SOUTH AFRICAN BUREAU OF STANDARDS

STANDARDIZED SPECIFICATION

for

CIVIL ENGINEERING CONSTRUCTION

LE : STORMWATER DRAINAGE

Approved by the COUNCIL OF THE SOUTH AFRICAN BUREAU OF STANDARDS on 3 November 1982

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1. SCOPE

This specification covers the construction of stormwater drainage systems and ancillary works.

NOTE: The standards referred to in the specification are listed in Appendix A.

2. INTERPRETATIONS

2.1 SUPPORTING SPECIFICATIONS. Where this specification is required for a project, the following specifications shall, inter alia, form part of the contract document:
   a) Project specification;
   b) SABS 1200 A or SABS 1200 AA, as applicable;
   c) SABS 1200 D or SABS 1200 DA, as applicable;
   d) SABS 1200 DB;
   e) SABS 1200 G or SABS 1200 GA, as applicable;
   f) SABS 1200 LB.

2.2 APPLICATION. This specification contains clauses that are generally applicable to the construction of stormwater drainage. Interpretations and variations of the specification are set out in Portion 2 of the project specification which precedes this specification in a contract document.

2.3 DEFINITIONS AND ABBREVIATIONS. For the purposes of this specification, the definitions and abbreviations given in the applicable of the specifications listed in 2.1 and the following definitions and abbreviations shall apply:
   a) Definitions
      Geofabric blanket. A blanket so woven from synthetic fibres that it is capable of acting as a filter that retains some or all of the solid particles carried in a fluid but, with varying degrees of restriction, allows the passage of the fluid.
      Invert slab. The slab (normally of concrete) that forms the bottom of a culvert.
      Prefabricated culvert units. Portal or rectangular culvert units that have been prefabricated from concrete.
   b) Abbreviations
      AC: Asbestos cement
      CI: Cast iron
      CID: Constant internal diameter
      COD: Constant outside diameter

3. MATERIALS

3.1 CULVERT UNITS AND PIPES. Prefabricated culvert units and pipes shall comply with the following requirements, as applicable:
   a) Precast concrete pipes. Concrete pipes shall comply with the applicable requirements for SC type pipes of SABS 677.
   b) AC pipes. AC pipes shall comply with the applicable requirements of SABS 819 and shall be provided with loose sleeve type couplings.
   c) Portal and rectangular precast concrete culvert units. Portal and rectangular precast concrete culvert units shall comply with the applicable requirements of SABS 986 for the classes of deck and of invert shown on the drawings or scheduled, as applicable, and in addition culverts or culvert sections, as relevant, shall be capable of withstanding the appropriate proof loads given in SABS 986 applied on any line parallel to the longitudinal axis without showing any sign of shear failure or incipient shear failure.
   d) Skewed ends. Where pipe culverts are to be constructed at a skew angle of more than 20°, units with the required skewed ends shall be obtained from the manufacturer or the skewed ends shall be cut on site, as specified in the project specification.
   Where portal and rectangular units are to be supplied square for a skewed culvert the portion that would otherwise be cut off shall project outside the culvert head walls.
   e) Defects. All broken, bent, chipped, cracked, dented, or otherwise damaged units shall, if so authorized in writing, be repaired to the Engineer's satisfaction, or they shall be removed and replaced with undamaged units.

3.2 NON-CELLULAR RUBBER JOINT RINGS. Joint rings shall be of one of the types of rubber specified in SABS 974: Part I.

3.3 BEDDING MATERIALS

3.3.1 Bedding Cradle and Selected Fill Blanket. Materials for the bedding shall comply with the applicable requirements given in Clause 3 of SABS 1200 LB.

3.3.2 Concrete. Except as required in 3.1(a) and (c), concrete shall comply with the relevant requirements of SABS 1200 G or SABS 1200 GA, as applicable.

3.4 MANHOLEs, CATCHPITs, AND ACCESSORIES

3.4.1 Bricks. Bricks shall have been obtained from an approved manufacturer and shall be either general purpose (special) burnt clay bricks or engineering bricks that comply with the applicable requirements of SABS 227, or Class S14 calcium silicate bricks that comply with the applicable requirements of SABS 265. The Contractor shall submit to the Engineer samples of the bricks that he intends using in the construction of the Works. The samples of the bricks that are approved will be retained by the Engineer.

(See Subclause 3.1 of SABS 1200 A or SABS 1200 AA, as applicable.)
3.4.2 Prefabricated Chambers and Shafts. Prefabricated manhole sections may be of spun concrete, asbestos cement, glass-reinforced polyester, PVC, or such other materials as are required in terms of the schedule. Precast concrete cylinders shall comply with the applicable requirements of SABS 1294. Sectional spun concrete cylinders shall comply with the requirements for pipes of SC type and Class A of SABS 677. Joining between cylinders shall be of the interlocking self-centring type.

3.4.3 Manhole Covers, Grid Inlets, etc. Covers and frames for manholes and grid inlets shall be supplied in matching sets. The cover and frame of each set shall bear a serial number (applied by means of oil paint) to enable the sets to be identified. The Contractor shall ensure that, when installed, the covers and frames still comply with the requirements of SABS 558 for freedom from warp and evenness of seating. Unless otherwise required in terms of the project specification, covers and frames for manholes shall comply with the requirements of SABS 558 for Type 2S in the case of manholes in roads and other areas subject to road traffic loads, and Type 4 in the case of manholes in areas not subject to road traffic loads.

3.4.4 Step Irons. Step irons shall comply with the applicable requirements of BS 1247 and shall be of suitable length for the well of the manhole into which they are to be built.

3.5 GEOFABRIC BLANKET. The synthetic fibres of a geofabric blanket shall consist of at least 85 % by mass of polypropylene, polyethylene, a polyester, a polyamide, or a co-polymer of vinyl chloride and vinylidene-chloride, or any combination of these polymers, and shall contain such additives as are necessary to render the filaments resistant to the effects of ultra-violet radiation and heat. The amount of water absorbed by the fabric after 24 h soaking in water at 20 °C shall be less than 1 % by mass, and its equivalent open size (EOS), strength, and other characteristics shall be as specified in the project specification.

The Engineer's approval of the make and grade of the geofabric shall be obtained by the Contractor before the Contractor orders any geofabric or uses it on the Works.

4. PLANT

4.1 HANDLING AND RIGGING. The plant and rigging equipment used by the Contractor for handling and placing any prefabricated culvert unit shall be such that the shell of the unit is not over-stressed at any time during construction.

5. CONSTRUCTION

5.1 TRENCH BOTTOM

5.1.1 Pipe Culverts. The preparation of the trench bottom for pipes at the depth specified shall comply with the applicable requirements of SABS 1200 DB and bedding shall comply with the applicable requirements of SABS 1200 DB. Trenches shall be kept sufficiently dry to allow proper and safe laying, jointing, and bedding of the pipeline.

5.1.2 Portal and Rectangular Culverts

5.1.2.1 Except in hard rock (see 5.1.2.3), the trench shall be excavated to a depth of 75 mm, or such other depth as may be shown on the drawings, below the level of the underside of the precast invert slab or to the level of the underside of the cast-in-situ invert slab, as applicable. Where the culvert is to be constructed in new fill, the height of the bank constructed shall be such that the depth of material over the top of the culvert after it has been laid will be at least 100 mm or such greater depth as may be shown on the drawings.

5.1.2.2 The excavation shall be trimmed to the shape of the invert of the culvert unit and, except on a rock foundation, a bed of selected granular material as specified in Subclause 3.1 of SABS 1200 LB, of thickness at least 75 mm, shall be placed, compacted, and shaped to enable the culvert units to be bedded as shown on the drawings, or as required in terms of the project specification.

5.1.2.3 Where hard rock is encountered the depth of excavation shall be at least 200 mm below, and to the shape of, the underside of the culvert floor unit, and this space shall be filled with granular material as specified in 5.1.2.2.

5.1.3 Unsuitable Founding Conditions. Where, because soft, soggy, spongy, or otherwise unsuitable material is encountered, the bottom of the trench as excavated does not provide a suitable firm foundation for the culvert, the unsuitable material shall be excavated to a depth below the bottom of the culvert indicated by the Engineer and replaced with gravel or other approved granular material compacted to at least 90 % of modified AASHOT maximum density. When so ordered, the Contractor shall construct a layer of concrete blinding to provide a suitable working floor.

5.1.4 Width of Excavation

a) Portal and rectangular culverts. The width of excavation shall be equal to the total outside width of the culvert portal plus a minimum of 1,0 m for both single and multiple openings. In the case of rectangular culverts having a span of up to 1 200 mm and located near the finished surface, the Engineer may require that the excavation width shall be the net width of cast-in-situ invert slabs plus the net width of precast invert slabs plus 100 mm. The additional width will apply where backfilling of the trench with concrete is required in terms of the project specification.

b) Pipe culverts. The requirements for minimum base width given in Subclause 5.2 of SABS 1200 DB shall apply.

5.2 BEDDING AND LAYING

5.2.1 General. Unless otherwise shown on the drawings or directed, construction of culverts shall, as far as is practicable, begin at the lower end. The Engineer may order that the end of the last unit of short culverts, or of that nearest the upper catchpit or manhole in the case of long drains, be cut to the length or skew required, or both.

Premade units shall be lifted and handled only by means of lifting devices approved by the manufacturer. Lifting eyes shall be caulked with a suitable mortar after the units have been installed.

The Contractor shall exercise due care not to damage, overstress, or displace any culverts by the imposition of any loads such as may be caused by the movement of his own vehicles or compaction equipment. Where superimposed moving loads in excess of those prescribed in the applicable road traffic ordinance are, during the construction of the Works, likely to pass over completed culverts, the Contractor shall provide sufficient additional cover over the culverts to ensure that the design stresses on the culverts are not exceeded.
Any units that become deformed or cracked, or that are not constructed to the required lines, levels, and grades (see 6.4 and 6.5), or that become displaced in the course of the work, shall be removed and replaced by the Contractor at his own expense.

5.2.2 Pipe Culverts. Pipes shall be laid and bedded to the level and alignment shown on the drawings or as directed. They shall be laid hard up against each other longitudinally to obtain tight joints and they shall be supported evenly throughout the barrel length. Holes or grooves of adequate size to allow for jointing and for bedding thickness under joints, shall be cut in the bottom of the trench. Pipes shall be laid centrally in the trench in such a manner that the side allowances specified in Subclause 8.2.3 of SABS 1200 DB are available as working space for the proper bedding of the pipes in terms of SABS 1200 LB and to suit the class of bedding specified in the project specification or given in the schedule or on the drawings. For ease of inspection pipes shall be laid with the manufacturer's class and quality identification marks visible from the top of the trench unless, in the case of larger pipes, the position of lifting eyes renders this impractical.

Each pipe shall be cleaned out and carefully examined for possible damage immediately before laying. The onus of detecting damage shall rest on the Contractor. Should any damaged pipe be laid, it shall be removed and replaced at the Contractor's expense and to the satisfaction of the Engineer.

Joints of butt-ended pipes shall be externally wrapped with:

a) two layers of 0.4 mm thick plastics dampcourse; or
b) two layers of hessian of mass per unit area 340 g/m², the hessian having been previously soaked in a bituminous emulsion; or
c) one layer of geofabric blanket of thickness at least 16 mm.

The wrapping shall in all cases be at least 200 mm wide and shall be centrally placed over each joint. Before being wrapped with hessian, pipes shall first be primed with a coat of 60 % bituminous emulsion. Ogee type pipes need not be wrapped but shall be laid with the spigot ends pointing downstream.

Spigot and socket pipes with rubber ring joints shall, unless another method is approved or specified by the Engineer, be jointed in accordance with the manufacturer's instructions.

5.2.3 Concrete Casing of Pipelines. Where shown on the drawings or ordered, pipes shall be fully encased in prescribed mix 15 concrete to the dimensions shown on the drawings or ordered. Temporary supports shall be provided near the pipe ends to support the pipes during placing of the concrete. The placing of concrete shall be such that all spaces under the pipes are completely filled. Use shall be made of poker vibrators to ensure proper filling with concrete of all spaces under and around the pipes, and displacement or flotation, or both, shall be prevented.

5.2.4 All temporary supports provided for the pipes shall be removed as concreting progresses.

5.2.5 Portal and Rectangular Culverts

a) Cast-in-situ invert slabs. Cast-in-situ invert slabs shall be constructed to the dimensions and at the locations shown on the drawings or as directed. They shall be reinforced as detailed on the drawings.

b) Precast invert slabs. A layer of fine selected granular material of thickness at least 75 mm shall be placed on the bottom of the excavation, levelled, compacted to at least 90 % of modified AASHO maximum density and trimmed to grade and line, to form a bed to receive the precast invert slabs. The slabs shall be carefully placed on the prepared bed, true to line and grade and so bedded that they are uniformly supported over their whole area on the bedding material.

c) Placing of upper portion. The units of the upper portion of precast portal and rectangular culverts shall be placed accurately on the invert slabs, with a thin layer of 1:3 cement:sand mortar between the horizontal contact surfaces to ensure a firm and uniform support. The units of the upper portion shall be butt-jointed end to end and each joint shall be covered with geofabric blanket placed symmetrically over the joint.

Where two or more culverts are placed side by side to form a multi-barrel culvert, the space between the culverts shall be filled with prescribed mix 10 concrete up to the level of the top of the culverts.

5.3 CULVERT CONSTRUCTION BEFORE MAJOR EARTHFILL OPERATIONS. Where a culvert is to be constructed ahead of major earthfill operations, the Contractor shall prepare the existing ground by excavating, filling, and compacting as necessary to ensure that the foundation for the culvert is true to grade and of uniform density over its entire length.

5.4 BACKFILLING OF PREFABRICATED CULVERT UNITS

5.4.1 Pipelines. Backfilling of pipe culverts shall comply with the applicable requirements of SABS 1200 DB.

5.4.2 Portal and Rectangular Sections. Material used for backfilling of portal and rectangular sections shall comply with the requirements of Subclause 3.5 of SABS 1200 DB and shall be obtained by the Contractor from approved borrow pits, if necessary.

Backfilling alongside the walls and over the top shall be watered, mixed, placed, and compacted in layers not exceeding 150 mm after compaction, to a density at least equal to that required for the material in the adjoining layers of fill, subgrade, and subbase, as applicable, or to at least 90 % of modified AASHO maximum density in the case of excavations made in natural ground.

Backfilling shall be carried out simultaneously and equally on both sides of the structure to avoid unequal lateral forces.
5.5 CATCHPITS, MANHOLES, INLETS, AND OUTLET STRUCTURES

5.5.1 General. Catchpits, manholes, and inlet and outlet structures shall be constructed in accordance with the details shown on the drawings or as directed.

5.5.2 Brickwork. Brickwork shall be properly bonded in a 1:3 cement: sand mortar, an approved bond being used where the thickness of the brickwork does not exceed 115 mm, and stretcher bond with headers every 5th course where the brickwork is more than 115 mm thick. Bricks shall be well and regularly bonded with no false headers. All bricks shall be whole except where required as closers. Bricks shall be well wetted before laying, and each brick shall be pressed into its bed to leave a finished joint of thickness not exceeding 10 mm. All joints shall be filled solid with mortar, and joints in exposed faces shall be pointed as the work proceeds.

5.5.3 Where pipes enter brickwork, they shall be thoroughly caulked into the wall and rendered with mortar where the thickness of the brickwork does not exceed 80 mm. Where plastering of brickwork is required, all joints shall be well raked out and the brick face thoroughly wetted before plaster is applied. Plaster shall be not less than 12 mm and not more than 20 mm thick. Plaster finish shall be smooth and even and shall show no trowel marks. Unless otherwise specified all plaster shall be finished with a steel trowel. Plaster shall consist of one part of cement to three parts of approved fine sand.

5.5.4 Manhole Covers and Grids. Manhole and grid frames shall be set firmly in a false headers. All bricks shall be whole except where required as closers. Bricks shall be well and regularly bonded with no false headers. All bricks shall be whole except where required as closers. Bricks shall be well wetted before laying, and each brick shall be pressed into its bed to leave a finished joint of thickness not exceeding 10 mm. All joints shall be filled solid with mortar, and joints in exposed faces shall be pointed as the work proceeds.

5.5.5 Precast Manholes. Precast manholes shall be constructed in accordance with the applicable details shown on Drawing LE-1.

5.5.6 Benching. All benching shall be rendered in 20 mm granolithic plaster and finished smooth and true with a steel trowel. Corners shall be rounded to dimensions shown on the drawings.

5.5.7 Precast Inlet and Outlet Structures. Precast inlet and outlet structures shall be manufactured in accordance with the dimensions shown on the drawings. These structures shall be laid and jointed generally as specified for precast concrete pipe culverts, or precast portal or rectangular culverts, as appropriate.

5.5.8 Headwalls. Cast-in-situ concrete headwalls shall be constructed in accordance with the details shown on the drawings and the concrete shall comply with the relevant requirements of SABS 1200 G or SABS 1200 G, as applicable.

5.6 CULVERNS OR STEEP GRADIENTS. Where culverts are constructed on gradients steeper than 1 in 5, particular care shall be taken to protect excavations from stormwater damage. The trenches shall be excavated to firm ground, or, if over-excavation is necessary in order to obtain a firm floor, the excess excavation shall be backfilled with selected granular material or prescribed mix 10 concrete. After that, successive units, starting from the lower end, shall be placed firmly against each other to prevent subsequent movement.

5.7 THE RAISING OR LOWERING OF EXISTING MANHOLES. Where existing manholes require to be either raised or lowered, the work shall be carried out in such a manner that the finished work complies with the applicable requirements of 5.5. Unless otherwise specified or ordered, the cover of each manhole that is to be raised or lowered shall be re-installed after the work of raising or lowering the manhole has been completed (see 5.5.4).

6. TOLERANCES

6.1 GENERAL. Tolerances will be determined on the basis of permissible deviations of inlet inverts from designated location, alignment, grades, and levels. The Contractor shall construct each of the various parts of the Works within the limits set out in 6.2-6.5 (inclusive).

6.2 KERBSIDE CATCHPITS, KERB INLETS, OR GRID INLETS. The permissible deviation of the longitudinal location of a kerbside catchpit, kerb inlet, and grid inlet shall be half a kerb length in the case of kerbs other than extruded kerbs, and 0.5 m in the case of extruded kerbs. The permissible deviation of the lateral location of a kerbside catchpit, kerb inlet, and grid inlet from the designated distance from the centre line of the road shall be ± 25 mm, except that any open grid or grid frame shall be truly parallel to and within 5 mm of the face of the kerb.

6.3 MANHOLES AND CATCHPITS

6.3.1 Location. The permissible deviation of the location of manholes and catchpits (other than kerbside catchpits) from the designated positions shall be half a pipe length laterally, except where locations are dimensioned from fixtures such as fences, kerbs, railway tracks, and the like, in which event the permissible deviation in each direction shall be ± 50 mm.

6.3.2 Construction. The walls and roof of each manhole and catchpit structure shall conform to the tolerances specified under Degree of Accuracy III for concrete structures in Clause 6 of SABS 1200 GA or SABS 1200 G, as applicable.

6.4 INVERT LEVELS. The permissible deviation of the level of the invert from the designated level shall be ± 25 mm (measured on the main flow culvert at the inlet to the manhole or catchpit, as relevant).

6.5 ALIGNMENT AND GRADE. The permissible deviation of the alignment and grade of each culvert and pipeline shall be ± 20 mm from the designated line and level, or from the line between culvert or pipe inverts at successive manholes or catchpits, as applicable, when measured over any 6 m length, and all such deviations shall be gradual.
7. TESTING FOR LEAKAGE

7.1 Stormwater drains will not be tested for leakage of water unless such a test is specified in the project specification.

8. MEASUREMENT AND PAYMENT

8.1 GENERAL. Although the measurement and payment for excavation and backfilling is dealt with in SABS 1200 DB and for bedding in SABS 1200 LB, the relevant items for trenches for stormwater will be scheduled in the section of the schedule covering stormwater drains. The operation of placing and compacting bedding shall be regarded as part of the operation of pipe or culvert laying.

8.2 SCHEDULED ITEMS

8.2.1 Supply and Lay Concrete Pipe Culverts. On Class ... bedding (type, class, and nominal diameter of pipes, and special jointing, if any, stated) ........................................... Unit: m

8.2.2 Supply and Lay Portal and Rectangular Culverts

a) Complete with precast invert slabs (size, class, and type stated)................................. Unit: m

b) Without precast invert slabs (size, class, and type stated)........................................... Unit: m

The length will be measured along the soffit of the culvert.

The rate shall cover the cost of supplying, testing, loading, transporting, and off-loading together with provision and placing of the selected granular material where required for bedding and installation, laying, jointing, cutting on site, and waste.

Separate items will be provided for different sizes, types, and classes of culverts and, in the case of concrete pipe culverts, for pipes laid on bedding of Classes A, B, C, and D.

8.2.3 Extra-Over Items 8.2.1 and 8.2.2 for Supplying End Units for Culverts with a Skew of more than 20°

a) Pipe culverts (type and diameter stated) ................................................................. Unit: No.

b) Portal and rectangular culverts (type and size stated) ........................................... Unit: No.

The rate shall be an extra over the rates for Items 8.2.1 and 8.2.2 above and shall cover the additional cost of manufacture, supplying, and laying of the skew end units, irrespective of the angle of skew.

8.2.4 Extra-Over Items 8.2.1 and 8.2.2 for Cutting End Units for Culverts on Site

a) Straight cut ........................................................................................................... Unit: No.

b) Skew cut ................................................................. Unit: No.

8.2.5 Cast-in-situ Concrete, Formwork, and Reinforcing Steel. The relevant items given in Clause 8 of SABS 1200 G or SABS 1200 GA, as applicable, shall apply.

8.2.6 Concrete (Specified Grade or Prescribed Mix Stated) Backfill to Rectangular Culverts and Trench Bottom ................................................................. Unit: m³

The relevant items given in Clause 8 of SABS 1200 G or SABS 1200 GA, as applicable, shall apply.

8.2.7 Supply and Lay Precast Concrete Inlets and Outlets to Culverts (size and type stated) .............................................. Unit: No. or pair

Except where scheduled as a pair, each inlet and each outlet will be measured separately.

The rate shall cover the cost of supplying, loading, transporting, off-loading, and installing.

8.2.8 Supply and Install Manholes, Catchpits, and the Like

a) Manholes (type and depth stated) ................................................................. Unit: No.

b) Catchpits (type stated) ................................................................. Unit: No.

c) Extra over or under item (a) above for variation in depth of manholes from the standard depth designated for purposes of tendering (standard depth and manhole type stated) ........................................... Unit: m

The rate shall cover the cost of supplying and installing or laying (as applicable) the units complete with floors, benching, concrete, brickwork (if any), covers, frames, grids, and other accessories, but excluding excavation and backfilling, which will be measured separately. The rate shall also cover the cost of connecting manholes, catchpits, and the like to conduits, and of building conduits into the walls of such structures.

The unit of measurement in the case of item (c) above will be the metre of increased or decreased depth of manhole measured in relation to the standard depth designated for tendering purposes.

The rate shall be an adjustment to the sum tendered for the manhole. It will be payable pro rata, measured to the nearest 0.1 m for each depth and type stated, either as an extra amount payable to the Contractor in the case of an increase in depth, or as a decrease in the amount payable in the case of a decrease in depth from the standard depth.

8.2.9 Alternative to Subclause 8.2.8. Where the items referred to in 8.2.8 are very large or cannot conveniently be standardized for payment according to complete units, or where details are not shown on drawings at the tender stage but are to be given later by the Engineer (see 5.5.1), the various types of work and items of material provided will be measured separately in accordance with the items listed in (a) - (c) below and such other items as may be necessary. Concrete and formwork will be measured in terms of Subclause 8.1 of SABS 1200 G or Subclause 8.1 of SABS 1200 GA, as applicable, and excavation and backfilling in terms of Subclauses 8.1 and 8.2 of SABS 1200 DB.

a) Brickwork

1) 115 mm thick ................................................................. Unit: m²

2) 230 mm thick ................................................................. Unit: m²

3) 455 mm thick ................................................................. Unit: m²

Brickwork will be measured on the centre line of the walls. Areas occupied in walls by pipes will be included in the areas measured, and corners and intersections common to more than one brick wall will be measured only once.

The rate shall cover the cost of the brickwork complete including pointing and building in of pipe units.

b) Plaster (minimum and maximum thickness stated) ........................................... Unit: m²

The rate shall cover the cost of plastering. The relevant items for trenches for stormwater will be scheduled in the section of the schedule covering stormwater drains. The operation of placing and compacting bedding shall be regarded as part of the operation of pipe or culvert laying.

c) Benching in ..., concrete with ..., rendering ......................................................... Unit: m²

The area will be measured in plan from the drawing.
8.2.10 Accessories
   a) Manhole covers including frames (type stated) ........................................ Unit: No.
   b) Grid inlets including frames (type stated) ............................................... Unit: No.
   c) Step irons .................................................................................................... Unit: No.
   d) Other accessories (detailed) ........................................................................... Unit: No.

Each rate shall cover the cost of supplying and installing the accessory.

8.2.11 Anchor Blocks ......................................................................................... Unit: No. or m³

The relevant items given in SABS 1200 G or SABS 1200 GA, as applicable, shall apply.

8.2.12 Extra-over Item 8.2.1 or 8.2.2 for Construction of Inclined Culvert ............... Unit: m

The rate shall cover the cost of additional or more difficult work of any kind in respect of laying, excavation, and backfilling that may be required to install the culvert at a slope in excess of 1:5.

8.2.13 The Raising or Lowering of Existing Manholes ........................................... Unit: No.

The rate shall cover the cost of removing the cover and frame, demolishing the top of the manhole, if required, materials and labour for rebuilding the manhole to the designated new level, and setting and grouting the cover and frame to the correct level.
### CHAMBER AND SHAFT SECTIONS

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<th>WALL THICKNESS, mm, min.</th>
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### REDUCER AND ADAPTOR SLABS

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<td>ADAPTOR</td>
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Drawing LE - 1 - Precast Concrete Manhole for Stormwater
Reference is made to the latest issues of the following standards:

- BS 1247: Manhole step irons
- SABS 227: Burnt clay masonry units
- SABS 285: Calcium silicate masonry units
- SABS 558: Cast iron surface boxes and manhole and inspection covers and frames
- SABS 677: Concrete non-pressure pipes
- SABS 819: Asbestos cement sewer pipes
- SABS 974: Rubber joint rings (non-cellular)

Part I: Joint rings for use in gas, water, sewer, and drainage systems.

- SABS 986: Precast reinforced concrete culverts
- SABS 1200 A: Civil engineering construction - General
- SABS 1200 AA: Civil engineering construction - General (small works)
- SABS 1200 D: Civil engineering construction - Earthworks
- SABS 1200 DA: Civil engineering construction - Earthworks (small works)
- SABS 1200 DB: Civil engineering construction - Earthworks (pipe trenches)
- SABS 1200 G: Civil engineering construction - Concrete (structural)
- SABS 1200 GA: Civil engineering construction - Concrete (small works)
- SABS 1200 LD: Civil engineering construction - Bedding (pipes)
- SABS 1294: Precast concrete manhole sections and slabs