

TECHNICAL SPECIFICATIONS

SECTION 1 EARTHWORKS, BACKFILLING AND RESTORATION

Conditions of Site

Before carrying out work on any Site, the Site shall be inspected by the Contractor prior to bidding (and confirmed through signing of pre-bidding site visit certificate) in conjunction with the IRC to establish its general condition which shall be agreed and recorded in writing and by means agreed upon Details recorded shall include the location of all boundary, existing sewerage apartments and their condition and temporary TBMs, existing buildings, surface, tracks, fences and other information relating to the Site and elsewhere which may be affected by the works.

Site Clearance and Topsoil Removal

Site clearance shall be carried out over the areas to be occupied by the Permanent Works before beginning excavation or filling or other work, and shall include the clearance of all trees, stumps, bushes and other vegetation and the removal of all boulders between 0.01 and 0.2m³ volumes. Boulders located within 1m of any pipe centreline shall be removed where directed by the IRC.

Before beginning clearance in any area the Contractor shall give seven days written notice of his intention to the IRC who will determine the extent and limits of such clearance. Topsoil shall mean the surface layer of soil which by its humus content supports vegetation and is unsuitable, as a formation to roads and concrete structures or as a backfill or bedding material. The extent and depth of topsoil that needs removal shall be agreed with the IRC. Topsoil shall be set aside for re-use or disposal as directed by the IRC. Where required trees to be removed shall be uprooted or cut down as near to the ground level as possible. Bushes, undergrowth, small trees stumps and tree roots shall, where directed by IRC, be grubbed out. All holes left by the stumps or roots shall be backfilled with suitable material in a manner approved by IRC. IRC may require that individual trees, shrubs and hedges are preserved; the Contractor shall take all necessary precautions to prevent their damage.

Erosion

The Contractor shall take care at all times to prevent erosion on every site and elsewhere on land which may be affected by his operations and the IRC may impose such reasonable limitations and restrictions upon the method of clearance and upon the timing and season of the year when clearance is carried out as the circumstances warrant.

Ground Levels

Before commencement of any earthworks or demolition the sites shall be surveyed, as necessary, in conjunction with the IRC to establish existing ground levels. These agreed ground levels shall form the basis for the calculation of any subsequent excavation and filling.

Excavation Generally

Excavations shall be made in open cutting unless tunnelling or heading is specified or approved by the IRC and shall be taken out as nearly as possible to exact dimensions and levels so that minimum of infilling will afterwards be necessary. The Contractor shall ensure the stability and safety of excavations and shall take all measures necessary to ensure that no collapse or subsidence occurs. Except where described in the Contract or permitted under the Contract excavation shall not be battered. The sides of all excavations shall be kept true and shall where necessary be adequately supported by means of timber, steel or other type struts, walling, poling boards, sheeting, bracing and the like. Excavations shall be kept free from water and it shall be the Contractor's responsibility to construct and maintain temporary diversion and drainage works and to carry out pumping and to take all measures necessary to comply with this requirement.

In the event of soft or otherwise unsuitable ground being encountered at formation level or if the formation is damaged or allowed to deteriorate the Contractor shall forthwith inform IRC, shall excavate to such extra

depth and refill with compacted granular or other approved fill or C15 concrete (minimum compressor strength 15N/mm^2) as the IRC may require for which prior approval will need to be granted. With respect to the side face of any excavation against which concrete or other work will be in contact the Project Manager may require that the net dimensions of the work be increased.

The Contractor shall be responsible for the disposal of Surplus excavated material off site, which shall be to a location approved by the County Authorities, the disposal site location and seeking for necessary County Government approval shall be the responsibility of the Contractor. No excavated material suitable for re-use shall be removed without the approval of IRC. The Contractor shall not deposit excavated materials on public or private land except where directed by IRC or with the consent in writing of the relevant authority or of the owner or responsible representative of the owner of such land and only then in those places and under such conditions as the relevant authority, owner or responsible representative may prescribe.

Excavation in Excess

If any part of any excavation is in error excavated deeper and/or wider than is required the extra depth and/or width shall be filled with Grade C15P concrete or compacted granular or other approved fill to the original formation level and/or dimensions as the IRC directs. In pipe trenches where the pipe is not bedded on or surrounded with concrete, excess excavation shall be filled with compacted granular material. Excess excavation in rock trenches shall be filled with concrete (15N/mm^2 compressive strength) up to 150mm below the pipe invert.

Mechanical Excavation

Where required, mechanical excavation shall be employed only if the subsoil is suitable and only in such manner which will allow adequate support of the excavations. The Contractor shall ensure that there are no pipes, cables, mains or other services or property which may be disturbed or damaged by its use.

Excavation for Foundations of Structures

The Contractor shall give sufficient notice to the IRC to enable him to inspect and approve foundations in advance of placement of the permanent works. The IRC may withdraw his approval if work is not commenced within 48 hours or the formation is subsequently allowed to deteriorate.

If the IRC directs a bottom layer of excavation of not less than 75mm thickness shall be left undisturbed and subsequently taken out by hand immediately before concrete or other work is placed. Formations which are to receive concrete blinding or a drainage layer shall be covered with such blinding or layer immediately the excavation has been completed, inspected and approved by IRC.

Surfaces against which permanent works are to be placed shall be kept free of oil, water, mud or any material. No concrete or other materials shall be placed until formations have been approved. Adequate notice shall be given to the IRC to enable him to examine the formation.

Excavated Materials Suitable for Re-use

In so far as they are suitable and comply with the Specification, materials arising from excavations shall be re-used in the Works. During excavation, the Contractor shall ensure that all material suitable for re-use are kept separate and set aside and protected as necessary to prevent loss or deterioration. The materials forming the surface and foundations of roads, road verges, tracks and footways shall when excavated, and if required for further use, be carefully separated. All hard materials shall be kept free from soil or other excavated materials. During excavation of pipe trenches the Contractor shall ensure that all granular or other approved

Material suitable for filling around and over pipes shall be kept separate and re-used for this purpose. Paving slabs, bricks and similar surfaces shall be carefully removed and stacked. Prior to the commencement of excavation the number of badly broken and unsuitable paving slabs, bricks etc. on the line of the excavations shall be agreed with the IRC. In verges and other grass surfaces the grass and top soil shall be stripped and separately stacked.

Backfilling of Excavations

Backfilling shall be thoroughly compacted in layers not exceeding 150mm (min.) compacted thickness and by means which will not damage the Works. Backfilling of reinforced concrete structures shall be with suitable material approved by IRC. "Granular material" as backfill is defined as unconsolidated quarry dust, gravel, murrum, sand or similar in which the clay or silt content is not predominant. The use of angular crushed stone shall not be permitted.

Selected Backfill Material

Backfill in contact with the pipes shall be selected material and shall not contain large stones, rocks, tree roots or similar objects which through impact or by concentrating imposed loads might damage the pipes. The material shall be capable of being compacted without the use of heavy rammers and should be free of clay lumps or other material larger than 75mm or stones larger than the maximum particle size specified for pipe bedding.

Making Good Subsidence after Backfilling

Backfilling, whether in foundations or in pipe trenches, shall be thoroughly compacted by ramming and any subsidence due to consolidation shall be made up with extra compacted material. Should subsidence occur after any surface reinstatement has been completed the surface reinstatement shall first be removed, the hollows made up, and then the surface reinstatement re-laid.

Any subsidence that occurs adjacent to the Site of the Works which is attributable to the Contractor's activities shall be reinstated to the full satisfaction of the IRC.

Removal of Timbering from Excavations

Timbering shall be removed from the excavations before or during the process of backfilling except in so far as this removal of timber would be likely to cause damage to adjacent property, structures or structure foundations in which event the Contractor shall leave in the excavation such timbering as he considers necessary or as may be ordered by the IRC.

Reinstatement of Surfaces

All surfaces whether public or private that are affected by the Works shall be reinstated temporarily in the first instance and when the ground has consolidated fully the Contractor shall reinstate the surfaces permanently.

Temporary reinstatement and permanent reinstatement of all surfaces, affected by the operations of the Contractor shall be carried out and maintained to the satisfaction of the Project Manager and the responsible authority or owner.

Temporary reinstatement shall be carried out immediately the trenches are backfilled. Permanent reinstatement shall not be carried out until the ground has consolidated completely. The Contractor shall inform the IRC before carrying out this work. In the event of further settlement occurring after completion

of the permanent reinstatement the Contractor shall forthwith make good the reinstatement to the approval of the IRC or responsible authority.

In verges, top of filtration beds and other grass surfaces and after the backfilling had been thoroughly consolidated the topsoil shall be re-laid rolled and planted with grass or other vegetation as directed by the IRC as may be necessary and watered until the grass or vegetation has become well established.

Should the Contractor not remedy the defect to the IRC's satisfaction forthwith any remedial work considered necessary may be undertaken by the Employer and/or the responsible authority at the Contractor's expense. Topsoil shall be carefully set aside and replaced at the surface of the backfilling.

The trenches shall be refilled and rammed solid as specified in the Contract and shall not be topped up above the original surface level to allow settlement. If any trench becomes dangerous the IRC may call upon the Contractor for its reinstatement at three hours' notice and failing this to have the work done by others at the Contractor's expense.

In the case of footpaths the trench shall be refilled and rammed as specified to within 125mm of the surface. A foundation layer of 100mm compacted thickness of approved crushed limestone shall then be laid and compacted. The surface shall be cleaned and primed and the footpath surfacing shall be temporarily reinstated with 25mm compacted thickness of 14 mm nominal size dense wearing course macadam laid and compacted so as to achieve a dense, smooth and even course surface using a roller of 750 to 3000kg mass. Any kerbs shall be reinstated to their original condition.

The trench surface shall be thus maintained until the end of the Period of Maintenance or permanent reinstatement is ordered by the IRC. Where permanent reinstatement is ordered by the IRC the temporary surface and part of the foundation shall be removed to 50mm depth to permit the construction of a tiled or paved surface to match the original surface. An approved tiled or paved surface shall then be laid and bedded on sand or mortar to an even finish.

SECTION 2. CONCRETE AND MASONRY WORKS – GENERAL

Scope

This Specification applies to structural concrete in small structures such as manholes, chambers, gully traps and superstructure elements of small building works. This specification also applies to concrete in thrust blocks, blinding, supports, fill etc.

Concrete

Classes

This Specification includes 4 grades of concrete

Grade CI5

Grade C20

Grade C25

Grade C30

The grade refers to the 28 day characteristic strength in N/mm²

Composition

The concrete composition shall generally conform to the requirements of the prescribed mix design, as set out in BS 5328 Tables I and 2. Small quantities of concrete may with the approval of the IRC be batched in accordance with the Table 3.1 of Nominal Mixes

Table 2.1 Nominal Mixes

Grade of concrete	Approx. volume of Aggregate m ³ per m ³ concrete		Approx. cement per m ³ finished concrete in bags (each 50 kg)	Remarks
	Fine	Coarse		
C15	0.450	0.900	5	Aggregate max. size to be 20 mm. Fine aggregate to Zone M of BS 882 Water not to exceed 28 litres per 50kg of Cement
C20	0.400	0.875	6	
C25	0.375	0.825	8	
C30	0.350	0.725	11	

Structural Concrete

Structural concrete shall be Grade C20, C25 or C30, as shown on the drawings. The cement content shall not be less than 320 kg per cubic metre and the water/cement ratio shall not exceed 0.55 (27.5 litres per 50 kg of cement). The slump shall be 50 mm +/- 15mm when tested to BS 1881.

Unless otherwise approved by the IRC, the fine aggregate shall comply with Zone M or Zone F of BS 882. Coarse aggregate shall be 20 mm max size. The proportions of the mix shall be approximately as shown in the Tables 1 and 2 of BS 5328 but these proportions may be varied to obtain the specified strength requirements. Admixtures may not be used in ordinary structural concrete. A trial mix of the concrete to be used shall be made in the presence of the IRC sufficiently in advance of the commencement of concreting to permit the 28 day compression test result of the cubes taken from the mix to be approved by the IRC. 28 day compression cube tests shall be carried out taking one sample for each 20 m³ of concrete placed with a minimum of one sample per day. Three cubes are to be cast from each sample. If more than 5% of test results fall below the specified characteristic strength when tested to BS 1881, adjustments to the mix shall be made in order to obtain the strength required and the IRC may require concrete already placed to be made good as described in this Specification.

Cement

Cement for normal concrete shall be Ordinary Portland or Rapid Hardening cement to BS 12 or shall be CEMI-32.5, CEMII-32.5 or CEMIV-32.5 or higher strength grade. Cement for sulphate resisting concrete shall be sulphate resisting cement to BS 4027. Cement which is not fresh and dry before mixing shall not be used in the Works.

Water

Water shall be potable

Aggregates

Fine aggregate shall be clean natural sand. Coarse aggregate shall be crushed stone, washed gravel or other inert granular material as approved by the IRC.

All aggregates shall comply with the requirements of BS 882 and grading curves shall be provided for all aggregates used.

Reinforcement

Reinforcement shall comply with BS 4449 and shall be bent in accordance with BS 4466. Fabric reinforcement shall be made from cold-drawn high tensile steel and shall comply with BS 4483. Reinforcement which is rusted shall be wire brushed before use to remove mill scale.

Formwork**Requirements**

Formwork shall be accurately formed and shall be of sufficient strength and rigidity as to carry the weights and pressures of the concrete without deformation. It shall be tight so as to avoid the loss of grout and shall be clean and free from damage. "Rough Finish Formwork" shall consist of sawn boards or sheet metal panels and shall only be used where specified in the Bill to produce a rough finish. "Fair Finish Formwork" shall produce a high standard of finish. Where not otherwise specified in the Bill of Quantities this formwork shall be used throughout the Works. It shall consist of wrought timber boarding 40 mm thick tongued and grooved, or framed plywood, and arranged in a uniform pattern.

Striking and Removal of Formwork

Striking of formwork shall be carried out having regard for the climatic conditions prevailing, and shall be undertaken at the sole risk of the Contractor. Where premature removal of formwork takes place and deformation is apparent, with or without distress in the concrete, the work shall be made good as described in this Specification. The following striking times are included as a guide for normal conditions and shall be treated as a minimum requirement:

Suspended Slabs	(props left under)	5 days
Ditto	(props removed)	10 days
Beam soffits	(props left under)	9 days
Ditto	(props removed)	19 days
Sides of beams, walls and Columns		1 day

All exposed concrete arises are to have 20mm x 20mm chamfer unless otherwise shown on the drawings.

Concreting Requirements

The finished concrete shall be dense durable and free from cracks and honeycombing.

Mixing, Transporting and Placing

All concrete shall be made in a mechanical mixer. Concrete shall be placed within 30 minutes of completing the mixing or agitation. Mixing may be continued in the mixer or agitator up to a maximum period of 90 minutes and for not less than the period required to achieve an even consistency of the mix. All concrete shall be compacted by a mechanical vibrator and a slump test shall be carried out on each batch mixed, unless otherwise approved by the IRC.

Concreting in difficult weather conditions

Concreting during hot or cold weather conditions shall comply with the established requirements of good practice. During wet weather adequate covering shall be provided to both materials and concrete.

Curing

All concrete shall be properly cured for 7 days, by wetting or by use of an approved curing membrane.

Finishes to Concrete

All exposed faces of concrete shall be hard, smooth and free from honeycombing and other blemishes. All projections shall be rubbed down with carborundum stone. The normal finish to slabs and screeds, unless otherwise specified, shall be formed by wood floating the accurately levelled or screeded surface.

Making Good

Any section of the work which, in the opinion of the IRC, does not conform to the requirements or clear intent of this Specification, or to the requirements of established good practice, shall be made good or removed and replaced as directed by the Project Manager at the expense of the Contractor.

Ready Mixed Concrete

Ready mixed concrete shall comply with the requirements of this Specification and to those other requirements of BS 5328 which do not conflict with the Specification.

Granolithic Concrete

Granolithic concrete shall conform to the recommendations laid down in the "Specification for Granolithic floor toppings laid on in-situ concrete" as published by the Cement and Concrete Association with special reference to monolithic construction.

Concrete Benching

Concrete benching shall consist of structural concrete, as herein specified, placed to a low workability and finished while still green with 50 mm Grade C25 fine concrete using a maximum aggregate size of 10 mm and steel trowelled to a smooth dense finish to the concrete contours.

Personnel

The Contractor shall ensure that at least one senior member of his field supervisory staff, who is experienced in such operations and fluent in both English and the language of his laborers is on site throughout the duration of the work.

The Contractor shall also ensure that all necessary skilled artisans and an adequate number of laborers for the operation are on site throughout the work.

Masonry Using Natural Irregular Stones

Stones shall come from selected quarry layers to the approval of the IRC. They shall be homogeneous, frost resistant, flawless, free of any cracks or bousins, solid, and of equal grain and shall have all the required quantities to give a regular facing. They shall give out a clear sound when hit by a hammer.

Mortar shall be removed from the external surface of the wall. The Contractor shall prepare a wall sample approved by the IRC which shall be kept at the construction site until all the masonry is completed.

Composition of Mortars

- a. Cement mortar for bonding concrete shall be composed of cement and sand mixed in the proportion of the jointed concrete.
- b. Cement mortar for setting precast concrete or pitching shall be composed of cement and sand mixed in the proportion of 50kg of cement to 0.14m³ of sand, with the addition of an approved plasticizer.
- c. Cement mortar for blockwork in concrete blocks shall be composed of cement and sand mixed in the proportion of 50kg of cement to 0.14m³ of sand.
- d. Sand and Cement for mortars shall be as described in the specification for concrete.

Mixing of Mortars

The materials of mortars shall be measured out in their correct proportions and shall first be thoroughly mixed together in a dry state by turning them over upon a clean wooden stage until they are of a homogeneous appearance in consistency and colour. Clean water shall then be added while the mixture is being turned over until it attains a suitable consistency. Plasticizer shall be added in accordance with the manufacturer's recommendations as approved by the IRC.

The mortar shall be used immediately after it has been mixed. No mortar which has commenced its first set shall be used, or mixed up again. Mortar shall, where possible in hot weather, be protected from too rapid action by covering with impervious material such as polyethylene film.

Mixing by hand will be allowed only if the IRC gives specific approval. Mixing by machine using the same sequence of operations described above shall be carried out whenever possible.

Cement Rendering

Rendering shall be in a 50 kg: 017-2-.20m³ cement: sand mix but where approval had been given to the use of a plasticizer or other additives these proportions may be modified to the approval of the IRC.

All surfaces to receive a finishing coat of cement rendering or fine concrete shall be thoroughly prepared and cleaned and the rendering or screeding shall be placed immediately after such surfaces have been thoroughly wetted.

All rendering shall be put to a minimum of two coats, the first being left rough to a minimum of 10 mm thickness, but the second coat shall be trowelled up to a fair faces as soon as possible after it is applied. All internal rendering shall be finished to an even and polished surface with a float, trowel or other suitable tool, special care being taken to obtain perfectly smooth and glazed faces. It shall not be less than 15mm thickness when finished unless instructed otherwise.

All external rendering shall be brought to an even surface with a wood float following which a tyrolean finish of approved colour shall be applied unless otherwise stated. All rendering shall be protected from sun and rain by adequate and suitable coverings which shall be supplied and fixed in advance of these conditions arising. The renderings shall be kept damp while setting and protected from drying winds.

Waterproof Rendering

Waterproof rendering slurry shall comprise a 50kg to 125kg cement sand mix with an approved waterproofing admixture such as styrene acrylate copolymer or Pudlo or other admixture as shall be approved by the IRC.

The material shall block capillaries and minor shrinkage cracks to prevent water ingress while allowing the passage of water vapour through the structure. The render shall be applied to a total thickness of not less than 20mm the first coat shall be applied levelled scratched and left to dry for not less than 3 days.