone in successive even layers not exceeding 150 millimetres in thickness, to a depth of 150 millimetres below the surrounding grade. Compaction of each 150mm layer shall be obtained by manual or mechanical vibratory compaction equipment to a density of 95% of the maximum dry density as determined by the Standard Proctor Compaction Test.
- .4 Match the elevation of adjacent base course under miscellaneous pavement slabs with Type 2 limestone.

3.4.3 Class B Backfill under Landscaped Areas

- .1 Backfill the excavation in accordance with SD-342.
- .2 Place sand, limestone and suitable excavated material under landscaped areas.
- .3 Backfill with Type 2 limestone in successive even layers not exceeding 300 millimetres in thickness, to a depth of 150 millimetres below the surrounding grade. Compaction of each 300mm layer shall be obtained by manual or mechanical vibratory compaction equipment, to a density of 90% of the maximum dry density as determined by the Standard Proctor Compaction Test.
- .4 Backfill the top 150 millimetres of the excavation with excavated material to match the adjacent grades.
- .5 Compaction of excavated material shall be obtained by manual or mechanical vibratory compaction equipment, and each layer shall be compacted by mechanical means to a density of 90% of the maximum dry density as determined by the Standard Proctor Compaction Test.

3.5 Temporary Restoration of Street Pavement and Miscellaneous Slabs

- .1 Temporary restoration shall be as directed by the Contract Administrator.
- .2 Backfill of a temporary restoration shall be in accordance with SD-342.
- .3 Capping of Street Pavement and Miscellaneous Slabs shall be constructed in accordance with the most recent version of the Streets Cuts Manual.

3.6 Supply and Installation of Concrete for Concrete Bases and Service Boxes

- .1 Supply and install concrete in accordance with Type A structures in Table 2160.1 of CW 2160, and the following requirements.
- .2 Prevent lateral or vertical distortions in the concrete by providing sufficiently rigid forms for concrete placement, Forms shall be set to the design grades, lines and dimensions as directed by the Contract Administrator. Ensure that anchor bolts are vertically aligned and that anchor bolts and conduits are properly positioned prior to placement of concrete.
- .3 Utilize Top ring forms and anchor bolt templates to achieve the dimensions and finish for signal pole and controller bases as indicated on the standard details.
- .4 Install tubular cardboard forming tubes to be used for signal pole and controller bases in accordance with Sections 3.12 & 3.13 of this specification.

- .5 Place concrete in excavations where the sub-grade shall be sufficiently moist to prevent absorption of water from the freshly placed concrete, but be free from soggy, muddy ground and water pondage. Where water pondage exists, pump out excess water and allow the soggy, muddy soil to dry sufficiently before placing sand, base course or concrete.
- .6 Strike off the surface of the concrete immediately following concrete placement so that the finished concrete will conform to the required dimensions and elevation.
- .7 Finish the top of the concrete smooth and even by means of a suitable float. Finish concrete at exposed areas. Tamp along the form at surfaces of excavations and forms to ensure that concrete has a dense, smooth surface devoid of imperfections.
- .8 Before initial set has begun, the concrete surface shall be floated with a suitable float by an oscillating movement until the entire surface presents a tight and compact appearance. Floating shall be regulated in order that the quality of the surface is not impaired by overworking.

3.7 Installation of Concrete Bases

- .1 Concrete bases shall be installed in accordance with the following Standard Details:

<u>STANDARD DETAIL</u>	<u>STANDARD DETAIL NO.</u>
Controller Base	SD-300
Pedestal Base	SD-302
Terminal Pedestal Base	SD-304
Signal Pole Base – Type A	SD-310
Signal Pole Base – Type D	SD-312
Signal Pole Base – Type G	SD-313
Signal Pole Base – Type J	SD-314
Signal Pole Base – Type L	SD-315
Top Ring Form for Standard Duty Traffic Signal Pole Base	SD-316
Top Ring Form for Medium Duty Davit Pole Base	SD-317
Signal Pole Base – General Alignment to Roadway	SD-318
Polyethylene Conduit Joint	SD-340
Beddings and Backfills for Underground Traffic Signal Work	SD-342

- .2 Install the number of plastic conduits in each base in accordance with the Drawings. The conduits shall enter 450 mm minimum below ground level and protrude vertically from the top of each base. The conduits shall be bound together at the top, and shall be secured to protrude through the centre of the concrete base and within the centre opening of the template supplied by the City.
- .3 Install base covers on the finished and completed concrete bases as directed by the Contract Administrator. The base covers shall be installed within 24 hrs. after the removal of the anchor bolt template and the top ring form.
- .4 Install conduit in accordance with Section 3.16 of this Specification. Terminate the conduit at the base; entering the base without joints or discontinuities.

3.8 Installation of Service Boxes

- .1 Service Boxes shall be installed in accordance with the following Standard Details:

<u>STANDARD DETAIL</u>	<u>STANDARD DETAIL NO.</u>
Service Box – Cast in Place	SD-320
Service Box – Pre-Cast	SD-322

- .2 Install Cast in Place Service Boxes in concrete sidewalks, concrete medians, other hard surfaced areas or as shown on the Drawings or as directed by the Contract Administrator.
- .3 Install Pre-Cast Service Boxes in grass boulevards/medians, and hard surfaced medians where the width between curbs is less than 0.5 m or as shown on the Drawings or as directed by the Contract Administrator.
- .4 Install the number of plastic conduits in each Service Box in accordance with the Drawings. The conduits shall enter 450 mm minimum below ground level and protrude vertically in the centre of each box. The conduits shall be bound together at the top and shall be secured to be in the centre of the service box and be below the centre opening of the cast in place or pre-cast service box..
- .5 Install conduit in accordance with Section 3.13 of this Specification. Terminate the conduit at the Service Box entering the Service Box without joints or discontinuities.
- .6 Leave the tubular forms for cast in place service boxes in place as directed by the Contract Administrator.

3.9 Rebuilding Existing Concrete Service Boxes

- .1 Rebuild existing concrete service boxes as shown on the Drawings or as directed by the Contract Administrator,
- .2 Protect existing conduit and wiring from damage during the rebuilding procedure.
- .3 Break down and remove the existing concrete from the service box to a depth of 300 mm below the elevation of the proposed grade (or the existing surrounding grade where no sidewalk, boulevard or pavement construction works are scheduled).
- .4 Install the inner and outer forming tubes in accordance with drawing SD-320.
- .5 Coat the exposed surface of the original concrete with a bonding grout prior to pouring of new concrete. Place the bonding grout in accordance with Section 9.4 of CW 3310.
- .6 Install the service box cover and frame to grade in accordance with drawing SD-320.

3.10 Removal or Abandonment of Existing Bases and Service Boxes

- .1 Obtain the permission of the Traffic Signals Branch and/or the utility having jurisdiction over the base or service box before commencing to remove the base or service box.
- .2 Remove or abandon existing bases and service boxes as shown on the Drawings or as directed by the Contract Administrator.
- .3 Remove bases or service boxes by pulling out of the ground or abandon by breaking up the base to a minimum depth of one metre (1 m) below grade and backfilling in accordance with SD-342. Restore the area in the vicinity of the base or box as directed by the Contract Administrator.

3.11 Installation of Conduit

- .1 Install conduit in accordance with the following Standard Details:

<u>STANDARD DETAIL</u>	<u>STANDARD DETAIL NO.</u>
Vehicle Detector Loops - Saw Cut in Concrete	SD-330
Vehicle Detector Loops - Saw Cut in Asphalt	SD-332
Vehicle Detector Loops - Pre-Formed	SD-334
Polyethylene Conduit Joint	SD-340
Beddings and Backfills for Underground Traffic Signal Work	SD-342

- .2 Install conduit of either a single length of 38 mm or 52 mm plastic conduit, or use multiple lengths of 38 mm or 52 mm plastic conduit placed side by side in accordance with the Drawings.
- .3 Install conduit at a preferred depth of one metre (1 m) below street level. The preferred one metre (1m) depth may be increased for the purpose of avoiding underground obstructions or decreased to minimum of 900mm as directed by the Contract Administrator.
- .4 Install conduit so that it enters a signal pole base, service box, or other underground appurtenance at a depth of installation that shall transition from the minimum 900 mm depth to the entrance depth as shown on the applicable standard detail with a bend radius of 500 mm.
- .5 Install conduits so that in no cases shall the conduit be formed into a bend radius of less than 500 millimetres.
- .6 Install conduit either by directional boring or open trenching, subject to the following conditions:
 - i) Install all conduit by directional boring under paved street surfaces.
 - ii) Open cut to facilitate pushing operations only at termination locations and cutovers, where required by outside utilities, or as directed by the Contract Administrator.
 - iii) Install conduit along landscaped boulevards by directional boring, unless otherwise directed by the Contract Administrator.
- .7 Open trench as directed by the Contract Administrator. The width of the trench shall be 200mm maximum, or in accordance with the drawings.

- .8 Terminate all conduit installations in accordance with the Drawings. Types of terminations are as follows:
 - i) Joining onto an existing conduit.
 - ii) Entry into a base or service box to be constructed under this Specification.
 - iii) Above ground level affixed to a wood pole or structure.
 - iv) Below ground level for a stub.
 - v) Through a drill hole into pavement to be used as a lead-in conduit for vehicle detector loops.
- .9 When the conduit is terminated above ground level on a wood pole or structure the conduit shall have a true vertical position below the termination point starting at ground level immediately adjacent to the designated pole or structure. The conduit projection left above ground shall have a length of at least 450 mm.
- .10 Immediately following installation, fit plastic conduit plugs snugly into the open ends of conduit terminated above and below ground, except for lead-in conduit for vehicle detector loops as noted in SD-332. Install plastic conduit plugs prior to placing any concrete for signal bases or service boxes, and before backfilling over conduit stubs. Leave plastic conduit plugs in place except for temporarily removal required for the installation of twine.
- .11 Lead-in Conduit is installed either prior to placement of concrete or is drilled through concrete in accordance with SD-330, SD-332, and SD-334.
- .12 Joining of conduit will not be allowed except:
 - i) Where conduit is installed in an open trench having a length of more than 75 metres (coil length of plastic conduit)
 - ii) Where a length of new conduit is to be joined to an existing conduit.
 - iii) Where conduit repairs have to be carried out in an existing conduit.
- .13 Join conduit in accordance with Drawing SD-340.
- .14 Install twine within one working day of the completion of the all underground work impacting a conduit or group of conduit. Extend the twine past the point of termination as far as is necessary to provide access to each end of the twine for the purpose of pulling in cables. Ensure that all conduit runs are clear of water and that there are no obstructions within any conduit runs. The twine within the conduit shall be free to move back and forth through the full length of the conduit.
- .15 Where the twine is not free to move investigate the cause and remedy the situation as directed by the Contract Administrator

3.12 Installation of Conduit into Existing Concrete Bases

- .1 Where conduit is terminated at an existing concrete base which supports a traffic signal pole or traffic signal controller, drill hole(s) in the base to permit entry of the conduit at least 150mm below ground level. Install conduit through the drilled hole(s).
- .2 Inform the Contract Administrator 48 hours prior to drilling into the base.

3.13 Installation of Conduit into Existing Utility Manholes and Service Boxes

- .1 Where installed conduit is terminated at an existing traffic signals service box, drill hole(s) in the base to permit entry of the conduit at least 300 mm below ground level. Install conduit through the drilled hole(s).
- .2 Where conduit installed under this Specification is terminated at an existing utility owned manhole, service box, underground vault or areaway, Contact the owner of the utility and arrange with the utility to enter the plant with a drilled hole and conduit. No work may be done inside the utility plant unless the work is directly supervised by the utility.
- .3 Following the conduit installation, place concrete around the conduit(s) so that the wall of the plant is repaired as directed by the utility.

3.14 Installation of Ground Rods (Electrodes)

- .1 Install ground rods (electrodes) in accordance with Section 10-700 of the Canadian Electrical Code, Part 1.

3.15 Cutovers

- .1 Provide the resources required to facilitate cutovers as directed by the Contract Administrator.
- .2 Cutovers may require standby time for others to complete tasks associated with cutovers.
- .3 Perform the following tasks for cutovers:
 - i) Expose existing conduit(s) by digging in alignment with the direction of the conduit as directed by the Contract Administrator.
 - ii) Standby while others remove the live cables from the conduit.
 - iii) Cut conduit at the specified location(s).
 - iv) Couple the existing conduit(s) to new or existing conduit(s) in accordance with SD-340.
 - v) Backfill exposed areas as directed by the Contract Administrator.
 - vi) Restore the excavated cut in accordance with this Specification and as directed by the Contract Administrator.

3.16 Saw Cutting and Sealing for Vehicle Detector Loops

- .1 Saw Cut and seal vehicle detector loops in accordance with the following standard details or as directed by the Contract Administrator:

<u>STANDARD DETAIL</u>	<u>STANDARD DETAIL NO.</u>
Vehicle Detector Loops - Saw Cut in Concrete	SD-330
Vehicle Detector Loops - Saw Cut in Asphalt	SD-332

- .2 Inform the Contract Administrator a minimum of 24 hours before undertaking saw cutting operations.
- .3 Cut street pavement with a maximum blade diameter of sixty-one (61) centimetres to ensure minimum damage to curbs for cuts leading to the lead-in conduit. Join corner cuts and intersecting cuts so that the wire loop placed in the cut is required to turn through 45 degree angles at the corners. Corner cross cuts shall be placed 250 mm \pm 25 mm below the apex where the extended cuts would join if continued, in accordance with SD-330 and SD-332.. To ensure the integrity of the concrete, at no time shall intersecting cuts be less than 115 mm \pm 10 mm of the apex of that corner.
- .4 When sawing through a construction or expansion joint, saw cut the home run cut perpendicular to joint(s). Construction joints shall not be used as part of the sawn loop. When sawing cuts parallel to construction or expansion joints, saw cut a minimum of 300 mm from the joint.
- .5 Drill a hole in the streets pavement for the installation of the lead-in conduit for the detector loop array so that the lower extremity of the drilled hole shall come out in the vicinity of the lower corner of the pavement. Excavate at the pavement edge to meet the hole drilled through the pavement. The specified diameter conduit shall be pushed upwards through the hole in the pavement. The conduit shall be cut and left 5 mm below the pavement surface.
- .6 Standby while others install loop wire in the sawn loop.
- .7 Standby while others seal the loop detector lead-in conduit, with oakum prior to installation of sealant.
- .8 Sealant shall be installed in accordance with Section 3.3 of CW 3250.
- .9 Remain at the work site until others have completed testing of the electrical integrity of the wire loop.

4 MEASUREMENT AND PAYMENT**4.1 Removal of Street Pavement Material**

- .1 Removal of Pavement Material shall be measured on an area basis and paid for at the Contract Unit Price per square metre for “Removal of Street Pavement Material”. The area to be paid for shall be the total number of square metres of pavement removed in accordance with this specification, accepted and measured by the Contract Administrator.
- .2 Disposal of Street Pavement Material shall be included in the payment for “Removal of Pavement Material”.

4.2 Removal of Miscellaneous Slabs Material

- .1 Removal of Miscellaneous Slabs Material shall be measured on an area basis and paid for at the Contract Unit Price per square metre for “Removal of Miscellaneous Slabs Material”. The area to be paid for shall be the total number of square metres of pavement excavated in accordance with this specification, accepted and measured by the Contract Administrator.
- .2 Disposal of miscellaneous slabs material shall be included in the payment for “Removal of Miscellaneous Slabs Material”.

4.3 Excavation of Soil Material

- .1 No measurement or payment shall be made for Excavation of Soil Material.
- .2 No measurement or payment shall be made for disposal of unused soil material.

4.4 Backfill

- .1 No measurement or payment shall be made for backfill.

4.5 Capping for Temporary Restoration of Street Pavement and Miscellaneous Slabs

- .1 Capping for Temporary Pavement Restoration will be measured on an area basis and paid for at the Contract Unit Price per square metre for “Items of Work” listed below. The area to be paid for will be the total number of square metres of Street Pavement and Miscellaneous Slabs restored in accordance with this specification, accepted and measured by the Contract Administrator.

Items of Work:

- i) Capping for Temporary Restoration of Street Pavement
- ii) Capping for Temporary Restoration of Miscellaneous Slabs

4.6 Supply and Installation of Concrete for Concrete Bases and Service Boxes

- .1 No measurement or payment shall be made for supply and installation of concrete for concrete bases and service boxes.

4.7 Installation of Concrete Bases

- .1 Installation of Concrete Bases shall be measured on a unit basis and paid for at the Contract Unit Price per unit for "Items of Work" listed below. The number of units to be paid for shall be the total number of concrete bases installed in accordance with this specification, accepted and measured by the Contract Administrator.

Items of Work:

- i) Controller Base
 - ii) Pedestal Base
 - iii) Terminal Pedestal Base
 - iv) Signal Pole Base - Type A
 - v) Signal Pole Base – Type D
 - vi) Signal Pole Base - Type G
 - vii) Signal Pole Base - Type J
 - viii) Signal Pole Base - Type L
- .2 Payment for the items of work in this Section includes the supply and installation of ready mix or mixed concrete on site.
 - .3 Payment for the items of work listed above includes the supply and installation of grounding rods (electrodes) installed with the concrete bases.
 - .4 Payment for the items of work listed above includes boring.
 - .5 Payment for the items of work listed above includes top ring forms.

4.8 Installation of Service Boxes

- .1 Installation of Service Boxes shall be measured on a unit basis and paid for at the Contract Unit Price per unit for "Items of Work" listed below. The number of units to be paid for shall be the total number of Service Boxes installed in accordance with this specification, accepted and measured by the Contract Administrator.

Items of Work:

- i) Service Box - Cast in Place
- ii) Service Box - Pre-Cast

4.9 Rebuilding Existing Concrete Service Boxes

- .1 Rebuilding of Existing Concrete Service Boxes shall be measured on a unit basis and paid for at the Contract Unit Price per unit for “Rebuilding Existing Concrete Service Boxes”. The number of units to be paid for shall be the total number of Existing Concrete Service Boxes rebuilt in accordance with this specification, accepted and measured by the Contract Administrator.

4.10 Removal of Existing Bases and Service Boxes

- .1 Removal of Existing Bases or Service Boxes shall be measured on a unit basis and paid for at the Contract Unit Price per unit for “Items of Work” listed below. The number of units to be paid for shall be the total number of concrete bases (controller or signal pole) or service boxes removed in accordance with this specification, accepted and measured by the Contract Administrator.

Items of Work:

- i) Signal Pole Base
- ii) Controller Base
- iii) Service Box

4.11 Installation of Conduit

- .1 Installation of Conduit shall be measured on a length basis and paid for at the Contract Unit price per metre for “Items of Work”. The length to be paid for shall be the total number of metres of conduit, including conduit stubs and loop detector lead-in conduit for vehicle detector loops installed in accordance with this specification, accepted and measured by the Contract Administrator.

Items of Work:

- i) Installation of Conduit in Open Trench – Single
 - ii) Installation of Conduit in Open Trench – Double
 - iii) Installation of Conduit by Directional Boring –Single
 - iv) Installation of Conduit by Directional Boring – Double
- .2 The length of conduit installed shall be measured horizontally between the centre points of the specified terminal points of the conduit. Installed conduit shall be measured along the path of installation.
 - .3 In cases where conduit installation includes more than two parallel conduits within the same open trench or bore hole, the installation of conduit shall be measured and paid by according to the methodology shown in the following table. The table provided applies to the Installation of Conduit in Open Trench and Directional Boring.

Conduits Installed	Items of Work Measured and Paid
One (1) Conduit x meters in length	x meters - Installation of Conduit - Single
Two (2) Conduit x meters in length	x meters - Installation of Conduit - Double
Three (3) Conduit x meters in length	x meters - Installation of Conduit - Double

	x meters - Installation of Conduit - Single
Four (4) Conduit x meters in length	x meters - Installation of Conduit - Double x meters - Installation of Conduit - Double
Five (5) Conduit x meters in length	x meters - Installation of Conduit - Double x meters - Installation of Conduit - Double x meters - Installation of Conduit - Single
Six (6) Conduit x meters in length	x meters - Installation of Conduit - Double x meters - Installation of Conduit - Double x meters - Installation of Conduit - Double

- .4 Installation of more than six (6) conduit shall be measured and paid with a similar methodology as described in the table.
- .5 No measurement or payment shall be made for Joining of Conduit.
- .6 No measurement or payment shall be made for the removal of blockages or water from the conduit unless the Contract Administrator determines that the cause of the blockage or water was not caused by the Contractor.
- .7 No measurement or payment shall be made for Manitoba Hydro safety watches.
- .8 No measurement or payment shall be made for the repair of conduit that is damaged by the Contractor and cannot accept wiring. This includes work and materials to remove pavement, excavate, and restoration of the cut.

4.12 Installation of Conduit into Existing Concrete Bases

- .1 Installation of Conduit into Existing Concrete Bases shall be measured on a unit basis and paid for at the Contract Unit Price per unit for "Installation of Conduit into Existing Concrete Base". The number of units to be paid for shall be the total number of drilled entrance points with conduit(s) installed in accordance with this specification, accepted and measured by the Contract Administrator.
- .2 Where multiple conduit are installed into a single drilled hole, measurement and payment will be according to the number of holes drilled.

4.13 Installation of Conduit into Existing Utility Manholes and Service Boxes

- .1 Installation of Conduit into Existing Manholes and Service Boxes shall be measured on a unit basis and paid for at the Contract Unit Price per unit for the “Items of Work” listed below. The number of units to be paid for shall be the total number of drilled entrance points with conduit(s) installed in accordance with this Specification, accepted and measured by the Contract Administrator.

Items of Work:

- i) Installation of Conduit into Utility Manholes
 - ii) Installation of Conduit into Traffic Signal Service Boxes
- .2 Where multiple conduits are installed into a single drilled hole, measurement and payment shall be the number of holes drilled.
- .3 Charges for associated work by utilities, under these items shall be paid by The City of Winnipeg, except for safety watches by Manitoba Hydro.

4.14 Installation of Ground Rods (Electrodes)

- .1 Ground rods (electrodes) shall be measured on a unit basis and paid for at the Contract Unit Price per unit for “Ground Rods (Electrodes)”. The number of units to be paid for shall be the total number of ground rods (electrodes) completed in accordance with this specification, accepted and measured by the Contract Administrator.

4.15 Cutovers

- .1 Cutovers shall be measured on a unit basis and paid for at the Contract Unit Price per unit for “Cutovers”. The number of units to be paid for shall be the total number of Cutovers completed in accordance with this specification, accepted and measured by the Contract Administrator.
- .2 Payment for “Cutovers” includes up to eight (8) hours standby time for others to complete tasks associated with cutovers.
- .3 No measurement or payment shall be made for Manitoba Hydro safety watches.
- .4 An additional Cutover shall apply for each new Cutover coupling point that is greater than 3 meters from another new Cutover coupling point; measured from butt ends of the coupled conduit to the other butt end of the other coupled conduit.
- .5 Payment for “Cutovers” includes excavation, backfill, and the coupling of existing ducts to other new or existing ducts.

4.16 Saw cutting and Sealing for Vehicle Detector Loops

- .1 Saw cutting and Sealing for Vehicle Detector Loops shall be measured on a length basis and paid for at the Contract Unit price per metre for “Saw cutting and Sealing for Vehicle Detector Loops”. The length to be paid for shall be the total number of metres cut in place and sealed in accordance with this specification, accepted and measured by the Contract Administrator.
- .2 Measurement of saw cutting and sealing includes only the length of saw cuts within which the loop and lead-in wires are installed.
- .3 No measurement or payments shall be made for the installation of the first detector lead-in conduit for each detector loop array.