

## **SECTION 8: SEWER NETWORK**

**Table of Contents**

|                                                                                 |           |
|---------------------------------------------------------------------------------|-----------|
| <b>SECTION 8: SEWER NETWORK .....</b>                                           | <b>I</b>  |
| <b>TABLE OF CONTENTS .....</b>                                                  | <b>II</b> |
| <b>SECTION 8.01 SEWER NETWORK: GENERAL REQUIREMENTS .....</b>                   | <b>2</b>  |
| 8.01.1 SCOPE .....                                                              | 2         |
| 8.01.2 SPECIAL REQUIREMENTS .....                                               | 2         |
| 8.01.3 WORKMANSHIP: OPERATIONS .....                                            | 3         |
| 8.01.4 SEQUENCE OF CONSTRUCTION .....                                           | 3         |
| 8.01.5 RIGHT OF WAY .....                                                       | 4         |
| <b>SECTION 8.02   PIPES AND APPURTENANCES .....</b>                             | <b>5</b>  |
| 8.02.1 SCOPE .....                                                              | 5         |
| 8.02.2 MATERIALS .....                                                          | 5         |
| 8.02.3 WORKMANSHIP .....                                                        | 6         |
| 8.02.4 MEASUREMENT .....                                                        | 13        |
| <b>SECTION 8.04   SURROUND, HAUNCHING, ENCASEMENT &amp; THRUST BLOCKS .....</b> | <b>16</b> |
| 8.04.1 SCOPE .....                                                              | 16        |
| 8.04.2 MATERIALS .....                                                          | 16        |
| 8.04.3 WORKMANSHIP .....                                                        | 16        |
| 8.04.4 MEASUREMENT .....                                                        | 17        |
| <b>SECTION 8.05   MANHOLES, INSPECTION CHAMBERS .....</b>                       | <b>18</b> |
| 8.05.1 SCOPE .....                                                              | 18        |
| 8.05.2 GENERAL .....                                                            | 18        |
| 8.05.3 MATERIALS .....                                                          | 18        |
| 8.05.4 CONSTRUCTION .....                                                       | 20        |
| 8.05.5 MEASUREMENT .....                                                        | 21        |

## **SECTION 8.01 SEWER NETWORK: GENERAL REQUIREMENTS**

### **8.01.1 SCOPE**

**A.** The work covered in this section includes the supply of materials, installation, testing and commissioning of all pipes, fittings, valves, and appurtenances related to:

- The provision and construction of wastewater collection networks including pipes, manholes and connections to existing sewers.

**B.** The work consists of finishing all materials and the construction installation and completion in all respects as described in this Specification and as shown on the Drawings.

### **8.01.2 SPECIAL REQUIREMENTS**

**A. Manufacturer's Certificate:** Materials shall be supplied with a certificate, in respect of each delivery, stating that products comply with and have been factory tested in accordance with the specified Standards.

**B. Marking:** Unless otherwise specified in the relevant Standard, products shall have legibly cast, stamped or indelibly painted on, the following marks, as appropriate:

- The manufacturer's name, initials and identification mark.
- Nominal diameter.
- Class designation.
- Initials and number of relevant Standard.
- Length of pipe if shorter than the standard length.
- Angle of bends in degrees.
- The date of manufacture.

**C. Special Tests:** Whenever required by the Engineer, the Contractor shall supply and transport to an approved testing laboratory samples of materials selected by the Engineer. The number of samples shall not be less than 0.5% of total supplied, with at least one from each class, diameter and manufacturer. Failure of any sample shall be followed by a second and if necessary a third test from the same batch. A third test failure will result in all material from that manufacturer being rejected and replaced by material from a different manufacturer, subject to approval by the Engineer, after satisfactory testing. Laboratory test reports in an approved form shall be provided.

### **8.01.3 WORKMANSHIP: OPERATIONS**

- A.** Manufacturer's recommendations on handling, repairing, laying, jointing, anchoring, testing and other works for pipes and fittings shall be strictly followed.
- B.** The Contractor shall use cranes, hoists or forklifts as directed by the Engineer. The Contractor shall use hooks, spreader beams, ropes, band or wire slings etc. as recommended by the manufacturer for each type of pipe and as approved by the Engineer.
- C.** The Contractor shall stack pipes on a level surface. Pipes shall not rest on sockets or flanges and end pipes in the bottom row shall be securely chocked. Heights of stacks shall be in accordance with the manufacturer's instructions.
- D.** The Contractor shall handle material with care to avoid damage whenever moved by hand, forklifts or hoists.
- E.** The Contractor shall provide safe storage for all material. The interior of pipes, fittings etc. shall be kept free from dirt and foreign matter. The Contractor shall provide shade for materials as required by manufacturers' instructions and recommendations and to the Engineer's approval.
- F.** Cutting: The Contractor shall use hacksaws, manually operated wheel cutter or pipe cutting machine in accordance with manufacturers' instructions. If, in the opinion of the Engineer, special precautions are required to eliminate airborne particles, the Contractor shall use methods and equipment as directed by the Engineer. The Contractor shall prepare ends according to type of joint used and follow manufacturers' recommendations. The Contractor shall take care not to damage linings. The Contractor shall repair on site minor damage if so permitted by the Engineer.
- G.** The Contractor shall repair damaged coatings, sheathings or linings in accordance with the Specification and the manufacturer's instructions. The Contractor shall use material compatible with that originally used. Repairs shall be approved by the Engineer before incorporating the materials into the works.

### **8.01.4 SEQUENCE OF CONSTRUCTION**

The Contractor shall adhere to the sequence of construction as set out below unless a justified request for modification is approved by the Engineer at least two weeks prior to commencement of work on the affected section of the network:

- Stake out pipe alignments
- Clear and grade the right of way (wherever required)
- Carry out surveys, including trial pits if necessary, along the alignments to verify the location, depth, size and type of existing utilities.
- Prepare and submit for approval composite Shop Drawings for all utilities showing alignment, ground elevation, trench invert elevation, pipe size, class and length, station and size of fittings, valves as applicable manholes, inlets, appurtenances and

structures to be demolished and reinstated (kerbstone, rails, culverts, etc.). Cross sections showing location and inverts of existing pipes and those proposed shall be prepared. Pipes, structures and other utilities to be removed or relocated shall be indicated on the Shop Drawings.

- Relocate, demolish and reinstate existing services and utilities interfering with pipeline alignments.
- Remove pavement layers, excavate trenches and place bedding as required
- Lay and join pipes, fittings, appurtenances, manholes, etc.
- Place primary backfill material
- Perform hydrostatic testing
- Complete connections to existing services and curb/gutter inlets as required
- Place final backfill
- Restore or reinstate surfaces and structures as required
- Carry out final surface works road surfacing curb stone, backing walls, sidewalk paving, etc.
- Dispose of surplus materials.

#### **8.01.5 RIGHT OF WAY**

##### **A. Extent**

**A.1** All utility services shall be installed in the right-of-way of existing or proposed roads as shown in the Drawings, typical cross sections and the utility provider's requirements.

## **SECTION 8.02 PIPES AND APPURTENANCES**

### **8.02.1 SCOPE**

- A.** The work covered in this section includes furnishing and installing pipes for sewers as and where shown on the Drawings including jointing, connections to other pipes and backfilling.
- B.** Sewer work shall be in accordance with the requirements of Section 8.01 of the Specification.

### **8.02.2 MATERIALS**

#### **A. Concrete Pipes (for Sewage)**

- A.1** Precast concrete pipes shall be manufactured in accordance with BS EN 1916: 2002 Class H. Cement used in manufacture shall be Ordinary Portland Cement to BS EN 197-1:2000.
- A.2** Joints shall to be the gasket type with flexible spigots and sockets. The shape of the joint shall be designed to prevent any movement of the gasket during assembly and to be watertight. Rubber gaskets shall be manufactured to BS EN 681-2:1996.
- A.3** The inside faces of pipes for sewer networks shall be lined as follows:
- For pipes smaller than 900 mm diameter a coal tar epoxy coat 70% minimum epoxy content shall be used. The minimum thickness of the coat shall be 1mm.
  - For pipes 900 mm and larger a polyethylene liner shall be used.
- A.4** For internal and external faces of concrete pipes for drainage networks and external faces of concrete pipes for sewer networks linings are not required.

#### **B. UPVC Pipes**

- B.1** Pipes shall be manufactured in accordance with DIN 8061/8062, Series 4 and 5 or ISO 161-1:/4422 Class 10 and & 16. Concrete encasement shall be used if the cover is less than 1.2 metres.
- B.2** Fittings shall be manufactured in accordance with DIN 8063 part 1 fabricated from pipe.
- B.3** Joints shall be manufactured in accordance with DIN 8063 Part 1, socket spigot with rubber sealing rings to BS EN 681-1:1996.

#### **C. Glass Reinforced Plastic (GRP) Pipes**

**C.1** GRP pipes and fittings shall be manufactured in accordance with BS 5480:1990. Resins, surface tissues and fibrous reinforcement shall be in accordance with clause 3; pipes and fittings shall be supplied with a resin rich corrosion liner consisting of a layer of 'c' glass backed by a layer of 'E' glass impregnated with resin - with a nominal thickness of 1.0 mm and an outer layer with a minimum thickness of 0.2 mm. The sand content shall not exceed 50%. GRP pipes shall have the following properties: -

- Stiffness: minimum 5000 N/m<sup>2</sup>. Suitability of stiffness shall be verified by Contractor for the various trench and pipe laying conditions and as recommended by the manufacturer.
- Longitudinal strength: to BS 5480:1990 table 2.
- Strain corrosion resistance: tests are to be carried out in accordance with BS 5480:1990 with a strain corrosion value at 50 years to equal or exceed 0.7%.
- Markings: to BS 5480:1990 clause 11.
- Joints: GRP double socket couplings or bell and spigot type with rubber rings to BS EN 681-1:1996. Allowable angular deflection shall be in accordance with BS 5480:1990 Table 3.

**C.2** Testing on GRP pipes: The following tests shall be carried out on manufactured pipes. Details of the testing programme shall be submitted to the Engineer for review and approval prior to commencement of pipe manufacture. The manufacturer quality control scheme shall be to BS EN ISO 9001:2000. Guidance on quality control and sampling shall be BS 5480:1990 Appendix Q. The following tests shall be carried out in accordance with BS 5480:1990 and reported to the Engineer for approval.

- Longitudinal strength
- Hydraulic test.
- Stiffness
- Wall thickness
- Diameter
- Hardness
- Loss of ignition

### **8.02.3 WORKMANSHIP**

Earthworks for pipelines shall be constructed in accordance with Section 2.10 of the Specification.

#### **A. Pipe Laying and Jointing - General**

**A.1** Pipes shall not be lowered into trenches until the pipe bed is brought to grade and approved by the Engineer.

**A.2** Pipes shall be lowered using ropes, wire slings, band slings and spreader beams as recommended by the pipe manufacturer for each type of pipe and approved by the Engineer.

**A.3** All materials shall be examined for damage. Tests shall be undertaken in accordance with the manufacturer's instructions and to the satisfaction of Engineer before installation.

**A.4** The Contractor shall ensure that all internal coatings and linings and outer coatings or sheathing are undamaged. Damaged areas shall be made good or disposed of as directed by the Engineer.

**A.5** Dirt and other materials shall be removed from pipes before lowering.

**A.6** Construction debris shall be cleared from the inside of pipes before making joints.

**A.7** Pipes shall be laid on an even formation true to grade and line, with sockets (if any) facing up the gradient.

**A.8** Holes shall be cut in the trench formation to allow for correct jointing and for barrels of pipes to bear evenly on solid ground for their full length.

**A.9** Bedding material shall be scooped out locally at sockets/couplings to enable pipes to rest uniformly on barrels and adjusted to the exact line and level. After testing, granular surround material shall be laid and compacted in 150 mm layers or as directed by the Engineer to levels shown on the Drawings.

**A.10** Rectangular blocks of concrete Class B shall be provided for pipes on concrete bed or surround. The blocks shall be made in approved moulds at least 14 days before use with hardwood folding wedges. Two concrete blocks shall be provided for each pipe, set and boned to the correct level on the formation and the pipe laid centrally and socketed. Two hardwood folding wedges shall be inserted, of widths equal to the width of the concrete blocks, between the body of the pipes and blocks and driven together until the pipes are brought to the exact level required. Blocks and wedges shall be left undisturbed while pipes are being jointed and the concrete bed and haunch or surround are being placed. Blocks and wedges shall be of sufficient size and strength to prevent settlement of pipes. Sufficient space shall be left to enable joints to be made, tested and inspected.

**A.11** When pipe laying is not in progress, open ends of pipes shall be closed with properly fitted temporary wooden plugs or standard caps as approved by the Engineer.

## **B. Jointing**

**B.1** Manufacturers' instructions shall be followed regarding placement of bedding and backfilling, cleanliness of joint surfaces, the lubricant used, the correct location of components and the provision of correct gaps between ends of spigots and backs of sockets.

**B.2** Flexible joints shall not be deflected beyond the maximum permissible angles given by the manufacturer and/or relevant Standard.

**B.3** Patent detachable and flexible joints shall strictly comply with special instructions issued by the manufacturers of proprietary joints when laying and jointing.



**B.4** Differing pipes and fitting material shall be jointed with adaptors as recommended by the pipe manufacturer.

**C. Line and Gradients**

**C.1** In open excavations sight rails and boning rods shall be provided and correctly maintained and painted to ensure the correct alignment of pipe runs. Sight rails shall be positioned either vertically above the lines of pipes or immediately adjacent thereto. At least three sight rails shall be provided for each length of pipeline under construction to any one gradient.

**C.2** In headings marks shall be provided and maintained to establish the line and level of pipelines. Marks shall be fixed in each working shaft and two further marks established in each length of heading.

**D. Tolerances**

**D.1** For gravity sewers tolerances shall be 6 mm in level and 25 mm in line between manholes or access points unless otherwise specified or approved by the Engineer. Where pipes are to be constructed in straight lines between manholes, the length will not be accepted if a light shone from each manhole cannot be seen from adjacent manholes.

**E. Floatation**

**E.1** Whenever water is excluded from the interior of pipes, sufficient backfill shall be placed above the pipes to prevent floatation.

**E.2** In the event of any pipe floating, the pipe shall be removed and relaid to the correct line and level.

**F. Pipes Built into Structures**

**F.1** Treatment of external surface: Outside surfaces of pipes to be built-into structures shall be thoroughly cleaned immediately before installation. Protective coatings to metal pipes shall be removed when specified. Clay and concrete pipes shall be roughened as directed on the drawings or instructed by the Engineer. Plastic pipes shall be painted with appropriate solvent cement and sprinkled with dry coarse sand whilst wet. Sheathing shall be cut away from sections to be built-in and protection shall be restored up to the external faces of structures with appropriate bituminous material after installation.

**F.2** Two flexible joints or flexible patented joints shall be provided adjacent to each structure. The first joint shall be placed not more than one pipe diameter from the face of the structure and the second joint not more than the following distances away from the first:

- Pipelines not exceeding 450 mm: 2 pipe diameters
- Pipelines over 450 mm and not exceeding 1000 mm: 1.2 m
- Pipelines over 1000 mm: 1.8 m.

**G. Field Testing: General**

- G.1** All items for testing, including pressure gauges, instruments and water shall be provided on site before testing commences
- G.2** Tests shall be carried out in the presence of the Engineer.
- G.3** Fittings shall be permanently anchored before testing with all joints left exposed for checking.
- G.4** Test sections shall be limited to runs of not more than 500 metres.
- G.5** Gravity sewers shall be tested in sections between manholes.
- G.6** Test plugs shall be secured at the end of the main by struts.
- G.7** Testing against a closed valve shall not be permitted unless agreed to by the Engineer.
- G.8** Pressure shall be applied by a manually operated test pump or, in the case of large diameter mains, by a power driven test pump, if approved by the Engineer.
- G.9** The Contractor shall examine exposed joints and repair all visible leaks.
- G.10** Should a test fail, the Contractor shall locate all leaks and replace or make good defective pipes or replace and make good faulty joints as necessary. The main shall then be retested.
- G.11** The Contractor shall prepare and maintain test records in a format approved by the Engineer. Original copies of the test record shall be presented to the Engineer immediately after completion of the test.
- G.12** Hydrostatic tests on pressure lines shall be carried out whilst pipelines are partially backfilled.
- G.13** Non-pressure lines not exceeding 1000 mm diameter shall be air tested before backfilling and hydrostatically tested after backfilling.
- G.14** Non-pressure lines over 1000 mm diameter shall be visually inspection tested from the inside. All joints shall be individually hydraulically tested.
- G.15** Infiltration tests shall be carried out on non-pressure lines where the crowns of pipes at the highest section under testing are more than 1.2 m below the water table.

**H. Hydrostatic Testing of Pressure Pipelines**

**H.1** For hydrostatic testing, pipes shall be slowly filled with water from the lowest point. Power-driven pumps shall not be used unless indicated on the Drawings or approved by the Engineer.

**H.2** Absorbent pipes shall be filled with water and allow to stand for at least 24 hours to allow complete absorption prior to hydrostatic testing.

**H.3** Entrapped air in the pipelines shall be bled before pressurizing.

**H.4** Pressurizing shall to continue until the specified test pressure is reached in the lowest part of the section under test. Entrapped air shall be bled while raising the pressure.

**H.5** The test pressure shall be maintained for the specified test duration with pumping stopped.

**H.6** The pipeline under test shall be repressurized to the original test pressure and the respective volumes of water pumped recorded.

**H.7** The pipeline will be deemed to have failed the test if:

- Visible leaks are detected, regardless of leakage being within specified limits,
- The volume of water lost during period when pumping was stopped exceeds allowable leakage levels.

**H.8** Test pressures shall be 1.5 times the maximum sustained pressure, minimum 13.5 kg/cm<sup>2</sup> unless otherwise specified on the Drawings or agreed by the Engineer.

**H.9** The test period shall be 2 hours.

**H.10** The allowable leakage shall be 0.1 litre/mm diameter/km length/day/30m of applied pressure.

## **I. Hydrostatic Testing of Non-Pressure Pipelines**

**I.1** The procedure for hydrostatic testing of non-pressure pipelines shall be as described for pressure pipelines.

**I.2** The test pressure shall be a 1.0 metre head of water above the pipe soffit at the highest point in the section under test and not greater than a 6 metre head of water at the lowest point. If the maximum head is exceeded then the section shall be tested in stages.

**I.3** The test period shall be 30 minutes.

**I.4** The allowable leakage shall be 0.02 litres/linear metre/metre diameter/30 minutes.

## **J. Air Testing of Pipelines**

**J.1** Testing shall be carried out in accordance with BS EN 752-4. The section under test shall be sealed at both ends with a leakproof plug.

**J.2** Pressure shall be applied by a hand pump or other method approved by the Engineer until a pressure of 3 psi (0.2 bar) head of water is indicated on a U-tube connected to the system.

**J.3** Without further pumping the pressure shall not fall to less than 1 psi (0.66 bar) after a period of 10 minutes.

**J.4** If the air test is not conclusive and no leakage can be traced by an external application of soapy water to all sealing areas, then hydrostatic testing shall be carried out.

**K. Infiltration Test for Gravity Pipes**

**K.1** Infiltration testing shall be carried out after total backfilling of the length under test.

**K.2** All inlets to system shall be plugged with an airtight seal prior to testing.

**K.3** Residual flow shall be measured by a method approved by the Engineer

**K.4** Infiltration limits: the following limits are not to be exceeded:

- Pipelines not exceeding 700 mm: 0.02 litres/hour/100 metres/mm diameter
- Pipelines over 700 mm: 0.03 liters/hour/100 metres/mm diameter.

**K.5** Tests shall be deemed to have failed if allowable infiltration water volumes are exceeded. The source of excessive infiltration shall be located by traversing lights and mirrors, inflated rubber plugs or other method approved by the Engineer and made good to the satisfaction of the Engineer. Tests shall be repeated until successful.

**L. Visual Inspection Tests**

**L.1** Visual inspection tests shall be carried out after backfilling of the section to be tested has been completed.

**L.2** The length to be visually tested at one time shall be three full-length pipes unless otherwise agreed with the Engineer.

**L.3** Rubber tyred bogies which do not damage the linings of pipes and an adequate supply of electric lamps shall be used to carry out the tests.

**L.4** Joints shall be checked by feelers to ensure rubber rings are correctly located.

**L.5** Pipes shall be checked for visible cracks.

**M. Hydraulic Individual Joint Test for Pipes Exceeding 1000 mm**

Testing shall be carried out in accordance with BS 5886:1980 (ISO 4483:1979), Type 2 testing after backfilling. Joints shall be pressurized to 2 bars and repressurized to 2 bars after 2 minutes. After a further 5 minutes no pressure drop shall be observed or the test shall be deemed to have failed.

**N. Deflection Tests for GRP Pipes**

**N.1** Deflection tests for GRP pipes shall be carried out in 3 stages as detailed below. Deflections shall be measured at the spigot ends, at mid points and at socket ends:

- **Stage 1:** at completion of primary backfill (maximum allowable deflection 0.5%).
- **Stage 2:** at final backfill (maximum allowable deflection 2.5%).
- **Stage 3:** six months after final backfill (maximum allowable deflection 4.0%).

**N.2** Pipes not passing the deflection tests at stage 2 or stage 3 shall be removed and replaced.

**O. Field Protection and Coating**

**O.1** Metal joints to patented detachable and flexible joints and flanged connections shall be protected with mastic compound and protective tape in accordance with the manufacturer's instructions. Minimum overlap shall be 55%. All folds and irregularities shall be pressed out.

**P. Sewer House Connections**

**P.1** The Contractor shall agree the location and invert levels of sewer house connections with the Engineer before starting construction.

**P.2** The Contractor shall programme connections to follow closely on from the construction of sewers.

**P.3** Connection to sewers shall be at manholes. Connections to T or Y junctions shall only be permitted if shown on the Drawings or if approved by the Engineer.

**P.4** Connections shall be laid at a minimum grade of 20 per 1000 unless otherwise approved by the Engineer.

**P.5** Sewer house connections shall be installed, laid and tested using the same methods as for main sewers.

**P.6** The Contractor shall maintain accurate records of locations of connections to main sewers that include the following:

- Connection number
- Type of connection
- Pipe diameter

- Downstream manhole numbers
- Distance from manholes
- Positions (left or right) when facing upstream of street sewers
- Distance from the sewer centre line to the end lateral
- Invert of street sewer
- Lateral invert at end point
- Number and type of inspection chambers
- Cover type
- Location, description and elevation of obstructions and method of protection.

**P.7** The Contractor shall keep records of sewer house connections in a survey log book, made available for inspection and handed to the Employer on completion. The survey log books shall include sketches and tables in a format approved by the Engineer and three bound copies shall be provided for the Employer.

#### **Q. Cleaning and Inspection of Sewers**

**Q.1** Sewer pipelines shall be cleared of silt and debris after backfilling of pipe trenches and completion of manholes, hatch boxes and the like but before surfaces are permanently reinstated and made ready for inspection by the Engineer.

**Q.2** Pipelines of 700 mm diameter and over are to be inspected from the inside and when necessary a suitable trolley is to be provided for this purpose.

**Q.3** Pipelines less than 700 mm diameter and larger pipelines which cannot be inspected from the inside shall be inspected by passing a cylinder of a diameter 25 mm less than the internal diameter of the pipe and a length of not less than the internal diameter of the pipe through each pipeline.

### **8.02.4 MEASUREMENT**

#### **A. Earthworks**

Measurement and payment for trench excavation and backfilling shall be made in accordance with the provisions of Section 2.09 of Division 2: Earthworks.

#### **B. Pipelines**

**B.1** Pressure pipes shall be paid for per linear meter measured as a straight line between the centres of consecutive coupling sections. The distance between the two centres of the couplings on both sides of any fitting or valve shall be included as pipe length. No allowance will be made for cut ends and waste. No separate payments for any in-line fitting shall be made and the costs shall be deemed to be included in the rate for pipelines.

For gravity networks, pipes shall be paid for per linear metre measured as a straight line between the inside edges of manholes plus 20 cm inside the manhole from each side. No allowance shall be made for cut ends and waste.

**B.2** Rates for pipes shall include for the following:

- 1) Staking out, field surveying and preparation of shop drawings,
- 2) Pipes, couplings and fittings,
- 3) Appropriate fittings and/or couplings for connecting to adjacent pipe or fitting including flanged fittings connecting to socket ended pipes,
- 4) Additional self restrained coupling sections adjacent to bends.
- 5) Bolts, nuts, gaskets and the like for flanged fittings,
- 6) Transportation and hauling about the Site, loading, unloading and lowering materials in the trench,
- 7) Lubricating agent used for assembling the pipe sections,
- 8) Cutting, machining, chamfering, etc. of standard length pipes,
- 9) Assembling the pipes and couplings
- 10) All work involved in connecting to new or existing fittings, valves, chambers, manholes and or structures as applicable.
- 11) Concrete thrust blocks including associated over excavation and anchors or additional self restrained coupling sections at bends. The concrete work shall include all items required for concrete work and concrete structures,
- 12) Testing in accordance with the specification,
- 13) Ancillary works and materials,

**B.3** Flushing, cleaning, painting, lining and coating.

**B.4** Rates for pipe relocation shall include for the following:

- 1) Staking out, field surveying and preparation of Shop Drawings.
- 2) Appropriate fittings and/or couplings for connecting to adjacent pipes or fittings including flanged fittings connecting to socket- ended pipes.
- 3) Additional self-restrained coupling sections adjacent to bends.
- 4) Bolts, nuts, gaskets and others for flanged fittings.
- 5) Transportation and hauling about the Site, loading, unloading and lowering materials in the trench.
- 6) Lubricating agent used for assembling the pipe sections.
- 7) Cutting, machining, chamfering, etc. of standard length pipes.
- 8) Assembling the pipes and couplings and connecting to fittings and valves, or chambers, manholes and or structures as applicable.

- 9) Concrete thrust blocks including associated over excavation and anchors or additional self restrained coupling sections at bends. The concrete work shall include all items required for Concrete Work and Concrete Structures.
- 10) Testing as per specification.
- 11) Ancillary works and materials.
- 12) Flushing, cleaning painting, lining and coating.
- 13) Disinfection of water supply pipes.
- 14) Draining, stopping and sealing ends of redundant pipes

**C. House Connections**

**C.1** Sewer connections shall be paid per connection installed.

**C.2** Rates for sewer connections shall include:

- 1) Supply and installation of all materials including pipes, fittings or specials.
- 2) Excavation, bedding, backfilling concrete works and reinstatement.
- 3) Connection to adjacent inspection chamber or to existing building discharge line and to the collection network using all necessary fittings and machining required to facilitate connection.
- 4) Installation, testing and commissioning.



## **SECTION 8.04 SURROUND, HAUNCHING, ENCASEMENT & THRUST BLOCKS**

### **8.04.1 SCOPE**

The work covered in this section includes in-situ concrete work and other fills necessary for the installation of sewer pipe installation.

Concrete work shall comply with the appropriate requirements of Section 5: Concrete, Steel and Structures.

### **8.04.2 MATERIALS**

**A.** Compressible board shall be 20 mm thick compressible fibrous board or similar material approved by the Engineer.

#### **B. Fill Material Under and Around Pipes**

**B.1** Material under and around pipe (pipe surround and backfill) shall comply with the appropriate requirements of Specification Section 2: Earthworks.

**B.2** Concrete bedding shall be in situ concrete Class 110/25.

**B.3** Concrete encasement, thrust blocks, arches and haunches shall comprise in-situ concrete Class 250/20.

### **8.04.3 WORKMANSHIP**

#### **A. Placing Concrete**

**A.1** After the laying of pipes in the trench, concrete shall be placed and compacted under the pipes to provide a solid and uniform surround.

**A.2** After pipe jointing has been completed the outstanding concrete or haunching shall be placed and compacted on both sides simultaneously.

**A.3** Vertical construction joints shall be formed in the concrete at the faces of pipe joints using compressible board and finished to the profile of the concrete and pipes. Gaps between spigots and sockets shall be filled with resilient material approved by the Engineer.

**B. Placing Material Other Than Concrete**

**B.1** Surround material shall be placed in the bottom of prepared trenches and hand tamped to the minimum thicknesses specified on the Drawings or instructed by the Engineer.

**B.2** When the pipe has been laid, additional material or haunching shall be placed in successive layers not exceeding 150 mm thick simultaneously on both sides. All spaces between pipes and the sides of trenches shall be filled and carefully hand tamped without disturbing the pipes.

**C. Thrust Blocks**

Thrust blocks shall be provided at bends and other fittings on pressure pipelines. The additional excavation required shall be undertaken after the pipeline has been jointed. No pressure shall be applied to the thrust block until the concrete has matured for at least 3 days.

**8.04.4 MEASUREMENT**

Concrete encasement for pipelines shall be measured by the cubic metre of concrete calculated on the basis of dimensions indicated on the Drawings after deducting the pipe section.

All other material and work items mentioned above, including compressible boards, surround, backfill and haunching material and thrust blocks shall not be paid for separately but shall be included in their respective pay items as indicated elsewhere in the specification.

## **SECTION 8.05      MANHOLES, INSPECTION CHAMBERS**

### **8.05.1 SCOPE**

The work covered in this Section includes the furnishing of all materials, construction, installation, connection and completion of manholes, catch pits, access shafts, and inspection chambers for sewer system.

### **8.05.2 GENERAL**

- A.**    Excavation and backfilling shall comply with the appropriate requirements of Section 2: Earthworks.
- B.**    Concrete work shall comply with the appropriate requirements of Section 5 Concrete, Steel and Structures.
- C.**    The method of reinforcing shall conform to the requirements of Section 5.03: Steel Reinforcement.

### **8.05.3 MATERIALS**

- A.**    Concrete shall conform to the requirements as specified in Section 5.01: Concrete Mixes and Testing.
- B.**    Reinforcement shall conform to the requirements as specified in Section 5.03 Steel Reinforcement.
- C.**    Precast concrete manhole sections shall be manufactured in accordance with BS EN 1917:2002 using reinforced concrete Class 250/20. Cement shall be ordinary Portland cement. to BS EN 197-1: 2000.
- D.**    Cast in situ units shall be constructed in plain and reinforced concrete class 210/25 and 250/20 respectively. Cement shall be ordinary Portland cement to BS EN 197-1: 2000.
- E.**    Bricks shall be manufactured in accordance with BS 3921:1985 and BS EN 772:1998.
- F.**    Precast concrete blocks for masonry walls shall conform to BS EN 771-3: 2003 and BS EN 772-2:1998.

- G.** Vitrified clay pipes and tiles shall conform to the requirements as specified in
- AASHTO M65: Vitrified clay pipes, extra strength, standard strength and perforated clay drain tiles
  - AASHTO M179: Clay drain tiles
- H.** Corrugated aluminium alloy culverts and underdraws shall conform to the requirements as specified in AASHTO M196: Corrugated Aluminium Alloy Culverts and Underdrains
- I.** Grey cast iron castings shall conform to AASHTO M105 (ASTM A48) Class 25 or higher. Castings shall be manufactured to the sizes and dimensions shown on the Drawings.
- J.** Test bars shall be prepared and tested as specified in AASHTO M105.
- K.** Steel castings: mild to medium strength castings shall conform to AASHTO M103 (ASTM A27). Unless otherwise shown on the Drawings or instructed by the Engineer, castings shall be grade 65-35 fully annealed. Steel castings shall conform to the dimensions shown on the Drawings. Test bars shall be prepared and tested as specified in AASHTO M 103.
- L.** Wrought iron plates and shapes shall conform to the dimensions shown on the Drawings. Rolled wrought iron bars and shapes shall conform to the requirements of ASTM A207. Wrought iron plates shall conform to ASTM A42.
- M.** Covers and frames shall be manufactured from ductile iron in accordance with BS EN 124:1994, non-rock, locking and solid tops. The wording on covers shall indicate the nature of the network (water supply, sewage, stormwater, etc). Grades of covers shall be as follows:
- For roadways: Grade A, heavy duty test load 40 tons
  - For sidewalks, carriage drives and cycle tracks: Grade B medium duty test load 25 tons
  - For footpaths and fields: Grade C light duty, test load 7 tons
- N.** Manhole covers shall be of a circular pattern unless otherwise indicated on the Drawings. Frames shall be provided with openings for fixing bolts for solid frame embedment into manhole concrete necks. Covers and frames shall be coated with a bitumen based compound to BS 3416:1991 with a minimum thickness of 200 microns.
- O.** Step Irons shall be manufactured in accordance with BS EN 13101: 2002.
- P.** Steel Ladders shall be manufactured in accordance with BS 4211:2005, mild steel, galvanized to BS EN ISO 1461:1999 with 200 grams of zinc per square metre.
- Q.** Safety Chains shall be 12 mm diameter wrought iron short link chains, galvanized in accordance with BS EN ISO 1461 with 200 grams of zinc per square metre.

**R.** Guardrails shall be either of the following:

- Tubular mild steel, medium grade to BS EN 10255:2004 with screwed joints, galvanized to BS EN ISO 1461:1999 with 200 grams of zinc per square metre.
- Round steel solid bars to BS 6722:1986 with welded joints galvanised in accordance with BS EN ISO 1461:1999 with 200 grams of zinc per square metre.

**S.** Fixing bolts shall be manufactured from steel and of a type suitable for the particular purpose and to the approval of the Engineer. When used to fix galvanized material, washers shall be galvanized and fixing bolts and nuts cut to pre-plating limits and electroplated with zinc to BS EN ISO 1461:1999.

**T. Coatings**

Internal surfaces of precast concrete manholes and chambers shall be treated with a coal tar or bitumen epoxy coating if so detailed on the Drawings.

External surfaces of precast concrete manholes and chambers shall be protected with waterproofing bitumen supplied and applied in accordance with the requirements of Section 5.15 of Section 5: Concrete, Steel and Structures.

**8.05.4 CONSTRUCTION**

**A. Manholes and Inspection Chambers**

**A.1** Manholes and inspection chambers shall be constructed from in-situ concrete or precast concrete as shown on the Drawings or as proposed by the Contractor and approved by the Engineer. In-situ units shall be constructed in accordance with Specification Section 5: Concrete Works.

**A.2** Precast units shall be cast in steel watertight forms for at least 3 weeks before the sections are used. Precast units shall be assembled on an in-situ concrete base and bedded on and sealed with cement mortar. Prior to fixing, joints of precast units shall be either completely coated with bituminous material or sealed with a preformed jointing strip, all in accordance with manufacturer's instructions or as detailed on the Drawings and approved by the Engineer. Any surplus jointing material extruded inside the chamber or shaft shall be trimmed off and joints shall be pointed on completion. This work shall be left undisturbed for 7 days. Precast concrete cover slabs shall be bedded on cement mortar.

**A.3** Channels in bottoms of manholes shall be smooth, semi-circular with a diameter equal to the adjacent sewer pipes. For straight- through manholes, channels shall be constructed from half pipe sections. Changes in direction of flow shall be accommodated with smooth curves as large as the manholes permit. Changes in the size and grade of channels shall be gradual and even.

**A.4** Benching shall be formed in concrete Class 110/25 rising vertically from the top of the channels to the level of the soffit of the outlet pipe and thereafter sloping upwards at 1 in 10 to the walls. Within 3 hours of completion of benching, a coat of sulphate resisting cement-sand mortar 1:2 shall be applied and smoothed using a steel trowel.

**A.5** External faces of manholes and chambers shall be protected by three layers of brush-applied bituminous paint with a minimum thickness of 600 microns and in accordance with Section 5: Concrete Steel and Structures or as detailed on the Drawings or as specified by the Engineer.

**A.6** Internal faces of manholes and chambers shall be covered with four coats of coal tar epoxy paint, 70% epoxy and 30% coal tar as detailed on the Drawings or as approved by the Engineer, applied by brush in accordance with the manufacturer's instructions. The minimum thickness of coating shall be 1000 microns.

**A.7** Step irons shall be cast into precast units or grouted into preformed mortises. Step irons shall not be used as lifting eyes. Devices for lifting and handling precast units shall be provided on exterior faces only.

**A.8** Top courses of brickwork or concrete rings shall be completed only after completion of the surrounding roadworks to ensure that the cover is flush to the finished surface.

**A.9** Covers and gratings shall be embedded in mortar and seated firmly using fixing bolts. Covers shall be positioned centrally over openings and be level and square with surrounding the finish.

**A.10** Manholes shall be tested on completion by plugging inlets and outlets, filling with water and standing for at least 24 hours or such longer period to allow for complete absorption. The manhole shall then be refilled with water. The allowable leakage after refilling over 24 hours shall not exceed 1% of total volume of the manhole. If a manhole fails this test it shall be made good and retested.

#### **8.05.5 MEASUREMENT**

**A.** Manhole shall be measured by the number of each type constructed, completed as shown on Drawings and accepted including protective painting, furnishing and installation of all materials, frames, covers and steps.

**B.** No separate measurement or payment shall be made for any excavation, shoring, sheeting or backfilling or for breaking into existing pipes in order to install new manholes; all such work being considered subsidiary to the relevant pay items.

**C.** No separate payment shall be made for blinding, protective and bituminous painting, equipment, forms, tools, furnishing and placing materials, labour or any other item necessary for the proper completion of the work.