CONSTRUCTION SPECIFICATION FOR MANHOLES, CATCH BASINS AND DITCH INLETS

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407.01 SCOPE

This specification covers the requirements for constructing, rebuilding, adjusting, and breaking into manholes, catch basins, and ditch inlets. Also covered is breaking into culverts and sewers.

407.02 REFERENCES

This specification makes references to the following standards, specifications, and publications:

Ministry Construction Specifications:

Form 206 - Grading
Form 353 - Concrete Curb and Gutter Systems
Form 501 - Compacting
Form 510 - The Demolition and Removal of Structures
Form 902 - Excavating and Backfilling Structures
Form 904 - Concrete Structures

Ministry Material Specifications:

Form 1004 - Aggregates - Mortar Sand
Form 1010 - Aggregates, Granular A, B, C, D, and 16 mm Crushed Type B, and Select Subgrade Material
Form 1301 - Portland Cement
Form 1302 - Water
Form 1350 - Concrete (Materials and Production)
Form 1351 - Components for Precast Reinforced Concrete Catch Basins, Manholes and Ditch Inlets
Form 1440 - Steel Reinforcement for Concrete
Form 1801 - Corrugated Steel Pipe Products
Form 1850 - Frames, Grates, Manhole Covers, and Lift Rings

CSA Standards:

CSA W59 - 77 - Welded Steel Construction (Metal Arc Welding)

CSA S157 - 69 - The Structural Use of Aluminum in Buildings

CSA G40.21 - M1981 - Structural Quality Steel

CSA G164 - M81 - Hot Dip Galvanizing of Irregularly Shaped Articles

CSA W47.1 - 73 - Certification of Companies for Fusion Welding of Steel Structures

Other:

ANSI/ASTM A307 - 80 - Low Carbon Steel Externally and Internally Threaded Standard Fasteners

CGSB-1-GP-18M - 1974 - Standard for Coating Zinc Rich Organic Ready - Mixed

407.03 DEFINITIONS

For the purpose of this specification, the following definitions apply:

Existing Rock Surface: means the rock surface as measured after removal of overburden, but before rock excavation.

407.05 MATERIALS

407.05.01 Concrete

Cast-in-place concrete shall conform to the requirements of Form 1350.

407.05.02 Precast Reinforced Concrete Manholes, Catch Basins, and Ditch Inlet Components for Both Precast Concrete Units, and Corrugated Steel Pipe Units

Precast units shall conform to the requirements of Form 1351.

407.05.03 Corrugated Steel Pipe Manhole, Catch Basin and Ditch Inlet Units

Corrugated steel pipe units shall conform to the requirements of Form 1801.

407.05.04 Steel Reinforcement

Steel reinforcement shall conform to the requirements of Form 1440.

407.05.05 Manhole Steps

Manhole steps shall conform to the requirements of Form 1351.

407.05.06 Bricks

Bricks shall be concrete or hard burned clay suitable for exterior application.

407.05.07 Precast Concrete Adjustment Units

Precast concrete adjustment units shall conform to the requirements of Form 1351.

407.05.08 Frames, Grates, Covers, and Lift Rings

Frames, grates, covers, and lift rings shall conform to the requirements of Form 1850.

407.05.09 Granular Material

Granular material for bedding and backfill shall be the type specified in the contract, and shall conform to the requirements of Form 1010.

407.05.10 Polyethylene Foam Gaskets

Polyethylene foam gaskets shall be 50 mm wide and shall have an uncompressed thickness of 40 mm.

407.05.11 Mortar

Mortar shall be composed of one part normal Portland cement meeting the requirements of Form 1301, and two parts masonry sand meeting the requirements of Form 1004, wetted with only sufficient water meeting the requirements of Form 1302 to make the mixture plastic.

407.05.12 Zinc Rich Paint

Zinc rich paint shall conform to the requirements of CGSB-1-GP-181 M.

407.07 CONSTRUCTION

407.07.01 Excavation

407.07.01.01 Excavation for Manholes, Catch Basins & Ditch Inlets

Excavation for manholes, catch basins and ditch inlets shall be performed at the locations, and to the dimensions specified in the contract, including excavation required for granular backfill.

407.07.01.02 Tolerances

The Ministry may raise or lower the elevation of the invert or grate of a manhole, catch basin, or ditch inlet by 150 mm, and any change within this limit shall not constitute a change in the character of the work. Bedding elevations would be adjusted accordingly.

407.07.01.03 Overexcavation

Overexcavation shall be backfilled with a material suitable for the particular application and on the approval of the Engineer. This material shall be compacted to the density required by Form 501 where materials other than concrete have been used.

407.07.01.04 Surplus Excavated Material

Excavated materials, which cannot be incorporated into the work, shall be disposed of according to the requirements of Form 206.

407.07.02 Options

The following options are available to the Contractor:

1) If rigid pipe, or plastic pipe is specified in the contract, or selected by the Contractor, either cast-in-place concrete, or precast concrete manholes, catch basins, or ditch inlets may be chosen.

2) If corrugated steel pipes are installed, the manholes, catch basins, or ditch inlets may be constructed, or installed as selected by the Contractor, from among the following choices: cast-in-place concrete, precast concrete or corrugated steel pipe.

   Where corrugated steel pipes are larger than 1200 mm in diameter, corrugated steel pipe manholes may be installed, except where any of the conditions listed in (4) following prevail.

3) If the Contractor elects to use precast construction, he may choose a design with the base cast as a separate component, or cast monolithic with the riser.

4) Where concrete pipes are specified in the contract, or selected by the Contractor for pipe sizes, 1200 mm or greater, concrete manhole tees with concrete manhole risers may not be selected when any of the following situations prevail:

   a) where a size change is required;

   b) where a change in longitudinal grade is required;

   c) where a change in direction is required.

407.07.03 Aluminum Safety Grating

Aluminum safety grating shall be installed as specified in the contract.

407.07.04 Cast-in-Place Construction

The forming, placing, finishing, curing, and protection of concrete, shall conform to the requirements of Form 904.

407.07.05 Precast Construction

The base shall be set level to the specified grade and shall have uniform overall contact with the underlying foundation. In rock excavations, a minimum of 0.3 m of granular material shall be placed under the base.

The inlet and outlet pipes shall be located fully within the lower riser section unless it is impractical, in which case the Contractor may request approval from the Engineer to allow the joint to fall within the limits of the pipe.

For manholes and catch basins larger than 1200 mm in diameter, the Contractor may use a transition cone or slab to reduce the barrel above the inlet and outlet pipes to 1200 mm. If a slab is chosen, a minimum height of 2 m shall be left between the bottom of the transition slab and the top of the floor slab, or invert of benching.

The manhole sections shall be installed with the ladder rungs on the free wall forming a continuous ladder.

The Contractor may use either a tapered cone or a flat slab top for supporting the manhole frame and cover/grate.

407.07.06 Corrugated Steel Pipe Construction

407.07.06.01 Concrete Base

The concrete base shall be cast-in-place and the manhole and catch basin riser shall be installed and inserted into the base before the concrete has set.

407.07.06.02 Saddle Connection

The saddle plate shall be welded to the CSP manhole, and welded or bolted to the sewer pipe.

407.07.06.03 Top Slab

Construction shall be of cast-if-place, or precast, the groove in the underside of the precast slab shall be sealed by a polyethylene foam gasket as specified in the contract.

407.07.06.04 Welding

All welds shall conform to the requirements of CSA W59, and shall be painted with two coats of zinc-rich paint conforming to the requirements of CGSB-1-GP181 M.

407.07.07 Installation of Inlet or Outlet Pipe

407.07.07.01 Concrete, Clay or Plastic Pipe

Pipe or tile placed in the walls for inlet or outlet connections shall extend through the wall a sufficient distance to allow for connections. The pipes shall be trimmed flush with the inside wall and shall be securely sealed into place using mortar.

407.07.07.02 Corrugated Steel Pipe

The inlet and outlet pipe shall be inserted into the riser a minimum of 15 mm and the edges bent back. The pipes shall then be welded to the inside and the outside of the riser, and the welded areas shall be painted with two applications of zinc rich paint.

407.07.08 Granular Backfill

Once the manhole, catch basin, or ditch inlet has been constructed, the excavation surrounding the exterior of the unit shall be filled with granular material to a minimum thickness of 0.3 m around all sides of the unit. The granular material shall be deposited in layers, and compacted to the requirements of Form 501, and each compacted layer shall not exceed 0.15 m in depth.

407.07.09 Installation of Frames, Grates or Covers

The manholes and catch basins shall be constructed or installed so that the surface on which the mortar bed is to be placed is at least 75 mm but not more than 150 mm below the bottom of the frame and grate, or frame and cover assembly.

Frames for grates or covers on manholes and catch basins shall be set in a full mortar bed.

Bricks or precast concrete adjustment units may be used to set the frames and grates or frames and covers of manholes and catch basins at the required position and elevation. The inside and outside surfaces of the bricks shall be parged with a 12 mm thick mortar coat.

Gratings for ditch inlets shall be installed and fastened down as specified in the contract.

Frames and grates which are within the flow lines of the curb and gutter system shall be installed in accordance with Form 353 and shall not be part of the work of constructing cast-in-place manholes or catch basins or supplying and installing pre-cast manholes and catch basins.

407.07.10 Cleanout of Manholes, Catch Basins and Ditch Inlets

During the progress of the work and until the completion and final acceptance, manholes, catch basins, and ditch inlets shall be kept clean.

407.07.11 Adjustment and Rebuilding of Manholes, Catch Basins and Ditch Inlets

407.07.11.01 General

The work to be carried out shall include changes of elevation of any of the above structures, regardless of type or size.

Prior to adjustment or rebuilding, the existing frame and grate or cover shall be removed and salvaged. Once a manhole, catch basin or ditch inlet has been adjusted or rebuilt, the salvaged or new frame and grate or cover shall be set to the correct elevation on the adjusted or rebuilt structure.

When manhole covers are to be raised only to accommodate resurfacing of the adjacent pavement, the Contractor may use manhole cover lift rings to raise the manhole cover a sufficient height to accommodate the thickness of resurfacing material.

Bricks may be used to raise structures by a maximum of 0.3 m which includes any extension of structures previously constructed using bricks. Precast adjustment units may be used to raise structures a maximum of 1.0 m which includes the extension of structures previously constructed using precast adjustment units. Where bricks are used, they shall be parged inside and outside with a 12 mm thick mortar coat.

All existing mortar and brick work shall be removed from the top of the existing structures prior to adjustment or rebuilding with precast concrete adjustment units.

Additional manhole steps shall be required when the distance from the adjusted elevation of the structure to the first step would be in excess of 0.6 m.

Where bituminous or concrete pavement must be removed to adjust or rebuild a structure, the pavement shall be removed according to the requirements of Form 510.

407.07.11.02 Cast-in-Place Units

Adjustment

The adjustment of manholes, catch basins, or ditch inlets by raising will apply where the tops are to be raised by 1.0 m or less.

The adjustment of manholes, catch basins, or ditch inlets by lowering will apply when the tops may be lowered to the required elevation by the removal of bricks, the removal of concrete adjustment units, the removal of the mortar bed in which the frame was set, and by the removal of a maximum of 50 mm of the concrete walls of the structures.

Where tops are to be lowered, the concrete shall be carefully removed to the required elevation.

Rebuilding

The rebuilding of manholes, catch basins or ditch inlets will apply when the top of the structure is to be lowered more than 50 mm or is to be raised more than 1.0 m.

To lower the tops of structures with upper frustum sections, the concrete in the structures shall be removed for the entire depth of the frustum plus as much of the straight wall sections as is necessary. The upper section of the structures shall then be rebuilt with standard frustums.

To lower the tops of straight walled structures, the upper sections of concrete shall be removed.

To raise the tops of structures with upper frustum sections, the concrete in the structures shall be removed for the entire depth of the frustums. The upper sections, including straight walls and the frustum, shall then be rebuilt.

To raise the top of straight walled structures, the existing walls shall be extended upward in concrete.

Where cast-in-place units are to be raised with cast-in-place concrete, the top surfaces of all existing walls shall be roughened before the walls are extended upwards.

407.07.11.03 Precast Units Adjustment

Adjustment

The adjustment of precast manholes, catch basins, or ditch inlets by raising will apply where the tops are to be raised by 1.0 m or less.

The adjustment of manholes, catch basins, or ditch inlets by lowering shall only apply where the tops may be lowered to the required elevation by the removal of bricks, the removal of concrete adjustment units, and/or the removal of the mortar beds in which the frames were set.

Concrete adjustment units, bricks, or manhole cover lift rings shall be removed or added, as required to adjust the structures to the proper elevations.

Rebuilding

Where the tops are to be lowered, or raised in excess of 1.0 m, the top sections of the precast manholes shall be removed, and riser sections of suitable heights shall be removed, substituted for, or added. The existing top sections may be repositioned or replaced by suitable substitutes.

407.07.11.04 Corrugated Steel Pipe Units

Adjustment

Adjustment of corrugated steel pipe manholes, catch basins, or ditch inlets by raising will apply where the top is to be raised by 1.0 m or less.

Adjustment of manholes, catch basins or ditch inlets by lowering shall only apply where the top may be lowered to the required elevation by the removal of bricks, the removal of concrete adjustment units, and/or the removal of the mortar bed in which the frame was set.

Concrete adjustment units, bricks or manhole cover lift rings shall be removed or added as required, to adjust the structure to the proper elevation.

Rebuilding

Where the top is to be lowered, or is to be raised in excess of 1.0 m, the unit shall be rebuilt as follows:

In a structure with an upper frustum section, the frustum shall be removed and a riser section of suitable height shall be removed or added. If the unit is to be raised, the additional riser section shall be welded to the existing riser section. The frustum shall be repositioned, and welded to the riser.

In a flat cap section, the flat cap and polyethylene foam gasket shall be removed, and the flat cap shall be salvaged. If the unit is to be raised, an additional riser section shall be welded as required to the existing riser section; if the unit is to be lowered, a section of the riser shall be removed equal to the required amount of adjustment. The flat cap shall be repositioned and a new polyethylene foam gasket shall be placed.

All welds shall be painted with two applications of zinc rich paint.

407.07.12 Breaking into Manholes, Catch Basins, Ditch Inlets, Culverts and Sewers

Under this item, the Contractor shall make whatever size openings are necessary in the walls of any of the above mentioned structures, and install connecting pipe as specified in Sub-section 407.07.07 of this specification.

407.09 MEASUREMENT FOR PAYMENT

407.09.01 Manholes, Catch Basins and Ditch Inlets

Measurement of the number of manholes, catch basins, and ditch inlets is by Plan Quantity, as may be revised by Adjusted Plan Quantity.

407.09.02 Adjusting and Rebuilding Manholes, Catch Basins and Ditch Inlets

Measurement of the number of manholes, catch basins, and ditch inlets for adjusting and rebuilding is by Plan Quantity, as may be revised by Adjusted Plan Quantity.

407.09.03 Breaking into Manholes, Catch Basins, Ditch Inlets, Culverts and Sewers

Measurement of the number of openings into manholes, catch basins, ditch inlets, culverts, and sewers is by Plan Quantity, as may be revised by Adjusted Plan Quantity.

407.09.04 Rock Excavation

Measurement of rock excavation for sewers, manholes, catch basins, and ditch inlets is by Plan Quantity, as may be revised by Adjusted Plan Quantity, of the volume in cubic metres below the upper limit. The upper limit is the existing rock surface, or the lowest elevation of all other excavation indicated in the contract, whichever is lower:

The volume of boulders in an excavation shall be determined on the basis of the three maximum rectilinear dimensions. Where boulders classified as rock are measured for payment, only the amount actually removed shall be considered for payment. The total volume or rock considered for payment shall not exceed the volume of excavation within the theoretical lines.

407.09.05 Classification of Materials

Material will be classified in accordance with the description of Earth and Rock in Form 206.

407.10 BASIS OF PAYMENT

407.10.01 Manholes, Catch Basins and Ditch Inlets

Payment at the contract price for the various tender items, "Manholes, Catch Basins and Ditch Inlets" shall be full compensation for all labour, equipment, and materials; for all earth excavation; for the removal of pavement except where there is a separate item for pavement removal which overlaps pavement removal required for placement of manholes, catch basins, and ditch inlets; for the disposal of surplus excavated materials for the placing and compacting of granular bedding and backfill; for the construction or installation of the cast-in-place, precast or corrugated steel pipe units, and for the installation of inlet and outlet pipe, for the installation of concrete manhole tees with concrete risers, for the installation of corrugated steel pipe manholes with saddle plates and corrugated steel pipe risers and sewers larger than riser; for the installation of the frame and grate or frame and cover; for the placing

of the full mortar bed; for the placing and parging of bricks; and the placing of precast concrete adjustment units - except where such installations are part of the work of constructing curb and gutter for all other work necessary to complete the structure in accordance with the contract.

407.10.02 Adjusting and Rebuilding Manholes, Catch Basins and Ditch Inlets

Payment at the contract price for the tender item "Adjusting and Rebuilding Manholes, Catch Basins, and Ditch Inlets" shall be full compensation for all labour, equipment, and materials for the removal and disposal of bituminous or concrete pavement where required, for all necessary excavation, including removal of any concrete and disposal of surplus excavated material, for handling, placing, and compacting of backfill materials, for salvaging and installing the frame and grate cover, for all protection required against the elements, and for all other items of work necessary for the satisfactory completion of the work, except for the removal of asphalt or concrete curb and gutter, which work shall be paid for at the contract price(s) for the item(s) concerned.

407.10.03 Breaking into Manholes, Catch Basins, Ditch Inlets, Culverts and Sewers

Payment at the contract price for the tender item "Breaking into Manholes, Catch Basins, Ditch Inlets, Culverts and Sewers" shall be full compensation for all labour, equipment and material for providing openings and installing connecting pipes.

407.10.04 Rock Excavation

When the contract contains an item for rock excavation for sewers, manholes, catch basins, and ditch inlets, payment at the contract price for rock excavation shall be full compensation for all labour, equipment, and material required to excavate the rock.

407.10.05 Overexcavation

Payment will not be made for any overexcavation not directed by the Engineer, and the backfill of such excavation.

Where overexcavation has been directed by the Engineer, payment for the overexcavation and backfilling such overexcavation shall be made according to the requirements of Form 100, Section 103-3, "Extra Work".

407.10.06 Payment Tolerances

Revisions to payment will not be made for variations in depth specified in clause 407.07.01.02.