

**CITY OF DURBAN**

**STANDARD ENGINEERING SPECIFICATION**

**PART "PH"**

**MANHOLES AND APPURTENANT DRAINAGE WORKS**

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## **PART PH**

### **MANHOLES AND APPURTENANT DRAINAGE WORKS**

#### **PH.1      SCOPE**

This specification covers requirements for the provision of manholes, stormwater inlets and various appurtenant works associated with drainage works.

#### **PH.2      INTERPRETATIONS**

##### **PH.2.1      Supporting Specifications**

The following standards are referred to in this specification:

S.A.B.S. 558 - Cast iron surface boxes and manhole and inspection covers and frames;

S.A.B.S. 677 - Concrete non-pressure pipes;

S.A.B.S. 1294 - Precast concrete manhole sections and slabs;

S.A.B.S. 1083 - Aggregates from natural sources;

All as published by General Notice 463 dated 9 July 1982.

S.A.B.S. 1215 - Concrete masonry units published in Government Notice 2636 dated 30 November 1984.

S.A.B.S. 227 - Burnt clay masonry units published in Government Notice 936 dated 16 May 1986.

B.S. 915 - High Alumina Cement

#### **PH.3      MATERIALS**

##### **PH.3.1      Bricks**

Clay units for foul-water and stormwater sewer manholes, stormwater inlets and inspection chambers shall be category Non-Facing Extra with an average compressive strength of 28 MPa i.e. NFX-E28 or similar suitable for use in manholes. They shall be thoroughly burnt throughout and free from flaws, stones, cracks and unground lumps.

Solid concrete masonry units for stormwater manholes and inlets shall have a minimum nominal compressive strength of 21 MPa.

All units shall be regular in shape, uniform in size (226 mm by 106 mm by 73 mm) and colour, with straight sharp arrises and even surface.

PH.3        MATERIALS (Cont'd)

PH.3.2     Precast Concrete Components

PH.3.2.1   Manholes

PH.3.2.1.1 General

Unless otherwise shown on the drawings or stated in the schedule of quantities, precast concrete standard manholes shall have a nominal internal diameter of 1 000 mm.

Details of the components of standard manholes are shown on standard drawings 38574 for foul-water sewers and 38570 for stormwater sewers.

Manhole components shall comply with the requirements of S.A.B.S. 1294.

PH.3.2.1.2 Sections

In addition to the requirements of S.A.B.S. 1294, manhole sections shall be formed by the spinning process.

The minimum cover to the reinforcement shall be 20 mm, and the joints shall be the interlocking self centering type.

Lifting holes are not permitted and no step irons are required.

PH.3.2.1.3 Covers, Frames and Circular Adapters

There are 4 types of precast concrete covers and frames used with the standard manhole :

- Type 1 : circular light duty cover and frame.
- Type 2 : circular heavy duty cover and frame.
- Type 3 : square light duty cover and frame.
- Type 4 : square heavy duty cover and frame.

Types 1 and 2 fit directly onto the manhole sections.  
Types 3 and 4 require a circular adapter slab.

For manholes of nominal diameter greater than the 1 000 mm standard manhole adapter slabs will be required for all types including cast iron covers and frames.

PH.3.2.2   Stormwater Inlet Slabs and Covers

Details of precast concrete stormwater inlet slabs and covers are shown on standard drawings 38572 and 38573.

PH.3        MATERIALS (Cont'd)

PH.3.2     Precast Concrete Components (Cont'd)

PH.3.2.2   Stormwater Inlet Slabs and Covers (Cont'd)

The slabs and covers shall be constructed in accordance with the relevant requirements of Departmental Specification Part "C" - Concrete.

Concrete shall be grade 35/13. The minimum cover to the main reinforcement shall be 30 mm. The upper and exposed surfaces shall have a class 3(a) smooth finish, and the finish from a steel mould in good condition is acceptable.

All surfaces and edges shall be free from imperfections that impair the serviceability of the slabs. The faces shall be true and free from twist. All arrises (other than those shown as being rounded) shall be clean and sharp. There shall be no patching of defective surfaces or edges and the slabs and covers shall be of uniform colour.

The tolerance on the dimensions as indicated on the drawing shall be  $\pm 1$  mm.

PH.3.3     Cast Iron Manhole, Surface Box and Inspection Covers and Frames

Cast iron manhole, surface box and inspection covers and frames shall comply with the requirements of S.A.B.S. 558.

The covers and frames are to be suitable for use in a corrosive atmosphere, coated with bitumen paint and without chain staples and chains.

The manhole covers and frames shall be to the standard Durban Corporation pattern with the words "D.C. Sewer" or "D.C. Stormwater" cast into the cover.

Foul-water sewer manhole covers and frames shall be Type 2A of S.A.B.S. 558 and stormwater covers and frames Type 2B.

The cavity under the Type 2A foul-water sewer manhole cover and frame shall be completely filled with grade 15/26 concrete.

PH.3.4     Cement Mortar

Cement mortar for brickwork and plasterwork shall be composed of one part of cement to 3 parts of sand.

PH.3.5     High Alumina Cement

High alumina cement shall comply with the requirements of B.S.915 and its use shall be in accordance with the manufacturer's recommendations.

PH.3        MATERIALS (Cont'd)

PH.3.6      Precast Concrete Manhole Section Joints

PH.3.6.1    Tape

Tape joints shall consist of low density polyethylene coated with a polyisobutylene pressure sensitive adhesive and conform to the following specification:

overall width	150 mm
overall thickness	0,3 mm
tensile strength	15 MPa (minimum)
elongation at break	300%
adhesion to steel	1,5 N/mm of width (minimum)
adhesion to self	1,0 N/mm of width (minimum)
temperature performance	20° to 60°C

PH.3.6.2    Flexible Sealant

Flexible sealant shall be 'Bitujoint' or similar approved.

PH.3.7      Stormwater Inlet Spacer Block

The spacer block used in stormwater inlets shall consist of a 150 diameter x 180 mm long normal duty class U.P.V.C. pipe filled with 20/13 grade concrete.

PH.4        PLANT

The Contractor will be required to provide suitable plant to enable the manhole components to be carefully off-loaded and placed in their final position. Manhole sections shall not be rolled on the ground.

Any items subjected to shock, bumps, rough handling or damaged during transit or handling shall be rejected by the Engineer. Particular care must be taken to protect the jointing surfaces.

PH.5        CONSTRUCTION

PH.5.1      General

The Contractor shall build the various manholes, inlets, and appurtenant foul-water and stormwater structures as detailed either on the drawings, or where directed by the Engineer.

PH.5        CONSTRUCTION (Cont'd)

PH.5.1      General (Cont'd)

Except where specifically detailed on the drawings exposed ends of pipes built into drainage structures should be, where practicable, uncut butt ends set flush with the inside face of the wall. No full collars will be allowed on the inside face of the wall.

PH.5.2      Excavation

The excavation and backfilling of manholes, stormwater inlets and appurtenant structures shall be undertaken in accordance with the relevant clauses of Departmental Specification Part "DD" - Earthworks for Structures pertaining to construction, which must be read in conjunction with this specification.

PH.5.3      Foundations

No concrete or other material shall be placed in the excavation until the bottom has been compacted to 95% Mod. A.A.S.H.T.O. density, cleaned, inspected and passed by the Engineer. The excavation must be kept free of water at all times.

Where the material at the founding level is soft material, or hard material which deteriorates rapidly on exposure, excavation to final level shall not be made until just before the Contractor is ready to place the foundation.

All foundation slabs shall be constructed in low-slump grade 25/26 vibrated concrete to the sizes and thickness shown on the drawings.

The foundation and partial benching to the precast concrete ring manholes shall be cast monolithically. Where the pipes enter and exit the manhole these shall be cast integrally into the concrete base and care must be taken to ensure a watertight joint between the manhole and the pipe.

With low slump concrete additional compactive effort will be required to ensure the concrete is free from honey-combing and planes of weakness.

Every U.P.V.C. pipe built into a manhole shall have clean dry sand complying with S.A.B.S. 1083 glued to its outside as recommended by the pipe manufacturer using special P.V.C. cement (Heinkel S.A. (Pty) Limited, Tangit or equal approved) to ensure good adhesion to the base concrete.



PH.5 CONSTRUCTION (Cont'd)

PH.5.4 Precast Concrete Manhole Sections

The first precast concrete manhole ring is to be bedded firmly into the wet concrete foundation and set true to level such that the completed manhole will be vertical. Care shall be taken in placing the first manhole ring to ensure that the joint is suitably mortared up on the outside to form a watertight joint. A minimum clearance of 50 mm is to be maintained between the bottom of the ring and the top of any built-in sewer pipe.

The precast concrete manhole sections and adaptor cover slab shall be carefully and firmly bedded on a continuous layer of 'Bitujoint' or similar approved jointing materials so as to ensure a watertight joint of approximately 5 mm all round.

The ends of the manhole sections must be dried and then coated with a suitable primer for the type of jointing material to be used, all in accordance with the manufacturer's instructions. The joint shall be neatly finished flush with the inner surfaces.

Care is to be taken to ensure the right end of the manhole sections, i.e. male, are uppermost.

The sections shall be selected and fitted such that the horizontal projection of the bearing surface between adjacent sections shall not be less than the minimum wall thickness as specified in S.A.B.S. 1294. Furthermore there shall be no lips between adjacent mating sections exceeding 5 mm.

In cases where there is a high water table and/or a deep manhole and there is a possibility of infiltration, the Engineer may order that tape be applied to the joints on the outside of the manhole. In such cases a single layer of tape shall be applied to the clean concrete surface, which shall be dry and free from grease, oil or other contaminants and which has been primed with a suitable, approved, primer evenly applied to the manufacturer's recommended specification. When the primer is dry, but tacky, the tape shall be applied to give a wrinkle free wrapped joint.

PH.5.5 Brick Manholes and Stormwater Inlets

Details of brick manholes are shown on drawings 38571, 38572 and 38573.

Brickwork shall be built as shown on the drawings or as ordered by the Engineer. It shall be well and regularly bonded in double stretcher bond in cement mortar with no false headers using only whole bricks except where required as closers.

All bricks shall be thoroughly damped before laying and each brick is to be laid with full joints and pressed into its bed so as to squeeze out surplus mortar and give a finished joint not exceeding 10 mm except in the case of special courses when the thickness of the joint shall be 15 mm maximum. All joints to be horizontal or vertical and, notwithstanding any trade custom to the contrary, are to be filled solid with mortar for their full width and depth, each course being flushed with mortar worked well down into all vertical joints before the succeeding course is laid.

PH.5 CONSTRUCTION (Cont'd)

PH.5.5 Brick Manholes and Stormwater Inlets (Cont'd)

When work is stopped at the end of the day, all joints on the exposed bedding plan shall be raked out to a depth of 25 mm to allow a key for the next course.

The internal surface of a brick manhole and stormwater inlet shall be of solid concrete masonry face units having a minimum nominal compressive strength of 21 MPa or selected hard burnt bricks without projections and the joints shall be pointed smooth, polished and flush.

When there is a possibility of infiltration, the Engineer may order that the outside surface of sewer manholes be given two coats of plaster, each coat consisting of 1:3 cement mortar at least 10 mm thick. The outer coat shall be steel trowelled to provide an impervious surface. When ordered, plastered work shall have the joints of the brickwork raked out to a depth of 15 mm to form a key for the plaster.

When a pipe enters a manhole or inlet it shall be thoroughly caulked into the wall with a low slump mix of 1:3 cement mortar to ensure a watertight joint between the pipe and the manhole.

The cast in-situ reinforced concrete manhole adaptor slab shall be concrete grade 25/13 with a class 1 ordinary finish, cast in one operation and conforming to Departmental Specification Part "C" - Concrete.

PH.5.6 In-situ Reinforced Concrete Manholes

PH.5.6.1 General

In-situ reinforced concrete manholes shall conform to the requirements of Departmental Specification Part "C" - Concrete and shall be constructed in accordance with the details given on the drawings.

A blinding layer of grade 15/26 concrete shall be laid prior to laying the foundation. The minimum cover to the reinforcement shall be 50 mm.

All pipes entering the manholes shall be cast in-situ with the concrete. The use of 'windows' is not permitted.

The manhole is required to be watertight and special care shall be taken by the Contractor to ensure watertightness especially at the construction joints and around the pipes.

PH.5.6.2 Concrete Finishes

The classification of the concrete finishes required in accordance with clauses C.5.3 and C.5.4 of Departmental Specification Part "C" - Concrete shall be -

(a) Clause C.5.3. : Formed Concrete Surface Finishes

- (i) all external faces : class 1 - ordinary finish;
- (ii) all internal faces of walls and roof slabs - class 2 - rubbed finish;

PH.5            CONSTRUCTION (Cont'd)

PH.5.6.2      Concrete Finishes (Cont'd)

(a)    Clause C.5.3. : Formed Concrete Surface Finishes

- (iii)   rendering to benching as detailed in clause PH.5.8.5 - class 5 - applied finish.

(b)    Clause C.5.4 : Concrete Upper Surface Finish

- (i)     manhole bases - class 2 - broomed finish;
- (ii)    manhole roof slabs - class 3 - wood float finish.

PH.5.7        Minor Drainage Structures

The concrete work in drainage structures shall include all concrete in the construction of inlets, headwalls and similar small concrete drainage structures. Typical structural details of the work are indicated on the drawings.

All concrete materials, mixing and placing shall be in accordance with Departmental Specification Part "C" - Concrete and with the mix proportions and concrete finishes as specified on the drawings. The workmanship for brickwork shall be as specified in clause PH.5.5.

PH.5.8        Benching, Inverts and Rendering

PH.5.8.1      General

Completion of all benching shall be formed in grade 20/13 concrete, laid to the correct slopes and shapes and thoroughly compacted. The contact surfaces on the floor and side walls shall be thoroughly cleaned and wetted, and a cement grout applied which shall be brushed in immediately before the concrete benching is placed.

The main line channel shall be laid at the grade determined from a straight line between the inverts of the incoming and outgoing pipes. A minimum of 5 mm of fall shall be provided, within the manhole, between the invert of any incoming secondary pipe and its point of connection with the main pipe line.

At truck main manholes whenever there is a change of direction or a junction occurs, a minimum fall of 25 mm, or as indicated on the drawings, shall be provided in the channel to compensate for head losses in the manhole.

PH.5.8.2      Foul-water Sewer Channel Sections

Wherever possible all foul-water sewer manhole inverts shall be formed with standard half-round channel sections of the same material as the sewer. These channels shall be laid in the benching concrete, the contact area of the manhole foundation having been previously roughened, washed and treated with cement grout. Care and attention to this aspect of the work is particularly important in wet ground to ensure that external water pressures do not tend to lift the channels.

PH.5      CONSTRUCTION (Cont'd)

PH.5.8.2      Foul-water Sewer Channel Sections (Cont'd)

The socket of the channel and the joint between channel sections shall be filled with high alumina cement 1:2 mortar and pointed to provide a glass smooth finish.

PH.5.8.3      Formed Inverts

In certain foul-water sewer manholes, junctions and changes in direction occur such that no standard channel sections can be cut to suit. In such cases and in all stormwater sewer manholes and inlets, a semi-circular channel invert shall be formed in the benching concrete by means of a properly shaped template.

The inverts shall be formed to the curves and junctions to suit the built-in pipes and to permit a steady flow through the invert without turbulence.

PH.5.8.4      Height of Benching

PH.5.8.4.1      Stormwater Manholes

In stormwater manholes and inlets, other than structures at the head of a pipeline, type A benching shall be brought up vertically to the level of the pipe soffit before being sloped uniformly at a grade of 1:5 back to the walls of the structure. The benching in stormwater manholes or inlets at the head of a pipeline may be scooped or dished to be free draining to the outgoing pipe without forming a semi-circular invert.

PH.5.8.4.2      Foul-water Sewer Manholes

There are 2 types of benching in foul-water manholes.

Type A benching shall be brought up vertically on each side of the channel to a height of one pipe diameter and Type B to a height of two pipe diameters above the invert before being sloped back towards the manhole wall at a grade of 1:5 all as shown on the drawings. Type A benching shall be used for all normal conditions of grade and small angles of deviation, and Type B shall be used in all cases where there is an approach grade into the manhole of 1:15 or steeper associated with a change of direction in the manhole of 30° or more.

PH.5.8.5.      Rendering to Benching

PH.5.8.5.1      Foul-water Sewer Manholes

Rendering to foul-water sewer manhole benching shall consist of one part high alumina cement to two parts sand, thoroughly mixed and applied to the concrete surfaces while the latter are still green. The thickness of the rendering shall not be less than 20 mm and the surface shall be steel trowelled to a glass-smooth uniform finish, neat cement being dusted on during the process. The top of the channel shall be rounded off to a radius of 25 mm. Care shall be taken to ensure that when completed, the surface is correctly cured.

PH.5            CONSTRUCTION (Cont'd)

PH.5.8.5.2    Stormwater Manholes, Inlets and Catchpits

Rendering to benching in all stormwater manholes, inlets, etc., shall consist of ordinary Portland cement mortar comprising one part cement to three parts sand, thoroughly mixed and applied to the concrete surfaces while the latter are still green. The rendering shall not be less than 20 mm thick and shall be steel trowelled to a glass-smooth uniform finish, neat cement being dusted on during the process. The top of the channel shall be rounded off to a radius of 25 mm.

PH.5.8.5.3    Curing

All rendered surfaces shall immediately after application be properly cured to prevent crazing or cracking. The rendering shall be kept thoroughly wet for 24 hours and damp for a further period of at least 3 days. Particular care must be taken in curing the H.A.C. rendering and the manufacturer's recommendations must be adhered to.

PH.5.9        Covers and Frames

PH.5.9.1      General

Unless either directed by the Engineer, indicated on the drawings or specified in the Project Specification, Part "AA", heavy duty cast iron covers and frames shall be used in roadways. Heavy duty concrete covers and square frames shall be used in footways, road verges, driveways and wherever light vehicular traffic may be expected.

Light duty concrete covers and frames or cover slabs shall be used in all other cases.

All manhole and inlet covers and frames in road reserves or other formed areas are to be set such that their levels conform accurately to the proposed or existing slopes and grades of the roads, footways or formed areas.

In general, inlet cover slabs and manhole covers and frames in paved areas shall be bedded with 3:1 cement mortar and set on 230 mm brickwork or grade 20/26 mass concrete to achieve the correct grades and levels.

Where manholes are located in areas such that the cover and frame are not required to conform to a fixed paved level, then the manhole cover level shall be set 50 mm above the existing ground level to prevent stormwater infiltration. In these locations, the cover and frame of a precast concrete manhole shall be set directly onto the manhole chamber or shaft section without the need of a manhole adaptor slab.

Unless otherwise directed by the Engineer the front face of the inlet slab shall be set 75 mm behind the kerb face and it shall conform accurately to the line, levels and grade of the kerb line.

PH.5 CONSTRUCTION (Cont'd)

PH.5.9.2. Manholes Situated in Road Reserves or Paved Areas

All manhole covers and frames in road reserves or other formed areas are to be set such that their finished levels conform accurately to the proposed or existing levels and grades of the roadway, footway or formed areas.

The procedure to be adopted to set the cast iron manhole cover and frame to level in asphalt surfacing shall be as follows :-

- (a) the manhole adaptor slab shall be brought up to the underside of the asphalt surfacing or within 200 mm of the finished paved level if the total surfacing layer thickness is less than 200 mm, and its location referenced by the Contractor;
- (b) the asphalt base course shall then be laid and compacted;
- (c) sufficient base course shall then be removed so that the manhole cover and frame can be set in 1:3 mortar on 230 mm brickwork or concrete spacer rings to the final paved surface level prior to laying the wearing course; and
- (d) any working space required to raise the cover and frame shall be backfilled with 10/25 concrete.

PH.5.10 Raising or Lowering of Existing Manhole Covers

Where an existing manhole is required to be raised or lowered the work shall be so carried out that the finished manhole complies with the applicable requirements of clause PH.5.9. Unless otherwise directed by the Engineer, the existing cover and frame shall be used.

PH.5.11 Ramps and Backdrops

When a foul-water sewer is designed to enter a manhole at a level higher than the invert level of the outgoing foul-water sewer in that manhole, a ramp or backdrop shall be constructed as detailed on the drawing 21701. The rodding eye shall be carried through to the manhole at the same gradient as the sewer from which the ramp or backdrop is taken off. In all cases where the ramp or backdrop occurs on a foul-water sewer having a grade of 1:10 or steeper, a rising rodding eye is to be used as detailed.

The ramp or backdrop pipes shall be fully encased with 150 mm grade 10/25 concrete.

PH.6 TOLERANCES

PH.6.1 Overall Centre Line Control and Manhole Locations

The permissible deviation of the location in plan of the centre line of the pipeline from the designated location shall not exceed 100 mm. This location will be treated as the control location for the purpose of locating intersections whether for manholes or stormwater inlets.

PH.6 TOLERANCES (Cont'd)

PH.6.1 Overall Centre Line Control and Manhole Locations (Cont'd)

Such manholes or stormwater inlets shall be constructed at the meeting points of intersecting pipelines subject to only such deviation as can be tolerated by the junction channels or specials to kerb lines in the case of stormwater inlets.

PH.6.2 Manhole and Stormwater Inlet Invert Levels

The maximum permissible deviation from the designated invert level at each manhole or stormwater inlet shall be 10 mm. However this permissible deviation shall be reduced to a value such that the gradient of the pipeline between any two successive manholes does not vary by more than 10% from the design gradient.

PH.6.3 Vertical Alignment of Manholes

A manhole shall be not more than  $\pm 15$  mm from the vertical.

PH.6.4 In-situ Reinforced Concrete and Brickwork Manhole and Inlet Structures

Degree II accuracy, as defined in clause C.6 of Departmental Specification Part "C" - Concrete shall apply to all elements of the structures except where there is conflict with the tolerance requirements of clause PH.6 - Tolerances in which case the latter shall apply.

PH.6.5 Cover and Frame Levels

The difference in level between the frame and the finished paved surface level adjacent to the frame shall not exceed -

2 mm in a roadway  
3 mm in a footway

PH.6.6 Stormwater Inlet Slabs

The finished level shall not differ by more than  $\pm 2$  mm from the design level.

The difference in level at the joint between two adjacent slabs shall not exceed 2 mm.

The front face of the inlet slab shall be parallel to and within 3 mm of the designated horizontal alignment.

PH.7 TESTING

PH.7.1 Foul-water Sewer Manholes

All foul-water sewer manholes shall be completely watertight on completion of construction. The Engineer may call for random watertightness tests to be carried out on any manhole. Any leaking or defective manholes shall be made good by the Contractor at his own expense.

PH.7            TESTING (Cont'd)

PH.7.1        Foul-water Sewer Manholes (Cont'd)

Where tests are ordered to be carried out, the Contractor shall supply all plugs, stoppers and other equipment and labour to seal the manhole and shall also supply, transport and dispose of the water used for the tests.

Tests shall be carried out by filling the manhole with water to the underside of the adaptor slab or frame of the manhole chamber whichever applies. After an initial period of 24 hours to allow for absorption, the drop in water level will be measured over a 24 hour period. The drop in water level during the test period shall not exceed 15 mm for each joint in a precast concrete manhole or 50 mm per metre depth of manhole for brickwork or cast in-situ concrete manholes.

Stormwater manholes will not be tested for watertightness unless specifically ordered by the Engineer.

PH.8            MEASUREMENT AND PAYMENT

PH.8.1        General

All standard manholes, inlets and appurtenant works will be scheduled by type and depth, and also by diameter in the case of precast concrete manholes and reference should be made to the standard drawings. The depth of manholes and inlets shall be measured from the invert level of the outgoing pipe to the top of the finished cover. All depths will be measured in increments of 500 mm.

The additional excavation, backfilling and compaction of the foundation and disposal of surplus material over the above the scheduled trench excavation, which is measured in Departmental Specification Part "DB" - Earthworks for Pipe Trenches, for standard manholes and inlets will not be measured separately but should be allowed for in the rate for the construction of the manhole or inlet.

Additional excavation for non-standard manholes etc., will be measured and paid for as specified elsewhere.

Additional "Hard Material" and "Rock" encountered in excavation for both standard and non-standard manholes, inlets etc., will be measured and paid for under the relevant item provided in the schedule of quantities.

Additional items will be allowed in the schedule of quantities to allow for departures from the item coverage for a standard manhole or inlet.

PH.8.2        Standard Foul-water or Stormwater Sewer Manholes

The unit of measurement shall be number (No.).

The tendered rates for a standard foul-water or stormwater sewer manhole shall include for -

- (a) the supply of all labour and materials to construct complete in accordance with the contract drawings and specification, the type and size of manhole specified in the schedule of quantities;



PH.8 MEASUREMENT AND PAYMENT (Cont'd)

PH.8.2 Standard Foul-water or Stormwater Sewer Manholes (Cont'd)

- (b) forming the invert based on -
  - (i) foul-water sewers : a 150 mm diameter straight channel with Type A benching;
  - (ii) stormwater sewers : a 375 mm diameter straight channel with Type A benching;
- (c) the provision and setting to level, of one of the four types of precast concrete covers and frames or a specified cast iron cover and frame and adaptor slab, where necessary, on a brickwork or cast in-situ concrete manhole;
- (d) additional excavation in excess of the trench width, disposal of surplus material and compaction of excavation bottom; and
- (e) connecting existing sewers including dealing with existing flows.

Payment for the following times will be Extra Over the payment for a standard manhole or inlet :

- (a) forming Type A benching comprising straight channel sections only of differing diameters to that of the standard channel;
- (b) forming Type A benching comprising change in direction only for each size of pipe;
- (c) forming Type A benching with junctions for each size of pipe including any change in direction that may occur in such an invert;
- (d) forming benching Type B;
- (e) additional concrete to manhole foundations where the gradient of the pipe on the downstream side is 1:10 or steeper.

PH.8.3 Standard Stormwater Inlets

The unit of measurement shall be number (No.) for the type of inlet and depth stated in the schedule of quantities.

The tendered rate for standard stormwater inlets shall include for the supply of all labour and materials to construct the inlet complete in accordance with the standard drawings and specification including additional excavation and disposal of surplus material, forming the invert using a straight 375 mm diameter pipe with one outlet, construction of concrete apron with length dependent on the number of splays including serrations and setting inlet cover and slab to level.

PH.8 MEASUREMENT AND PAYMENT (Cont'd)

PH.8.4 Ramp and Backdrop Junctions

The unit of measurement shall be number (No.) for various heights of drop. The height shall be measured from the invert level of the incoming pipe, at the start of the drop, to the invert level of the manhole.

The tendered sum shall include for the supply of all labour and materials to construction complete the ramp or backdrop junctions in accordance with the contract drawings including all extra pipes and fittings, plugs where necessary, concrete surround to the pipes, additional excavation and disposal of surplus material.

PH.8.5 Non-Standard Manholes and Minor Drainage Structures

Measurement and payment for non-standard manholes shall be made as detailed in the following clauses with Extra Over the benching and rendering items being provided for any variations to a Type A benching with a straight channel;

PH.8.5.1 Excavation and Backfilling in all Materials

The unit of measurement shall be cubic metres (m<sup>3</sup>).

The volume shall be determined from the horizontal plan area of foundation multiplied by the mean vertical height minus the volume of trench excavation, which is measured in Departmental Specification Part "DB" - Earthworks for Pipe Trenches, the mean vertical height being determined as specified in clause DB.8.3.2 - Trench Depth.

The tendered rate for excavation and backfill in all materials shall include for all the items covered in Departmental Specification Part "DD" - Earthworks for Structures, clauses DD.8.2 - Excavation and DD.8.3 - Backfilling.

PH.8.5.2 Concrete, Steel Reinforcement and Shuttering and Formwork

The tendered rate and measurement of the concrete, steel reinforcement, shuttering and formwork shall be in accordance with Departmental Specification Part "C" - Concrete clause C.8 - Measurement and Payment.

PH.8.5.3 Brickwork

The unit of measurement shall be square metres (m<sup>2</sup>).

Separate items will be provided in the schedule of quantities for the various wall thicknesses.

No deduction will be made for the area of the pipes built into the manhole wall.

The tendered rate for brickwork shall include for the supply and laying of the brickwork, selection of bricks for the inner surface of the manhole, all cutting, waste, corbelling, over sailing, and caulking of pipes into the walls.

PH.8            MEASUREMENT AND PAYMENT (Cont'd)

PH.8.5.4      Benching

The unit of measurement shall be cubic metres (m<sup>3</sup>) and will be measured nett to the dimensions ordered.

The tendered rate for benching shall include for supply of all labour and materials including formwork, forming a Type A straight channel invert, rendering the benching and curing.

PH.8.5.5      Precast Concrete Units

The unit of measurement for precast concrete manhole rings forming the shafts of non-standard manholes shall be linear metres (m) measured in 0,25 m increments from the top of the adapter slab to the underside of the bottom ring.

The tendered rate for precast concrete units shall include the supply and fitting of the wall units and adapter slab including all jointing materials, cutting and wastage.

PH.8.5.6      Manhole Covers and Frames

The unit of measurement shall be number (No.) for the various types of covers and frames.

The tendered sum for manhole covers and frames for non-standard manhole shall include for -

- (a) the supply of all labour and materials; and
- (b) setting the cover and frame to level including provision of brickwork or concrete spacer rings and backfilling working space with concrete.

PH.8.6        Plastering of Brick Manholes

The unit of measurement shall be square metres (m<sup>2</sup>).

The tendered rate for plastering of brick manholes shall cover the cost of raking out joints in the brickwork and applying plaster in 2 coats as specified to all surfaces required to be plastered.

PH.8.7        Raising or Lowering of Existing Manholes and Inlets

The unit of measurement shall be number (No.) measured in increments of 0,25 m in paved or unpaved areas.

PH.8 MEASUREMENT AND PAYMENT (Cont'd)

PH.8.7 Raising or Lowering of Existing Manholes and Inlets (Cont'd)

The tendered rate shall include for the removal of the existing adapter slab, cover and frame, storing on site for re-use, demolition of the manhole as necessary, provision of labour and materials for rebuilding the manhole to the designated new level and setting and cover and frame to the correct level.

Extra Over items for the various types of cover and frame will be scheduled if new covers and frames are to be provided.

The Extra Over rate should include for the supply of the new covers and frames and the removal from site of the old ones.

PH.8.8 Alterations to Existing Manholes and Stormwater Inlets

The unit of measurement shall be 'Sum'.

Details of each item together with a summary of activities that the 'Sum' is to cover will be stated in Part "AA" - Project Specification.

PH.8.9 Testing of Manholes

The unit of measurement shall be the kilolitre (kl) based on the volume of water supplied by the Contractor for each successful test. No payment shall be made for tests which fail.

The tendered rate for the testing of manholes shall include for the supply and transporting of the water, provision of all plugs, stoppers, pumps, measuring equipment and disposal of water on completion of the test.