

TOBIN

Refurbishments & Extension at Cape Clear Heritage Centre at Oileán Chléire, Co. Corcaigh

Volume A2: Specification - Materials, Workmanship and Methods of Construction



Údarás na
Gaeltachta

BUILT ON KNOWLEDGE

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5.0 MATERIAL STANDARDS AND QUALITY OF MATERIALS

5.1 PURPOSE OF THIS SECTION

This section sets out how the A3 General Works Specification should be used and read. It includes a narrative on the common rules associated with subsequent sections of this A3 General Works Specification, regardless of the particulars of the project. It includes overarching advice on the quality of materials, testing of materials, the priority of standards, how references to various standards, regulations, Codes of Practice should be interpreted.

5.2 CURRENCY OF STANDARDS

In this Specification, where there is reference to an Irish or other international Standard, Specification or Code of Practice, this is taken to mean the current issue of such Standard, Specification or Code of Practice.

5.3 HIERARCHY OF STANDARDS

The primary standard for all materials, where a standard exists, shall be the European Standard (EN) as published by CEN, or as transposed in Ireland as ISEN. The following hierarchy shall apply to the interpretation of standards:

- ISEN – if such a standard has been published for the material, this shall be the standard specification for the material. If no ISEN has been published for the material, then.
- EN shall apply. If no EN has been published for the material, then.
- IS shall apply. If no IS has been published for the material, then.
- Any equivalent national standard of another Member State of the European Union shall apply, if no equivalent national standard is available, then particular requirements related to specific materials will be set out elsewhere in this specification.

Any reference in this specification to an ISEN standard shall be taken to include the Irish National Annex. Any reference in this specification to a national standard shall be taken to mean the equivalent ISEN standard, if the national standard has been subsequently replaced by an ISEN standard, or if the co-existence period has elapsed.

5.4 QUALITY OF MATERIALS - GENERAL

The whole of the materials shall be subject to the approval of the Employer's Representative whose decision in all matters pertaining to quality and suitability of materials and workmanship shall be final and binding. So far as is practicable, the origin of goods and materials used in the Works shall be Ireland, or one of the other member states of the European Union.

All materials shall be new (unless the contract allows otherwise) and of the best quality and shall be transported, handled and stored in such a manner as to prevent deterioration, damage or contamination. As soon as possible after the contract is awarded, the Contractor shall inform the Employer's Representative of the names of the suppliers from whom he proposes to obtain materials, but he shall not place orders for such materials without the approval of the Employer's Representative, which approval may be withheld until samples have been submitted and satisfactorily tested.



When proprietary products are specified, similar products from other manufacturers may be accepted at the discretion of the Employer's Representative provided they are at least equal in quality to those specified. Samples shall be taken in accordance with the appropriate standard where applicable. The materials subsequently supplied shall conform to the quality of samples that have been approved by the Employer's Representative. Names of additional suppliers and sources may be submitted by the Contractor during the execution of the contract, but no source of supply shall be changed without the Employer's Representative's approval.

All materials or substances shall comply with current applicable Irish Standards (IS or ISEN) and current applicable Irish Codes of Practice, and where there are no applicable Irish Standards or Codes of Practice, then the materials or substances shall comply with the current applicable British Standards (BS or BSEN) and Codes of Practice. No materials or substances shall be used which are known to be deleterious to health or safety or the durability of the Works in the particular circumstances in which these materials or substances are to be used.

Nothing stated in this Specification is to be construed as discriminating against products and materials manufactured in any of the Member States of the European Union.

Where items to a particular national standard of a Member State of the European Union are called for, this requirement shall be read as including items to a relevant international standard, or the relevant national standard of any Member State of the European Community that provides an adequate guarantee of safety and suitability.

Where items certified by the National Standards Authority of Ireland as complying with an Irish Standard are called for, the provisions of Circular Letter BM2/87 and Circular Letter BC 14/92 shall apply, i.e. the requirement shall be read as either certified by the National Standards Authority of Ireland as complying with the Irish Standard and shall bear the Irish Standard Mark, or shall be certified as complying with the relevant national standard of another Member State of the European Union, which provides an equivalent guarantee of safety and suitability – certification to be by the National Standards Authority of Ireland.

5.5 QUALITY OF MATERIALS – DECLARATION OF PERFORMANCE/CE MARKING

Wherever, in respect of any Irish Standard (either ISEN or IS), an NSAI Scheme of Supervision and Control is available, all materials used in the Works required to comply with that Standard, or the containers of such materials, must have a Declaration of Performance (DoP) and bear a CE mark in accordance with EU Construction Products Regulation No 305/2011, when delivered to site.

CE marking enables a construction product to be placed legally on the market in any EU country and then be traded on the EU's single market.

If requested, the contractor shall demonstrate compliance with the EU Construction Products Regulation No 305/2011 for every product used on the project. The Contractor shall not accept delivery of any products without first getting a copy of the certification showing that the product complies with the EU Construction Products Regulation No 305/2011, including the harmonised technical specifications, the specific requirements of this contract including works requirements, specifications and drawings, the minimum requirements in the National Annexes and Standard Recommendations, compliance with the Building Regulations in relation to use of proper materials that are fit the use for which they are intended and conditions of use, and the appropriate Declaration of Performance.



This requirement shall not apply where the Employer's Representative is satisfied and confirms to the Contractor in writing that such materials are not readily available. In such a case, or where an NSAI Quality Assurance Scheme is not available but the materials are manufactured to the appropriate standard specification as certified by the appropriate certification body in the member state in which the product originates, the Contractor shall on request produce a certificate from the manufacturer stating that from each consignment a representative sample has been tested, and has proved to be in accordance with all the requirements of that specification.

Notwithstanding the furnishing of this certificate, nothing shall prejudice or override the inalienable right of the Employer's Representative to have independent tests carried out. For the purpose of carrying out such tests the Employer's Representative shall have full authority to have the samples taken, either at the manufacturer's factory or from consignments at the Works, and to submit the same to an approved Engineering Laboratory chosen by him for testing. Furthermore, the Employer's Representative shall have the right to reject any material as a result of such tests, notwithstanding that the manufacturer's certificates may have shown the materials to be satisfactory.

5.6 TESTING OF MATERIALS

Particular attention of the Contractor is drawn to the requirement that all materials used (whether imported or re-used from materials recovered on the site) shall be tested and be accompanied by a certificate to be presented prior to their first use on the site, to demonstrate compliance with the recognized standards, including current Building Regulations (including Technical Guidance Documents recommendations) and other statutory requirements, NRA requirements, and other recognized construction industry body requirements.

Every item of material shall from time to time be subject to such tests as the Employer's Representative may prescribe and the materials tested shall conform in every detail with the requirements of the appropriate standard specification or with any other standard test which the Employer's Representative may lay down in the course of this Specification.

6.0 SITE CLEARANCE, EXCAVATION & EARTHWORKS

6.1 SITE CLEARANCE

The Contractor shall clear from the proposed locations of new structures and pipelines all trees, stumps, bushes, hedges, structures and loose objects. Stumps of trees and roots shall be grubbed up or destroyed. Mature trees shall not be damaged or removed unless specifically required by the contract or instructed by the Employer's Representative.

All materials from the clearance shall be disposed of to a place approved by the Employer's Representative and acceptable to the Planning Authority. If required by waste management legislation, the appropriate disposal permit shall be obtained by the Contractor.

Existing buildings and/or structures specified for demolition elsewhere in this Specification shall be carefully demolished and rubble disposed of to a place approved by the Employer's Representative and acceptable to the Planning Authority.

6.2 CLASSIFICATION OF EXCAVATION

Excavation for the purpose of this Specification and of the accompanying Pricing document and of the Contract shall be classified as (a) excavation in any material except solid rock, and (b) excavation in solid rock.

6.3 METHODS OF EXCAVATION

The Contractor shall carry out his excavating operations in such a manner as to avoid damage to or deterioration of the Final Surfaces. The Contractor shall be responsible for the safe preservation of existing underground services, and if any damage is occasioned thereto, the Contractor shall at his own expense make good all such underground services to the satisfaction of the Employer's Representative, and of the Authority concerned.

All excavations shall be to the widths, depths and lengths shown on the Drawings or described in the specifications, or to such alternative depths and dimensions as may be directed by the Employer's Representative.

The surfaces of road excavations shall all have saw cut edges.

Field turf shall be carefully cut into narrow widths and carefully rolled and stacked for later re-use. All productive topsoil shall be carefully stripped and stockpiled separately from other excavated material for subsequent re-use. It shall be kept free of weeds. The Contractor shall not cut or break down any live fences or trees in the line of the pipes without the permission of the Employer's Representative.

The Contractor shall examine the bottom of all excavations and shall call the attention of the Employer's Representative Site Staff to any unsound or weak places, which shall be dealt with in any such manner as the Employer's Representative may direct, and shall not commence any of the Permanent Works until the foundations have been approved by the Employer's Representative. If the bottom is damaged as a result of excavations or allowed to deteriorate the Employer's Representative shall be promptly informed. The Contractor shall in all cases carry out his operations in such a manner as to avoid such damage or deterioration of the final surface.



If any ground is excavated to a depth exceeding that shown on the Drawings or described in the Specification or otherwise than is necessary for the Works or to accord with the instruction of the Employer's Representative, such extra depth shall be made good with concrete or in such other manner as the Employer's Representative may direct.

The last 100mm above formation level shall not be excavated until immediately before concrete or other formation material is to be placed upon it.

The excavation bottoms are to be carefully examined for the presence of hard objects such as stones, rock projections or tree roots, and these removed, and the bottoms then prepared. Filling the bottom of excavations or trenches to the level of any hard objects found on the bed is forbidden.

Excavations in and adjacent to roads and footways shall be adequately protected by substantial barriers and illuminated at night with lamps.

The Contractor shall remove and dispose of surplus and other excavated material and rubbish off the site at places to be located by himself which have a permit from the Local Authority or licence from the EPA. Such disposal shall take place at frequent intervals to prevent any accumulation of spoil and rubbish.

The sides of excavations shall be adequately supported at all times and, except where required by or permitted under the Contract, shall not be battered. No excavations with battered sides will be permitted within 30 metres of any building or other structure. In the event of any trench for pipelines being excavated with battered or stepped sides that portion of the trench which extends from the formation to a point not less than 300mm above the crown of the pipe shall be formed with vertical sides the minimum practicable distance apart but nowhere a greater distance apart than the maximum trench width indicated in this specification.

No excavated material suitable for re-use in the Works shall be removed from the Site except on the direction, or with the permission of the Employer's Representative.

Excavation for trenches up to 4.50 metres in depth shall be made in open cutting unless the Employer's Representative otherwise instructs or permits.

Excavated material to be used for backfilling shall be kept well clear of open trenches at least 1000mm from the edge of the trench and shall not be placed or stored in a manner which might constitute an excessive load on the open trenches or otherwise endanger the stability of the excavations or which causes obstruction to any road or right of way, or which jeopardises the safety of any person in or about the Works. If excavated material is deemed by the Employer's Representative to be unsuitable for refilling, then following disposal of same approved fill shall be imported to the site for this purpose. Where excavation is in Solid Rock the Employer's Representative's approval must first be obtained before excavated rock can be used as a backfilling material. In such cases crushing and screening may well be required before re-use and the Contractor shall be deemed to have included for this in his overall pricing.

Where a step occurs in the underside of a structure, the subgrade material at the step in formation level shall be excavated to its natural slope. The void formed by this additional excavation shall be backfilled with lean mix concrete to the underside of the structure.

Excavated material shall not be stacked along the sides of trenches. Unless otherwise permitted or directed by the Employer's Representative, excavated material shall be taken off site and temporarily stored for re-use in a location, approved by the Employer's Representative and the Local Authority and for which the Contractor has obtained Planning Permission if required. Where the excavated material is considered suitable for re-use by the Employer's Representative, the Contractor shall include for bringing the excavated material back for backfilling of trenches. Where the excavated material is unsuitable for re-use, it shall be removed to a permitted place of disposal approved by the Employer's Representative and the Local Authority, and backfilling shall be carried out with imported fill consisting of Clause 804 material or as specified. The cost of this work shall be deemed to have been included in the Contractor's Rates and Prices as shall be the costs arising from obtaining the necessary Planning Permissions associated with the storage and/or disposal of excavated materials.

6.4 DEALING WITH WATER

The Contractor shall not allow water to lie in any part of the Works unless required to do so under the Contract. Water arising from or draining into the Works shall be drained or pumped to an approved disposal point. Any drainage sumps required, shall where practicable, be sited outside the area excavated for the Permanent Works, and shall be re-filled with blinding concrete to the level of the underside of the adjacent Permanent Works.

The Contractor shall be liable for and shall make good any damage caused by prolonged or excessive pumping and shall take all necessary precautions to prevent any adjacent ground from being adversely affected by loss of fines through any de-watering process. He shall also be liable for the safety of any adjoining structures, roads, buildings etc., by shoring or otherwise during the time that the excavations are open.

The Contractor shall take all necessary precautions to prevent any ground water from entering mains to be used for the conveyance of potable water.

6.5 SOLID ROCK

Rock shall mean natural rock formation which can properly be removed only by means of blasting, barring, or wedging or by some other recognised methods of quarrying. It shall also include solid rock boulders of one quarter cubic metre or more in volume which can only be removed by one or other of the aforesaid methods, existing concrete, or bonded masonry laid in mortar, but shall not include shale formations, tree trunks or such like objects, despite their removal by methods similar to those normally adopted in solid rock excavation.

Where rock or boulders are encountered in trenches the bottom of the trench shall be excavated to the additional depth specified before bedding is placed. No projection of rock closer than 200mm to the side of a pipe in trench shall be permitted. The trench width for the purpose of measurement of rock in trenches shall be deemed to be the maximum trench width defined in Section 15 – Civil Engineering Works and Pipelines.

6.6 SLIPS, FALLS AND EXCESS EXCAVATION

Every precaution shall be taken by the Contractor to prevent slips and falls of earth and other material in the excavations. In the event of slips or falls occurring or in the event of excavation being made in excess of the minimum necessary or practicable for the construction of the Works the voids so formed shall be filled at the Contractor's expense. In all cases where the voids so formed may in the opinion of the Employer's Representative affect the stability of the ground



for the support of the permanent works or of adjacent structures and services then such voids shall be filled solid with concrete Grade C12/15. In all other cases the voids shall be packed either with imported granular material or selected suitable excavated material thoroughly compacted.

6.7 EXCAVATION IN NARROW PASSAGES

In narrow passages the excavated material shall be removed at once so as not to obstruct the passage and shall be brought back when required for re-filling the trench or tunnel. The Contractor shall also include for excavation by hand where necessary in confined locations.

6.8 SHORING OF BUILDINGS

The Contractor shall shore up any building the stability of which may possibly be endangered by the execution of the works.

6.9 UNDERPINNING

In excavating near the foundations of existing buildings the Contractor may be required to underpin, so as to ensure the stability of such foundations. In such circumstances the excavations shall be carried out in short lengths not exceeding 1 metre and the underpinning shall be constructed in alternative sections. In excavating each length, the foundations of the existing structure and all sides of the trench or heading shall be boxed with close boarding all around and properly strutted. The Contractor will be responsible for the safety for such structures, and should any subsidence or any other damage occur due to the insufficiency of the underpinning or other supports provided, the damages shall be made good by the Contractor at his own expense.

6.10 SUPPORT OF TRENCHES

The Contractor shall provide and place all piles, sheeting, timbering or otherwise necessary for supporting the sides of trenches and other excavations and shall be responsible for their safety. In soft or sliding soils or in such other locations as appear to warrant it, the Employer's Representative may order the sides of trenches to be close boarded in a continuous partition. The Contractor shall provide and place such sheet piling, planking or strutting as may in particular circumstances be required. The use of trench boxes shall be permitted where necessary for support of the trench slopes.

All linings and framings shall be inserted as the excavation proceeds and shall be tightened up against the adjacent soil by wedging or jacking and secured by cleats or other suitable means. In deep excavations provision shall be made for bracing the framings vertically so as to prevent downward slipping of any of the framing units. In long excavations horizontal diagonal bracings may be necessary. In so far as is possible all timber linings and framings to excavations shall be so arranged that they can be withdrawn as the pipelaying or building in of the foundation proceeds.

6.11 TIMBER SUPPORTS LEFT IN

Although it is ordinarily intended that timbering shall be removed as the work proceeds, the Employer's Representative may require any portion of it to be left in the excavations for safety. If timbers or supports are left in the trenches unnecessarily and without express directions

given by the Employer's Representative, then or in any such circumstances the cost thereof shall be borne by the Contractor at his own expense.

6.12 BACKFILLING – GENERAL

Backfilling shall, wherever practicable, be undertaken immediately the specified operations (laying, jointing, testing, haunching and surrounding watermain, sewers and other pipelines and final approval of the work as being in compliance with the appropriate sections of the Specification) preceding it, have been completed. Backfilling shall not, however, be commenced until the works to be covered have achieved a strength sufficient to withstand all loading imposed thereon.

Backfilling around tanks and other structures shall be undertaken in such a manner as to avoid uneven loading and damage, where appropriate, as the permanent work is built.

Filling material to excavations shall be placed in layers not exceeding 250mm unconsolidated thickness and compacted to form a stable backfill. Where the excavations have been supported and the supports are to be removed, these where practicable, shall be withdrawn progressively as backfilling proceeds in such a manner as to minimise the danger of collapse, and all voids formed behind the supports shall be carefully filled and compacted.

As filling proceeds, the greatest care shall be exercised in ensuring that the filling is sufficiently solid to take the thrust at the sides of excavations as timbering is removed. Vertical timbering shall be gradually withdrawn, and the top frames shall be retained until the whole of the filling in material is known to have thoroughly set.

6.13 WATCHING AND LIGHTING

The Contractor shall fence, light and otherwise protect all open trenches and all heaps of accumulated material whether it has been excavated from the trenches or not. For nighttime warning to drivers adequate warning lights shall be placed to indicate all obstructions in the highway. The Contractor shall meet the requirement of the Traffic Management Guidelines in planning his Lighting System.

The Contractor shall be held responsible for accidents and damage arising from failure on his part properly to fence, guard and light as aforesaid and for the inconvenience or damage caused to the public or to property owners through his negligence in these matters.

6.14 WARNING SIGNS

The Contractor shall wherever necessary erect warning signs of size and colour and with lettering to the approval of the Road Authority indicating that there is a constructional hazard "including a warning, where necessary, of restricted sight distances". The Contractor shall erect appropriate signs for the benefit of construction traffic to alert of dangers and for the benefit of the public road users to alert them of the danger of emerging construction traffic from the site. Such signs shall be arranged with the Employer's Representative Site Staff and the Employer's Personnel shall be consulted as to the location of signs, which may only be erected with their permission first obtained. All such signs shall be properly maintained while in use and shall be removed when need for them is no longer apparent.

Adequate warning to drivers approaching the excavation or road obstruction shall be provided with warning boards which meet the requirement of the Traffic Management Guidelines

(Chapter 18). Such warning boards shall be maintained in a clean and easily legible condition and shall be moved daily or as required as the work proceeds so as always to be properly positioned for the convenience of road users.

Notwithstanding compliance with statutory public notices in the Press etc. where Roads are closed, the Contractor must provide Diversion Notices complying with the above Guidelines at all such locations as may be necessary so that no user of the road is obliged to retrace his steps upon discovery of the Works and the obstruction to passage.

6.15 DAMAGE TO ROADS AND STREETS

If through the improper use of excavating machinery or through carelessness or for any other avoidable reason the Contractor excavates trenches to greater widths than are specified, or if in the remaining portions of roadways, pavement or footpath, damage is done to surfaces by caterpillar tracks or wheels of heavy machinery, the Contractor shall be entirely responsible for the complete restoration of the surfaces so damaged and shall himself restore them to the condition in which they were before the Contractor commenced his operations, or shall pay to the Employer the certified costs of such repairs.

6.16 USE OF EXPLOSIVES

The Contractor shall use explosives only with the consent of the Employer's Representative and when such consent is given it shall not include blasting operations outside the ordinary working hours except in very special circumstances to be determined after consultation with the Garda Siochana and the Local Authority concerned. Prior to the commencement of blasting operations, the Contractor shall notify the Orderly Officer of the day of the local Garda Station, as well as nearby householders, and shall place flag men at a reasonable distance on either side of the site of the blast to divert or temporarily prevent pedestrian or vehicular traffic from entering the danger zone. The Contractor shall use a siren to sound a warning prior to each blast. Trenches shall be covered with protective material to break showers of rock and stone and to prevent damage to adjacent buildings. Before commencement of any blasting operation the Contractor shall obtain the Employer's Representative's approval of the pattern and nature of the blasting proposed and shall satisfy the Employer's Representative that safe values of vibrational amplitude and peak particle velocity will not be exceeded.

Should the Contractor propose to conduct the operations in a manner which the Employer's Representative considers dangerous, the Employer's Representative shall be empowered to order modifications in the number, size and depths of holes or in the weight and nature of explosives to be used or he may order the work to be carried out by means other than those proposed. As a general rule the weight of charge to be used in any site should be kept down to the absolute minimum, and in cases where large numbers of shots have to be fired at one time, the charges should be arranged in groups, and fired electrically with the use of gasless delay detonators with a time interval of one second between each group. Explosives shall be used in the quantities and manner recommended by the manufacturers.

Where blasting is to be carried out adjacent to Buildings the Contractor shall provide a Vibrograph or other suitable instrument to measure and record with printout facilities the peak particle velocities for each blast together with personnel experienced in the operation of such equipment and in the interpretation of results.

Explosives shall be packed, conveyed and stored in accordance with the relevant statutory orders, instruments and by-laws. The Contractor shall comply with Part 8 of Safety, Health &



Welfare at Work (Construction) Regulations, 2013, and with any supplementary issue of this document and with all current regulations and requirements of the Gardai for the security and use of explosives. Explosives shall be handled by experienced and competent personnel and only with the direct authority of the Contractor. The Contractor shall ensure that there is no unauthorised issue or improper use of Explosives on site.

In each and every circumstance the Contractor will be entirely responsible for all damage and accidents arising out of or in relation to blasting operations and he shall hold the Employer indemnified against any claims for injury or damage arising therefrom.

Generally rock excavation by use of explosives or rock breaker shall be carried out so that vibrations caused are in accordance with the reference values as set down in the Union of Swiss Road Engineers Publication *"The Effects of Vibrations on Structures"*. The Contractor shall carry out surveys of all properties within a distance of 75 metres from blasting and rock breaking operations and he shall include for having photographs taken in conjunction with such surveys. The cost of this work shall be deemed to be included in the Contractors Rates for Excavation.

The following two Tables are abstracted from that publication are given hereunder.

Types of Structures	
Type of Structure	Description
I	Reinforced concrete and steel constructions (without mortar plastering) such as industrial and commercial building, retaining walls, bridges, pylons, overground pipelines. Underground structures such as caverns, tunnels, galleries, with or without concrete lining.
II	Buildings with concrete foundation walls and ceilings, walls rising through all storeys and composed of artificial stone, cut stone and concrete retaining walls in regular-coursed ashlar stonework. Underground structures such as caverns, tunnels, galleries with masonry lining. Pipelines laid in loose stone and soil.
III	Buildings with foundation walls and cellar ceilings made of concrete, wood joist ceilings in upper storeys, walls rising through all stores and composed of artificial stone.
IV	Structures particularly sensitive to vibration or deserving of protection.

Reference Values			
Type of Structure	Source of Vibration, M. machinery, traffic, construction equipment, S. Blasting	Frequency Range (Hz)	Reference Value Vmax. Total vector (mm)
I	M	10...30	12
		30...60	12...18*
	S	10...60	30
		60...90	30...40**
II	M	30...30	8
		30...60	8...12*
	S	10...60	18
		60...90	18...25**
III	M	10...30	5
		30...60	5...8*
	S	10...60	12
		60...90	12...18**
IV	M	10...30	3
		30...60	3...5*
	S	10...60	8
		60...90	8...12**

Comments: *) The lower value applies to 30 Hz, the higher to 60 Hz; intervening values require interpolation

**) The lower value applies to 60 Hz, the higher to 90 Hz; intervening values require interpolation

As the buildings and structures adjacent to the works fall generally into Category II or Category III as defined in the above Tables, the max values permitted will be 5mm/s for use of machinery and 12mm/s where explosives are used. If however the pre-works survey indicates that any of the existing adjacent buildings show any signs of distress, then these buildings will be classified as Category IV and the maximum values permitted will be 3mm/s for use of machinery and 8mm/s where explosives are used.

If the Contractor finds it necessary to remove the overburden prior to drilling he shall ensure that drilling, blasting and pipelaying operations follow in close succession and in accordance with a programme approved by the Employer's Representative. Alternatively, if there is delay in carrying out Works after blasting has been carried out, the Contractor will be required to fill in the trench until such time as he is ready for continuing with the Works. Such backfilling and

excavation shall be carried out with no extra expense on the Contract. Nothing in these requirements related to blasting shall imply an expectation that permission to blast rock will be given.

Excavated rock may be used after first obtaining the permission of the Employer's Representative for backfilling provided that such material is in compliance with the Guidelines for Managing Openings in Public Roads, as published by the Department of the Transport, Tourism and Sport.

6.17 ARTICLES OF VALUE

All fossils, coins or articles of value or antiquity uncovered by the Contractor's excavations in any part of the Works shall be deemed to be the absolute property of the Employer, and the Contractor shall take reasonable precautions to prevent his workmen from removing or damaging any such articles or things and shall immediately upon discovery and before removal acquaint the Employer's Representative of such discovery and carry out the Employer's Representative's orders as to the disposal of the material.

6.18 INTERFERENCE WITH UNDERGROUND SERVICES

The Contractor shall comply with the "*Code of Practice for Avoiding Danger from Underground Services*" published by the Health and Safety Authority.

Before the commencement of work in any area where there is likelihood of interference with Underground Services of any kind, the Contractor must first of all consult with all the Service Authorities and obtain from them site location information.

Where locations of existing services are identified following consultation with the Service Providers the Contractor shall if necessary carry out trial excavations or other investigations so that all available information regarding the service may be obtained before excavating in the vicinity of same. Where an unanticipated service is encountered in excavation the Contractor shall immediately call the attention of the Employer's Representative Site Staff and the appropriate Authority thereto.

A proper record shall be kept showing the precise position of services encountered. Location seeking of the various services can only be carried out under the supervision of the particular Authority concerned with that service.

The Contractor shall make all arrangements for the temporary shoring up and supporting, diversion when permitted by the owner, and keeping in operation all sewers, drains, land drains, gas, water and other pipes, culverts, electricity, broadband and telephone cables, fibre, etc., as may be affected, disturbed or exposed by his operations. In the event of any damage during or after the execution of the Works, he shall immediately notify the Authority or owner concerned and shall be liable for the full cost of such remedial works as may be determined by that Authority or owner and including consequential damage to the property of third parties which may arise from the execution of the Works.

Where permanent diversion or permanent support is rendered necessary as the unavoidable result of the construction of the Works in accordance with the Contract or where in the opinion of the Employer's Representative Site Staff the position of existing services over 75mm external diameter which cross the permanent work for a distance not less than five times the net width

thereof warrants temporary diversion or support the Employer's Representative Site Staff will instruct the Contractor accordingly.

Before commencing any work which may affect the flow in any sewer or storm drain the Contractor shall submit and obtain the approval of the Employer's Representative to his detailed proposals for maintaining or temporarily diverting the flow. Standby pumping equipment with day and night attendance shall be provided where the Contractor proposes to pump the flow and in general he shall provide and fix all necessary dams, chutes, tanks and other plant and labour as may be required.

Temporary pumping for diversions or over pumping of existing sewers shall be arranged with electrically operated pumps from ESB mains supply as the continuous 24 hour running of diesel pumps or generators adjacent to residential properties will not be permitted.

The Employer's Representative will not approve any proposal for the temporary diversion of flow, which does not provide capacity equal to or greater than that which it replaces or which unnecessarily affects the sewer conditions upstream. Notwithstanding that such works may be required only for a limited period they shall if so required by the Employer's Representative be constructed to a standard similar to that specified for the permanent works.

Any temporary works constructed for the diversion of flow shall be entirely removed and the connections to the existing structures made good if and when the Employer's Representative shall so order. Where the Employer's Representative considers that the removal of the temporary works would involve risk to the permanent works or other structures or would give rise to undesirable further opening up of ground surfaces he may direct the Contractor that such temporary works are to be cleaned out and filled in as specified.

6.19 DISPOSAL OF SURPLUS EXCAVATED MATERIAL

The Contractor shall provide for the disposal of all surplus excavated material not required for use in or on the Works. The place of disposal shall be a licensed tip site and must be approved by the Employer's Representative and the Planning Authority concerned. Transport of surplus excavated material shall be carried out by a licensed haulier. Disposal of all surplus excavated material shall be carried out in compliance with the requirements of the latest Waste Management Regulations, and more specifically disposal of excavated material shall comply with the provisions of the Waste Management (Facility Permit and Registration) Regulations, SI 821 of 2007.

As each trench is refilled the surplus earth shall be properly removed, and in no circumstances will the Contractor be allowed to leave spoil heaps or loose and uncollected rubbish along trench lines or on any site.

At completion all surfaces shall be properly restored and roadways, pavements, paths, yards, gardens, fields and any other place disturbed during the execution of the work shall be left as they were found, neat and tidy and free from accumulation of excavated soil.

6.20 OBSTRUCTION OF ROADS

The Contractor shall not occupy or obstruct by his operation more than one half of the width of any road or street.

If it becomes necessary with the approval of the Local Authority first obtained to restrict traffic to a single lane, properly trained and alert flagmen shall be provided to direct traffic. One-way traffic will not be permitted over continuous lengths of road exceeding 100 metres except in very exceptional circumstances or where the density of traffic is light.

6.21 CLOSING OF ROADS AND TEMPORARY BRIDGES

In streets or along roads where traffic may conveniently be diverted the Contractor may make written application for permission to close a road. Before any road can be closed to vehicular traffic the Contractor must be obtained the written consent of the Employer's Representative and the Employer and must ensure that all statutory obligations preliminary to the closing of the road have been complied with. Even if a road is closed to vehicular traffic a footway for pedestrian traffic must be kept clear.

In addition to the obligation imposed upon the Contractor under the provisions of other Clauses to provide temporary footways and bridges in locations where private holdings are divided into two parcels by a pipeline trench, the Contractor will also be obliged to provide a similar convenience for the public while trenches are open in all roads, either Public or Private. Such temporary bridges shall be built solid with 225mm x 75mm planks tightly cramped together with a minimum width of 1600mm or alternatively sheet steel properly supported may be used. Guardrails 900mm over the deck of the temporary bridges shall be provided and toe boards shall be fixed 225mm high on each side of the footway. Entries to footways shall be kept clean and spoil heaps shall be kept back so that accident or injury to pedestrians will be obviated.

6.22 MATERIAL EXCAVATED FROM PUBLIC PROPERTY

Earth, stone, gravel, clay, turf, sand, timber and all other materials and things excavated from works on public property shall not become the property of the Contractor. Permission may, however, be given to the Contractor to use the same for the purposes of the Contract, provided no detriment to the works is occasioned thereby and that such portion of the said materials as the Contractor is permitted to re-use are suitable and in accordance with the terms of the Specification.

6.23 MATERIAL EXCAVATED FROM PRIVATE PROPERTY

Surplus earth, stone, gravel, clay, sand or other material excavated from any trench on private property shall become and be deemed to be the property of the owner of the lands and shall, if the owner of the lands asserts his ownership, be dealt with by the Contractor according to his instructions, except that the Contractor will not be required to remove any materials for such land owners to a greater distance than 500 metres from the trench.

If on the other hand the owner of the property does not require the material then the Contractor shall remove and dispose of it in accordance with the appropriate clause hereof.

6.24 REMOVAL OF OFFENSIVE MATERIAL

All offensive material met with during the progress of the works shall not be deposited on the surface of any street or placed near dwelling houses where it is likely to cause a nuisance, but shall be forthwith placed in bins and thereupon, without delay removed to a suitable place of disposal provided by the contractor and approved by the Employer's Representative and the Local Authority.

The Contractor shall take great care and all reasonable precautions to ensure that roads and thoroughfares used by him either for the construction of the works or for the transport of plant, labour and materials are not dirtied as a result of such construction or transport and in the event of their becoming thus dirtied in the opinion of the Employer's Representative Site Staff the Contractor shall take all necessary and immediate steps to clean them.

6.25 PROTECTION OF TRENCHES

The Contractor shall ensure that the trenches are safe for passing traffic, pedestrians and children. The Contractor shall erect warning signs at suitable intervals on either side of such excavations; he shall erect a protective barrier around excavations together with luminous tape and he shall provide warning lights. Where excavations are close to paths, the Contractor shall erect an orange-coloured PVC mesh fence, 1 metre high along the kerb line as a further barrier for the protection of pedestrians. The path and any road open to pedestrians within the working area or affected by construction traffic shall be swept regularly to keep the area free of small stones, loose gravel or debris arising from the contract work. In trenches and other excavations where there is a build-up of water, the Contractor shall arrange to have continuous pumping or alternatively he shall arrange to fence off such trenches or excavations.

The Contractor shall nominate a person with responsibility for warning signs, lighting and protective barriers at open excavations who shall check these items at regular intervals outside normal working hours.

The Contractor will be required to erect protective barriers or hoardings along the sides of trenches to screen the working area from the public and such barriers or hoardings should be of sufficient height to prevent the arm of an excavating machine from inadvertently slewing out over trafficked areas. These hoardings shall be provided in locations as instructed by the Employer's Representative and they shall be required generally in trafficked areas and in narrow streets.

6.26 DAMAGE TO BOUNDARY WALLING

The Contractor shall be responsible for the restoration and making good of all boundary walling indirectly damaged or affected by the use of explosives or machinery during the course of construction.

7.0 CONCRETE CONSTRUCTION AND CONCRETE PRODUCTS

7.1 EXECUTION OF CONCRETE STRUCTURES

The execution of concrete structures shall generally be in accordance with IS EN 13670 - Execution of concrete structures as amended by the Irish National Annex.

7.2 FALSEWORK/FORMWORK

All falsework and formwork practice and design shall in accordance with BS 5975- Code of practice for temporary works procedures and the permissible stress design of falsework and take account of the recommendations given in CS 030 'Formwork: A guide to good practice' (Concrete Society) and CONSTRUCT's Guide to flat slab formwork and falsework.

The provisions of Section 5 and Annex C of IS EN 13670, in relation to falsework and formwork shall be met.

Materials for formwork should be chosen to produce the required finish to the concrete and may consist of timber, plywood, steel or other approved material. Materials must not be adversely affected by weather. Damaged formwork shall not be reused.

The Contractor shall provide details of the systems of falsework and formwork proposed for use for all main structural members.

All formworks shall be designed by a competent designer, to carry the loads to which it will be subjected and in such a way that all concrete elements are constructed within the limits of Table 1 of BS 5606 Guide to Accuracy in Building.

The Contractor shall make allowances for the settlement or deflection of formwork that is likely to arise during construction so that the hardened concrete conforms accurately to the specified line and level.

No ferrous metals shall be left in the concrete cover zone when the formwork has been removed.

The location of through ties shall be agreed with the Engineer, and any holes left exposed to view in the faces of concrete shall be filled as agreed with the Engineer.

In watertight construction, methods of fixing formwork which result in holes through the concrete section when the formwork is removed shall not be used.

Wall kickers shall be cast monolithically with the base slab.

Release agents shall be chosen to suit the method of construction and the finish required.

Before being loaded the formwork must be checked and verified ready for use.

Formwork shall be clear of all debris, water, snow and ice before concrete is placed.

Set out and fix all cast-in items shown on the drawings. Any clashes between holes, cast-in items and reinforcement shall be resolved to the agreement of the Engineer before any concrete is placed.

The exact sequence of propping and back propping to the structure shall be set out in a method statement prepared by the Contractor and shall be agreed by the Engineer

The striking of falsework/ formwork shall be carried out in such a manner as to avoid damage of any kind to the concrete. The recommendations of Report 136 (CIRIA) shall be used to determine suitable striking times.

Note that the use of GGBS in concrete may delay early strength development.

The following Table is included for guidance only

Formwork Element	Temperature	
	Above 7 Deg. C	Above 16 Deg. C
Vertical Formwork to Columns, Walls and Beams	12 Hrs.	12 Hrs.
Soffit Forms to Slabs	7 Days	4 Days
Props to Slabs	14 Days	11 Days
Soffit Forms to Beams	14 Days	11 Days
Props to Beams	21 Days	15 Days

For the purpose of the above Table, the temperature shall be the surface temperature of the concrete. Days during which the concrete surface temperature falls below 3 Deg. C. shall not be considered in the above Table. For each day, during which the concrete surface temperature is generally between 3 Deg. C and 7 Deg. C a half of a day shall be added to the period listed in the above Table.

The Contractor shall produce drawings showing the layout of construction joints and agree their location with the Engineer.

Construction joint surfaces shall be prepared so as to expose the coarse aggregate to provide a key to the adjoining concrete.

Construction joints in water-resisting construction will require waterstops. The Contractor shall obtain approval for the types, location, jointing details and fixing of all waterstops proposed.

7.3 REINFORCEMENT

All reinforcement shall comply to the requirements of IS EN 10080, BS 4449, BS 4483, BS 6744 and BS 8666 as appropriate.

Reinforcement shall meet the requirements of IS EN 13670 and its National Annex.

Reinforcement in accordance with BS 4449 shall be Grade 500 unless otherwise specified.

All reinforcement delivered to site shall have a certificate showing compliance with the above standards. All reinforcement shall be from an approved supplier certified by the UK

Certification Authority for Reinforcing Steels (CARES) or a similar equally approved independent certification body.

All reinforcement shall be stored on site in such a manner so as not to become contaminated by deleterious materials, become corroded or otherwise damaged. Fabric shall be stored flat.

Cover blocks and spacers shall meet the requirements of BS7973. They shall be adequately fixed to maintain the required cover. Spacers should be chosen so as not to adversely affect the strength of, or the finish to the concrete.

The Contractor shall supply and fix all chairs required to maintain the reinforcement in its correct position. Chairs are not scheduled in the schedules provided but are deemed to be included in the tender price.

The use of proprietary continuity strips is subject to the agreement of the Engineer.

The use of couplers is subject to the agreement of the Engineer.

The use of punching shear reinforcement systems is subject to the agreement of the Engineer.

The use of fibre reinforcement is subject to the agreement of the Engineer.

All reinforcement shall be adequately fixed in position in accordance with the reinforcement detail drawings and schedules. Reinforcement shall be tied using black annealed mild steel 16-gauge wire to BS6744, all ends shall be bent away from the concrete face.

The welding of reinforcement is not permitted.

7.4 PRESTRESSING

7.4.1 General

The following requirements apply to prestressed concrete construction.

Prestressing shall be performed by adequate experienced specialist companies.

7.4.2 Material for prestressing

Post-tensioning systems shall hold a European Technical Approval (ETA)

Sheaths shall conform to EN 523 or otherwise be in accordance with the European Technical Approval for the prestressing system.

Tensile elements shall be prestressing steel conforming with EN 10138.

Anchorage components for the prestressing system shall be those specified in the European Technical Approval.

Grout for filling ducts and anchorages shall conform to EN 446/ EN 447.

7.4.3 Transport and storage

Materials shall be protected from harmful influences during transport and storage and also whilst placed in the structure prior to permanent protection. Materials that have corroded to an extent which is likely to impair their performance shall be replaced by conforming materials.

7.4.4 Installation of tendons

The prestressing tendons shall be assembled, placed and secured in accordance with the ETA.

The type and class of prestressing steel and source documentation for all components shall be recorded in the project documentation.

Welding of prestressing steel is not permitted.

Any de-bonded lengths of prestressing steel shall be adequately protected against corrosion.

7.4.5 Tensioning

Tensioning shall conform to a prearranged and approved tensioning programme.

7.5 CONCRETING

7.5.1 Standards

Concrete shall conform to IS EN 206:2013 + A1:2016, Concrete- Specification. Performance, production and conformity, and National Annex to IS EN 206-13

7.5.2 Concrete Materials

7.5.2.1 Cement

Cement and GGBS shall be produced by certified suppliers operating EN ISO 14001 and BS OHSAS 18001 certified systems.

Cement shall conform to EN 197-1, CEM I, CEM II/A-L, CEM II/A-S, CEM II/B-S or CEM III/A may be used when specified. GGBS shall conform to IS EN 15167-1.

7.5.2.2 Aggregates

Aggregates shall be natural normal-weight aggregates conforming to IS EN 12620 and SR 16.

The preferred maximum aggregate size is 20mm but if a smaller size is necessary it should be 10mm.

Recycled aggregated (RA) and recycled concrete aggregate (RCA) shall conform to BS 8500-2.

7.5.2.3 Water

Mixing water shall conform to EN 1008, it shall be clean and free from ice or snow at the time of use.



7.5.2.4 Admixtures

Admixtures shall conform to EN -934-1 and EN 934-2

Admixtures are to be used strictly in accordance with the manufacturer's recommendation and instructions. Where more than one additive is used manufacturers of each additive to confirm compatibility.

7.5.3 Concrete Specification

All concrete used on the projected shall be designed concretes in accordance with IS EN206 and its Irish National Annex

The Contractor shall be responsible for selecting the constituent material proportions to achieve the required strength and consistence of the concrete, and to meet the requirements of the schedule as set out in the project particular structural specification.

7.5.4 Ready-mixed Concrete

Ready-mixed concrete shall be supplied by a producer from a plant holding accredited third-party certification of production and conformity, meeting the requirements of IS EN 206.

The supplier shall confirm that the concrete is in conformity with the specification for the period of supply and on request supply test data on which this confirmation is based.

The Engineer is to be informed of any non-conformity that arises.

Details of the ready-mix concreter plant proposed for use shall be forwarded to the Engineer.

Discharge of concrete from a truck mixer or agitator shall be completed within two hours after the introduction of cement to the mix. Where concrete is transported in non-agitating equipment, discharge shall be completed within one hour after the introduction of cement to the mix. Following the introduction of water to the mix at the Ready-Mixed Company's Works the addition of further water to the mix shall not be permitted.

The Contractor shall also ensure that the Ready-Mixed company can deliver an uninterrupted supply of consistent concrete in order to maintain continuity of concrete placement between approved construction joints.

Delivery ticket information shall be in accordance with IS EN 206 and shall be completed and available before discharging concrete.

7.5.5 Site batching and mixing

Site batching and mixing of concrete is not allowed, unless it can be clearly demonstrated that the independent accreditation procedures required for ready-mix concrete can be achieved.

7.5.6 Transporting concrete

Concrete shall be transported from the mixer to the formwork as rapidly as practicable by methods that will prevent segregation or loss of any of the ingredients and maintain the required workability.

It shall be deposited as near as practicable to its final position to avoid re-handling.

7.5.7 Placing and compaction

Concrete shall not be placed in any part of the structure until formwork, reinforcement, inserts and water bars, means of mixing, transporting, placing and compaction have all been inspected and approved by the Employer's Representative.

Concrete shall be discharged, placed and compacted in its final position, in one operation by experience operatives, under the direct supervision of a competent member of the Contractor's staff.

The concrete shall be deposited as near as possible to its final position quickly and efficiently to avoid segregation. Moving of concrete with poker vibrators is to be avoided.

Concrete shall be placed in such a manner as to avoid segregation of concrete, or displacement of formwork, reinforcement, inserts or water bars. Concrete shall not be allowed to fall freely more than 1.5m unless otherwise approved by the Engineer. A suitable tremie pipe shall be used in all concrete pour lifts greater than 1.5m, to deposit the concrete as close as possible to its final location.

In walls the concrete shall be placed in uniform layers not exceeding 500mm.

Concrete placement and compaction shall proceed continuously between approved construction joints.

Concrete which has partially hardened, has been adversely affected by delay or by weather, has become contaminated or segregated, or has fallen outside the section of formwork being filled shall not be used.

Concrete shall be thoroughly compacted by vibration, or other means approved by the Engineer, or thoroughly worked around reinforcement, inserts, water bars and corners of formwork to ensure a solid mass free of voids throughout and to achieve the required surface finish.

All concrete shall be compacted to its final position within 30 minutes of discharge from the mixer, unless otherwise directed by the Engineer.

When in situ concrete has been in place for four hours, no further concrete shall be placed against it for a further twenty hours.

7.5.8 Concreting in cold weather

Concreting shall not be carried out when the air temperature is 5°C and falling and should only begin when the temperature is at 3°C and rising.

Fresh concrete shall not be placed on or against frozen ground.

The temperature of concrete at the time of placing shall be at least 5°C and shall not exceed 30°C.

The concrete temperature shall be measured at the most unfavourable position for the limit in question. If the air temperature is below 2°C, or if less than 5°C on a falling thermometer, no concrete shall be placed. Special care shall be taken to prevent the temperature of fresh concrete falling below 5°C when placing against previously cast concrete that is at a lower temperature.

Concrete when deposited shall have a temperature of not less than 5°C.

Suitable precautions, such as covering with suitable insulating material shall be taken to ensure that the temperature of the concrete after placing does not fall below 5°C until it has thoroughly hardened or for a period of 72 hours whichever is the longest period.

The method of heating the concrete or formwork shall not be such as to cause drying of the concrete.

Before placing concrete, all contact surfaces including formwork, reinforcement, adjacent concrete, and the ground shall be free of ice, snow and frost damage.

All concrete damaged by frost shall be replaced by the Contractor at his own expense.

7.5.9 Concreting in hot weather

Concrete shall not be placed if the temperature exceeds 35°C.

The Contractor shall ensure that the constituent materials of the concrete are sufficiently cool to prevent the concrete from stiffening in the interval between its discharge from the mixer and compaction in its final position.

The concrete shall be placed in position as soon as possible after mixing.

Rapid loss of moisture from the concrete shall be prevented by the use of sheets of impervious material supported away from the surface or sprayed-on curing membrane or other suitable means.

7.5.10 Curing and Protection

Curing is the process of preventing the loss of moisture from the immature concrete whilst maintaining a satisfactory temperature regime.

The Contractor shall provide a method statement for curing concrete in the various situations that arise on the project (Horizontal surfaces and soffits-slabs, Vertical surfaces – walls and columns. The recommendations of Concrete Advice Note No. 20 (Concrete Society) which includes the use of curing compounds, impervious sheeting, wetting, insulation and the delayed removal of formwork, should be adhered to.

Curing periods shall be in accordance with Appendix F of IS EN 13670 and the Irish National Annex to IS EN 13670.

Care shall be taken to ensure that components intended to have a similar exposed surface finish are cured under the same conditions.

Where chemical curing agents are used in water retaining structures in water treatment works and in structures containing potable water, only those agents, certified by WRC (Water Research Council) as suitable in contact with potable water, shall be used.

7.5.11 Formed surface finishes

Basic Finish: There are no requirements for finish other than to enable adequate compaction, to provide adequate cover to the reinforcement and to achieve the specified tolerances.



Ordinary Finish: There are no special formwork requirements for this finish. Concrete should be thoroughly compacted, and the formed surface should be free from major inherent blemishes and honeycombing. There is no requirement for consistency of colour for the struck surface. Surface defects may be made good subject to agreeing a method with the Engineer. Steps at joints between forms to be a maximum of 5mm.

Plain Finish: Produce an even finish with a sheet material (e.g. plywood), with panels arranged in a regular pattern as a feature of the surface. Abrupt irregularities to be not greater than 5 mm. Gradual irregularities, expressed as maximum permissible deviation from a 1m straight edge, to be not greater than 5mm. Variation in colour resulting from the use of an impermeable form lining will be permitted but the surface to be free from discolouration due to contamination or grout leakage. Blowholes less than 10 mm in diameter will be permitted but otherwise surface to be free from voids, honeycombing, segregation and other large defects. Formwork tie holes to be in an approved regular pattern, filled with matching mortar to an approved sample.

Special Finish: Produce a smooth even finish with an impervious sheet material (e.g. resin film faced plywood), with panels as large as is practicable and arranged in an approved regular pattern as a feature of the surface. Do not replace parts of formwork panels where this may cause a change of colour in the concrete. Abrupt irregularities to be not greater than 0 mm. Gradual irregularities, expressed as maximum permissible deviation from a 3 m straight edge, to be not greater than 3 mm. Variation in colour resulting from the use of an impermeable form lining will be permitted but the surface is to be free from discolouration due to contamination or grout leakage. Blowholes less than 5 mm in diameter will be permitted but otherwise surface to be free from voids, honeycombing, segregation and other defects. Formwork tie holes to be avoided if possible, otherwise in an approved regular pattern, filled with matching mortar to an approved sample.

An Ordinary finish is to be provided unless otherwise specified in the Schedule of Finishes below or shown on the drawings.

7.5.12 Unformed surface finishes

Unless a finish is specified Type U1 shall be provided.

- Type U1 finish. The concrete shall be levelled to produce a closed uniform surface. No further work shall be carried out.
- Type U2 finish shall be produced by floating, or a similar process, to produce a level, uniform surface.
- Type U3 finish shall be produced by trowelling, or a similar process, to produce a dense, smooth surface.
- Type(s) U4 finish shall be produced by further working of either U1, U2 or U3 type of finish.

7.5.13 Testing concrete and concreting materials

The producer shall carry out sampling and testing for conformity during concreting operations in accordance with IS EN 206-1. Where the producer identifies a non-conformity that was not obvious at delivery, this shall be reported to the Engineer and the Employer within 24 hours of the Contractor receiving notification.

The Contractor shall carry out testing in accordance with IS EN 12350: Testing fresh concrete to ensure concrete consistence, and where relevant air content, at delivery is in accordance with this specification. If water or other material is added to the concrete truck mixer drum before

discharge, in accordance with IS EN 206-1 additional identity testing for strength shall be carried out where designated or designed concretes are used. The frequency of testing shall be as given below:

Rates of Sampling and Testing		
Grade of Concrete	Size of Pour	Sample from one batch selected randomly to represent an average volume of not more than the lesser of:
Greater than 40N/mm ²	Any size	10m ³ or 10 batches
30-40 N/mm ³	Less than 20m ³	10m ³ or 10 batches
	20-75 m ³	15m ³ or 15 batches
	Greater than 75m ³	20m ³ or 20 batches
Less than 30N/mm ²	Any size	20m ³ or 20 batches

Concrete cubes shall be tested in accordance with IS EN 12390 in an INAB accredited laboratory, or equivalent, independent of contractual parties. Where identity testing is required for designed concretes, the Contractor is to inform the producer that identity testing for strength is required. The criteria for acceptance will be that given in IS EN 206 Appendix B.

7.6 PRECAST CONCRETE

7.6.1 General

Precast elements, including lintels, precast beams and slabs, stairs etc. may only be used on the project, if shown on the drawings or otherwise approved by the engineer.

All precast concrete elements shall be designed to meet all relevant European standards and be in accordance with the Performance Specifications included in the Appendix to this Specification. (To be completed by Specifier for each precast element and included in the Appendix).

Precast concrete elements shall meet the requirements of IS EN 13369- Common rules for precast concrete products

7.6.2 Handling and Storage

Handling and storage of precast elements shall be as required by the manufacturer of the precast elements.

The weight of the units and the lifting systems to be employed and the manner they are to be supported and stacked in storage, shall be made known to the Contractor by the Designer/ Fabricator.

7.6.3 Placing and Adjustment

Before any delivery of precast elements, a method statement/ erection specification, for their safe handling and erection shall be submitted to the engineer. The erection specification shall define the arrangements of the supports, the necessary props and where necessary the temporary stability provisions and the sequencing of the work

During installation, the correct position of the precast elements, the dimensional accuracy of the supports, the conditions of the joints and the overall arrangement of the structure shall be checked, and any necessary adjustments made.

Ensure that minimum bearing requirements are met.

7.7 GEOMETRIC TOLERANCES

All geometric tolerances for concrete works shall be in accordance with NSCS.

7.8 STEEL STRUCTURES

7.8.1 Execution of Steel Structures

The execution of steel structures shall generally be in accordance with: -

IS EN 1090-1 -Execution of steel and aluminium structures - Part 1: Requirements for conformity assessment of structural components.

IS EN 1090-2 -Execution of steel and aluminium structures - Part 2: Technical requirements for steel structures.

IS EN 1090-4- Execution of steel structures and aluminium structures – Part 4: Technical requirements for cold-formed structures of roof, ceiling, floor and wall applications.

IS EN 1090-2, refers to an execution specification, which is intended to give specific project information in relation to various clauses of IS EN 13670, the National structural Steelwork Specification for Building Construction (6th Edition -UK) hereunder referred to as NSSS, may be regarded as providing such project specific information, as further qualified below.

Section	Clause Text	
4. Specification and documentation		
Execution classes	4.1.2	The execution class shall be EXC2
5. Constituent products		
Structural Steel products	5.3	See Clause 2.2 of NSSS
Property classes of bolts and nuts	5.6.4	See Clause 2.4 of NSSS
Welding		See Clause 2.3 of NSSS

6. Preparation and assembly		See Section 6 of NSSS
7. Welding		See Sections 4 and 5 of NSSS
8. Mechanical fastening		See Section 4 and 6 of NSSS
9. Erection		See Section 8 of NSSS
		Provide erection method statement to comply with Health and Safety Regulations
10. Surface Treatment		See Section 10 of NSSS
11. Geometric tolerances		See Section 7 of NSSS
		See Section 9 of NSSS
12. Inspection, testing and correction		See Section 11 of NSSS

8.0 MASONRY

8.1 MATERIALS

8.1.1 Masonry Units

All masonry units shall comply with the standards as listed in the Table below along with S.R. 325 as published by the NSAI.

Masonry Unit	Standard
Clay	I.S. EN 771-1
Calcium silicate	I.S. EN 771-2
Aggregate concrete (dense and lightweight aggregate)	I.S. EN 771-3
Autoclaved aerated concrete	I.S. EN 771-4
Manufactured stone	I.S. EN 771-5
Natural stone	I.S. EN 771-6

8.1.2 Mortar

All mortar shall conform to IS EN 998-2 along with S.R. 325. The compressive strengths shall be as listed in Table NA.3 of Irish National Annex to IS EN 1996-1-1 and reproduced below.

Compressive Strength Class	Equivalent Prescribed Mortars (Proportion of Materials by Volume) <i>(see Note)</i>			Mortar Designation
	Cement:Lime:Sand with or without Air Entrainment	Masonry Cement:Sand	Cement:Sand with or without Air Entrainment	
M12	1:0 to ¼:3	Not suitable	Not suitable	(i)
M6	1:½:4 to 4½	1:2½ to 3½	1:3 to 4	(ii)
M4	1:1:5 to 6	1:4 to 5	1:5 to 6	(iii)
M2	1:2:8 to 9	1:5½ to 6½	1:7 to 8	(iv)
The number following the M is the compressive strength for the class at 28 days in N/mm ²				
NOTE When the sand portion is given as, for example, 5 to 6, the lower figure should be used with sands containing a higher proportion of fines whilst the higher figure should be used with sands containing a lower proportion of fines				

8.1.3 Lintels

Lintels shall comply with the relevant standards as listed below.

Material	Standard
Autoclaved aerated concrete Cast concrete Reinforced concrete Pre-stressed concrete Manufactured stone	I.S. EN 845-2
Pressed steel Rolled low carbon steel	
Prefabricated reinforced masonry	
Timber	I.S. EN 1995-1-1
Natural stone	N/A
In-situ reinforced concrete	I.S. EN 1992-1-1
In-situ reinforced masonry	I.S. EN 1996-1-1
Composite lintels	I.S. EN 1996-1-1

8.2 ANCILLARY METAL ITEMS

8.2.1 Wall ties, frame cramps & steps

Wall ties should conform to I.S. EN 845-1 and Table 2 of S.R. 325.

8.2.2 Bed joint reinforcement

Bed joint reinforcement should conform to I.S. EN 845-3 and Table 2 of S.R. 325.

8.2.3 Metal lath

Wall ties should conform to I.S. EN 845-1 and Table 2 of S.R. 325.

8.3 DAMP PROOF COURSE (DPC)

Damp proof course shall comply with the relevant standards as listed in the Table below.

Material	Standard
Bitumen	I.S. EN 14967
Mastic asphalt	I.S. 65
Polyethylene	I.S. EN 14909
Copper	I.S. EN 1172

Lead	I.S. EN 12588
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8.4 MOVEMENT JOINTS

Expansion joint filler shall be expanded polyethylene foam strip and shall allow for up to 50% MAF. Sealing compound for expansion joints shall be high modulus Type F sealants to achieve an MAF of 50% to comply with IS EN ISO 11600 and BS 6213. Joints to be placed as shown on drawings.

8.5 WORKMANSHIP

8.5.1 Storage of materials

Stack blocks and bricks for facing work on a raised clean platform and protect from damage and staining. Keep dry during delivery and before use all facing blocks and bricks

Cement shall be delivered in unbroken bags as dispatched by the manufacturer or in approved bulk cement delivery vehicles. Store cement under weatherproof conditions on a raised floor or in suitable silos. Do not use air set cement.

Store sand on a hard self-drained area.

Store hydrated lime under weather-proof conditions on a raised floor or in suitable silos.

8.5.2 Tolerances

The execution of masonry structures shall conform to IS EN 1996-2 with the permissible deviations as set out in that standard.

8.5.3 Laying Masonry Units

The contractor is responsible to ensure the stability of blockwork and brickwork during erection.

Lay bricks/blocks on a full bed of mortar; do not furrow. Mortar joints to be min 5mm to max 15mm thick. Fill all cross joints and collar joints; do not tip and tail. Build walls in stretching half lap bond when not specified otherwise. Plumb perpends of facework every third or fifth cross joint along a course and even out the joint widths in between.

Brickwork and Blockwork shall rise uniformly; corners and other advanced work shall be raked back and not raised above the general level more than 1 metre. No work shall be carried up higher than 1.5 metres in one day. No bats or broken bricks or blocks shall be incorporated in the work unless essential for bond.

Bring both leaves of cavity walls to the same level at:

- Every course containing vertical twist type ties or other rigid ties.
- Every third tie course for double triangle/butterfly ties.
- Courses in which lintels are to be bedded.



Cut and fit blockwork and brickwork neatly to the line and profile of parts of the structure which the walling abuts or surrounds.

Before brick or block orders are placed, and at intervals as required throughout the period of delivery, the Contractor shall satisfy the Engineer that the suction rate of the bricks or blocks does not exceed 2kg/sqm min or that he is able to adjust the suction rate so that it does not exceed this value on site.

8.6 ADVERSE WEATHER

Do not use frozen materials.

Do not lay bricks/blocks in cement mortar when the air temperature is at or below 3°C and falling or 1°C and rising unless mortar has a minimum temperature of 4°C when laid and walling is protected. Do not lay mortar on frozen surfaces.

Do not lay units in lime mortar at or below 5°C and falling or below 3°C and rising.

Maintain temperature of the work above freezing until mortar has fully hardened.

Rake out and replace mortar damaged by frost. When instructed, rebuild damaged work.

In very hot and dry weather, wet clay bricks and blocks to the minimum necessary to prevent drying out of the mortar.

Protect all newly erected walling against rain and snow by covering when precipitation occurs, and always when the work is not proceeding.

Protect all newly erected walling against drying out too fast in hot and windy conditions, and always when the work is not proceeding.

8.7 LINTELS

For precast concrete lintels and prefabricated steel lintels, bed on mortar used for adjacent work with bearing of not less than 150 mm unless specified otherwise. Use slate packing pieces. There should be no perpendicular joints within the bearing area nor should perpendicular joints, both over and under the lintel, line up with its ends.

For prestressed concrete lintels, bed on mortar used for adjacent work with bearing of not less than 150 mm unless specified otherwise. Adequately prop at not more than 1.2m centres during construction of walling above. Retain props in position for not less than 14 days or until mortar has matured, whichever is longer. There should be no perpendicular joints within the bearing area nor should perpendicular joints both over and under the lintel line up with its ends.

8.8 WALL TIES

Wall ties shall be installed as to meet the requirements of S.R. 325. The spacing of ties and embedment depth shall be as per the Table below.



Cavity width for which tie is intended mm	Number of ties per m ²	Declared mean load capacity N	Embedment length mm
50 to 75	2,5	± 1 780	50
>75 to <100	3,0	± 1 490	50
100 to 150	4,9	± 900	50

Provide wall ties at openings or at movement joints at centres not exceeding 225 mm vertically.

Insulation panels shall be clipped to wall ties as the blockwork and brickwork rises.

Care shall be taken to keep the ties within the cavity free from mortar or mortar droppings

8.9 MOVEMENT JOINTS

Movement joint spacing in masonry walls shall be as shown on the drawings. In unreinforced masonry walls the spacing shall not be greater than the spacings specified in IS EN 1996-2 National Annex and S.R. 325 for brickwork and blockwork.

Movement joints shall be built in as work proceeds filling joint with no projections into cavities, and to correct depth to receive sealant system.

8.10 BED JOINT REINFORCEMENT

All walls shall incorporate bed joint reinforcement in accordance with the following requirements unless noted otherwise on the drawings or in the Specification.

The bed joint reinforcement shall be continuous between control joints and shall be incorporated generally at 450mm centres vertically from the first joint above the DPC at the base of the wall to the top of the wall.

Additional bed joint reinforcement shall be provided above and below windows and above doors so that there are two layers incorporated within 600mm vertically of the opening. This additional bed joint reinforcement shall be continued for a minimum of 750mm beyond the opening.

The bed joint reinforcement shall be staggered vertically with the wall ties in alternate rows. Laps in bed joint reinforcement shall be kept to a minimum and where these occur, a minimum lap of 150mm or the Manufacturer's minimum lap recommendation (whichever is the greater) shall be used. In no case shall any reinforcement be provided with less than 3mm mortar all round. A minimum cover of 25mm of mortar shall be provided between the faces of the blockwork/brickwork on external walls and a cover of 12mm shall be provided on internal walls. The reinforcement shall be specially cut and bent to achieve the minimum lap.

At wall corners the bed joint reinforcement shall also be specially cut and bent to achieve the minimum lap. At intersecting walls clashing of bed joint reinforcement shall be prevented, by staggering the reinforcement.

8.11 CHASING IN WALLS

The maximum depth of both vertical and inclined chases permitted shall be in accordance with IS EN 1996-1-1 and the Irish National Annex.

The Structural Engineer is to review all proposed chase locations if they are not specified on the Engineering Drawings.

9.0 STRUCTURAL STEELWORK

9.1 GENERAL

9.1.1 Structural Steelwork

Structural steel generally shall conform to IS EN 10025: “Hot Rolled Products of Structural Steels”. Structural sections shall be in accordance with IS EN 10365: “Hot Rolled Steel channels, I and H Sections – Dimensions and Masses”, IS EN 10210: “Hot Finished Steel Structural Hollow Sections” and IS EN 10056: “Structural Steel Equal and Unequal Angle Sections”.

Cold formed hollow sections shall be in accordance with IS EN 10219.

Unless otherwise specified, the use of all Structural Steelwork shall be in accordance with IS EN 1993: “Design of Steel Structures” and the National Structural Steelwork Specification (NSSS) for Building Construction, Latest Edition, published by The British Constructional Steelwork Association Ltd. and the Steel Construction Institute.

All structural steelwork shall be minimum grade S275JR for internal steelwork and grade S275J0 for external steelwork to IS EN 10025 unless noted otherwise. Structural hollow sections shall be grade S355 J2H to IS EN 10210.

Unless noted otherwise, all steelwork shall be in accordance with

9.1.2 Cold-formed Galvanised Steel Sections

All cold-formed sections (purlins, cladding rails eaves beams.. etc.) are to be manufactured from hot-dip galvanised steel to IS EN 10346 and IS EN 10143.

Steel sections to be formed from minimum grade S450GD with Z275 zinc coating giving an average coating thickness of 0.02mm to each side.

9.2 FABRICATION

9.2.1 Notification of Commencement

A minimum period of 10 working days are required for approval of fabrication drawings.

A minimum period of 5 working days are required before fabrication is due to start.

9.2.2 Identification Marks

Identification Marks on structural steel to be visible for checking after erection but should be on surfaces not exposed to open view in the completed work.

9.2.3 Hard Stamping

Not permitted unless indicated on drawings.

9.2.4 Welding

Welding of structural steelwork shall be in accordance with IS EN 1011. All welding shall be carried out by approved coded welders. Certificates for the welders shall be submitted to the Permanent Works Structural Designer.

Site welding only permitted where indicated on drawings and in suitable welding conditions.

Welds to be carefully dressed to remove slag. Do not deform surface of weld.

Testing of welds shall be carried out in accordance with the requirements of the latest edition of "National Structural Steelwork Specification for Building Construction" published by the BCSA and SCI (Publication No. 203/02), Section 5 "Workmanship – Welding", Section 5.5 "Testing of Welds".

9.3 ERECTION

9.3.1 Pre-Erection Checks

At least 7 days before the proposed erection start date the following should be checked:

- Foundation and other structures that steelwork will be fixed to.
- Accuracy of setting out.
- Position, protruding length, slackness and condition of holding down bolts. Inaccuracies should be reported immediately.

9.3.2 Temporary Works

Temporary works are the responsibility of the contractor. All temporary works are to be designed by a competent temporary works designer, and designs, together with method statements for erection should be submitted to the Permanent Works Structural Designer for comments prior to the commencement of any construction activities.

9.3.3 Bolting

Black bolts shall conform to BS 4190 or equivalent. High Precision Tensile Bolts shall conform to BS 3692 or equivalent. High strength friction grip bolts shall conform to IS EN 14399 or equivalent. Steel washers shall comply with IS EN ISO 898 Part 3 or equivalent. All bolts shall be grade 8.8 unless noted otherwise.

The use of high strength friction grip bolts shall be in accordance with IS EN 1993-1-8 or equivalent.

9.3.4 Holding Down Bolts

The contractor shall provide holding down bolts for the Building which shall comply with BS 7419 and shall be hot-dip galvanised to IS EN ISO 1461. The exact position of the holding down bolts is to be coordinated between the Steel Fabricator and the Contractor. The holding down bolts are to be cast in the agreed positions by the Contractor. The steel fabricator shall be required to supply and install the steel structure to suit the fixed location of these bolts, and shall check dimensions on site prior to finalising fabrication.



9.3.5 Grout Under Base-Plates

Holding down bolt sleeves and the nominal 20mm gap under base plates shall be completely filled and grouted up respectively using non-shrink grout.

Non-shrink grout requirements:

- Final strength (28 Days) >80 Mpa
- No volume loss
- Shrinkage <1.2mm/m (23°C/50% Relative Humidity)

The contractor shall allow for all works and materials associated with this grouting including shuttering of the grouted areas. The grout shall be installed strictly in accordance with the Manufacturer's recommendations. The contractor shall allow for the provision of all steel shim plates required to level the structure prior to grouting.

9.4 PROTECTIVE TREATMENT – GENERAL

Steel not to be coated with protective treatment shall be:

- Steel encased in concrete.
- Top flange of steel beam to receive shear studs.

All internal structural steel work to be treated as follows unless noted otherwise:

- Remove by chipping, scraping and wire brushing loose rust and scale, welding slag and splatter from steel surfaces. Clean out crevices. Remove oil, grease and dirt.
- Prepare by blast cleaning the steel surface to give preparation grade of surface quality Sa 2½ in accordance with BS 7079 or equivalent.
- Apply high build Zinc phosphate epoxy primer to minimum 80µm thickness.
- Where site welding to treated structural steel occurs, appropriate post treatment is required to achieve the original standard of preparation and coating.
- For shop made black bolted joints, the appropriate primer should be applied to contact surfaces prior to assembly in the shop. For site made joints, where shop primer has been applied, no further treatment is required before assembly. For site joints that have not been primed in the shop the appropriate primer should be applied prior to assembly.
- For high strength friction grip bolted joints, faying surfaces at the time of assembly must be free of any contaminant which would prevent the development of the slip factor required of the joint. After tightening and inspection of the bolt groups, the crevices around the load indicating washers, bolt heads, edges of the faying surface etc. should be sealed if necessary with the compatible paint or mastic. The nuts and bolts should then be cleaned and the full coating system applied.



All external exposed structural steelwork and structural steelwork within the cavities of external walls, including bolts, shall be treated as follows unless noted otherwise.

- Remove by chipping, scraping and wire brushing loose rust and scale, welding slag and splatter from steel surfaces. Clean out crevices. Remove oil, grease and dirt.
- Grit blast the steel surface to BS 7079 using chilled angular iron grit of size G24.
- Steel Hot Dipped Galvanised to IS EN ISO 1461 with minimum nominal coating thickness of 85 µm.
- No site welding of galvanised steel will be allowed.

9.5 PROTECTIVE TREATMENT – FIRE

Fire protection method and fire rating period will be as per the Architect's specification. Fire protection system should be in accordance with "Fire Protection for Structural Steel in Buildings" latest edition produced by the Steel Construction Institute and the Association for Specialist Fire Protection.

The fire protection system is to be applied in accordance with the manufacturer's details.

N.B. All steel fabrication is to take place at the suppliers works, no drilling/cutting/welding is to take place on site, bricklok check ties for blockwork to stanchions connections are to be provided.

N.B. Compatibility should be ensured between the fire protection paintwork and the architectural paint finish on the steelwork.

9.6 ADDITIONAL CONSIDERATIONS

The contractor shall allow for any adjustment to the structural members required by the fabrication, galvanising, painting, transport and erection processes.

The contractor shall allow for all necessary temporary bracing required during the erection process.

Steelwork fabrication drawings must be approved by the Permanent Works Structural Designer prior to fabrication.

The Contractor shall be responsible for checking all relevant dimensions on site prior to fabrication of steelwork to ensure that all elements of the structural steelwork, etc. tie in with all the remaining elements of the building.

9.7 PROFILED STEEL SHEETING

Profiled steel sheeting and cladding shall comply with IS EN 1993-1-3, BS 476, BS 5427 and IS EN 1993-1-1.



10.0 STRUCTURAL TIMBER

10.1 NOT USED

11.0 PILING

11.1 NOT USED



12.0 PERFORMANCE SPECIFICATION: PREFABRICATED TIMBER FRAME HOUSE INCLUDING ROOF TRUSSES

12.1 NOT USED

13.0 PRECAST CONCRETE SYSTEMS

13.1 PRECAST CONCRETE

13.1.1 General

This section deals with additional considerations for structures partly or wholly of precast construction.

13.1.2 Building Regulations

All Precast concrete elements shall be designed to meet the current requirements of Part A of the Second Schedule of the Building Regulations.

Floors and walls shall also comply with all other relevant parts of the Building Regulations such as Part B, Part C and Part E. To meet these requirements the precast concrete elements may be required to have solid ends in certain locations.

In accordance with the Building Control Regulations (1997-2015) the designer of the precast elements is required to:-

- Design the precast units in accordance with the applicable requirements of the Second Schedule of the Building Regulations.
- Arrange to provide sufficient information to the Assigned Certifier to enable them to fulfil their role.
- As agreed with the Assigned Certifier, carry out work inspections which are pertinent to their elements of the Design, and liaise with the Assigned Certifier on terms of this and the required ancillary certification.
- Notify the Assigned Certifier of their proposed inspection regime for inclusion in the overall Inspection Plan.
- Provide the Ancillary Certificates when required by the Assigned Certifier.
- Maintain records of inspection.

In particular you are required to issue Cs ancillary certificate which in the second schedule to the annex states clearly that you have carried out the design in accordance with the accompanying performance specification and the relevant design standards.

13.1.3 Manufacture And Supply

General

- (i) The design and installation of precast slabs shall be carried out and/ or supervised by suitably qualified persons.
- (ii) The Contractor shall submit details of the proposed concrete plant to the Engineer for agreement before starting work.

- (iii) The precast concrete plant shall operate an agreed quality management system to ISO 9001, unless otherwise agreed with the Engineer. This system shall include appropriate methods of checking the work to ensure that the precast components are constructed in accordance with all the contractual requirements. The relevant Standards applicable to the project shall be identified in the Quality Plan, where not specified elsewhere in the documentation.
- (iv) Before any precasting is carried out the Contractor shall agree with the Engineer all details of manufacture, supply and testing.
- (v) Permitted dimensional deviations shall be in accordance with IS EN 13369:2018 Section 4.3.1 Before manufacture the Contractor shall ensure that adequate allowances have been made for all construction tolerances to ensure proper final fit up of the structure.
- (vi) The Contractor shall keep records of the unit mark, the composition of the unit, the date of manufacture, the date of release from the mould and the curing regime. These records shall be kept on site and made available for inspection.
- (vii) Hollowcore Slabs shall be designed in accordance with:
 - a. IS EN 1992-1-1: Design of Concrete Structures: General rules and rules for buildings
 - b. IS EN 206-1: Concrete: Specification, production and conformity
 - c. IS EN 13369: Common rules for precast concrete products
 - d. IS EN 1168: Precast concrete products- Hollowcore slabs

Reinforcement

Cages shall be made up and securely fixed in accordance with the reinforcement detail drawings to provide adequate rigidity and to ensure that the specified cover and fit within the mould are achieved.

- (i) Reinforcement up to 12 mm in diameter that projects from the face of the units may be bent to facilitate the casting or demoulding of the unit subject to agreement for each case. The reinforcement shall not be rebent to its final position in the structure before the concrete has achieved two-thirds of its specified characteristic strength.
- (ii) For concrete surfaces to be exposed in the finished structure spacer blocks shall not be used unless agreed with the Engineer.

Steam Curing

Precast units may be steam-cured at atmospheric pressure subject to the agreement of the Engineer and to the following conditions:

- (i) The total chloride ion content of the concrete from the aggregate, water and any admixtures shall not exceed 0.1 % of the weight of cement.
- (ii) Steaming shall not be started until at least two hours after completion of casting.

- (iii) The temperature in the enclosure surrounding the units shall not exceed 60°C when measured close to the surface of the units.
- (iv) The Contractor shall take adequate precautions to prevent the units being damaged by an excessive rate of cooling.
- (v) Curing, with or without steam, shall be continued until the concrete has reached at least two-thirds of its specified characteristic strength.

Demoulding

For precast concrete units cast under factory conditions the minimum period before removing the formwork shall be at the discretion of the Contractor on the basis of the assessed compressive strength of the unit.

No unit shall be lifted from the base on which it was cast before the concrete has attained its design demoulding strength and in no case less than 8 N/mm², and is strong enough to prevent the unit from being damaged, overstressed or distorted, having due regard to the demoulding equipment to be used.

13.1.4 Marking

- (i) Each precast unit shall be clearly marked before delivery in accordance with the drawings to indicate its weight, location and orientation in the structure in order to facilitate correct erection.
- (ii) All marks shall be positioned so that they are hidden from view or may be removed without marking the concrete surface.

13.1.5 Storage

- (i) If precast units cannot be delivered to site and installed directly into their final positions, the Contractor shall arrange suitable storage to ensure that no deterioration or damage occurs. Storage shall be on firm supports clear of the ground. The Contractor shall submit storage proposals to the Engineer.
- (ii) Storage instructions for precast units shall include the storage position, the allowable support points, the maximum height of any stack and any protective measures required.
- (iii) Unit faces to be exposed in the finished construction shall be protected from mechanical damage, dirt, staining, rust marks or other disfiguration.

13.1.6 Handling and Erection

- (i) The Contractor shall determine the need for any additional reinforcement or fittings that may be necessary for handling the units until they are incorporated into the structure. The Contractor shall make provisions for temporary works purposes and shall make good any inserts, holes etc. used for lifting or other temporary works purposes.

Any inserts or fixings required by the Contractor to be cast in the concrete and permanently exposed either externally or within the cavity of the building envelope

shall be of stainless steel unless agreed otherwise by the Engineer. In other conditions, any protective treatment shall be as agreed with the Contractor.

- (ii) The Contractor shall ensure that any precast concrete unit to be incorporated into the structure is kept stable in its erected position until such time as the element can safely carry the construction loads without distress. The overall stability of the structure shall be maintained at all times during erection.

13.1.7 Alignment of Precast Units

Precast units shall be positioned in the frame to the tolerances given the concrete section of this specification.

Any deviation from the permitted tolerances shall be evaluated by the Contractor who shall submit proposals for remedial work for agreement with the Engineer.

13.1.8 Mortar

Mortar for bedding precast units shall be made of cement, sand and water in the proportions, by volume, of:

1 part of CEM I Portland cement

2 parts of sand to IS EN 13139:2002 Aggregates for mortar.

The quantity of water required to achieve a mix suitable for the jointing details shown on the drawings shall be determined by the Contractor.

No other ingredients shall be added without approval.

Mortar designated as dry-packed shall be of such a consistency that it can be properly compacted by ramming.

13.1.9 Concrete Infill

The surfaces of precast units shall be thoroughly cleaned and wetted. Concrete shall be placed avoiding segregation, and compacted thoroughly to eliminate voids. Precast units shall be prevented from moving until the concrete infill has gained sufficient strength to ensure stability.

13.1.10 Composite Construction

The surfaces of precast units shall be thoroughly cleaned and wetted. Concrete shall be placed avoiding segregation, and compacted thoroughly to eliminate voids. Precast units shall be prevented from moving until the concrete infill has gained sufficient strength to ensure stability.

13.1.11 Connections

Connection details shall be compatible with the design assumptions. Details shall be submitted to the Engineer by the Contractor for agreement.



14.0 CLADDING

14.1 NOT USED

15.0 CIVIL ENGINEERING WORKS AND PIPELINES

Note: For Irish Water Projects please refer to the latest version of the General Civil Engineering Specification IW-TEC-300-01. Details contained in this Section may be used to supplement IW-TEC-300-01 where required to be included in the Scope document.

15.1 PIPELAYING GENERALLY

The location of pipelines in roads will generally be as described in the Drawings but the actual final position will be agreed on site with the Employer's Representative Site Staff.

Where socketed pipes are required to be laid on a granular or sand bed, or directly on a trench bottom, joint holes shall be formed in the bedding material or excavated formation to ensure that each pipe is uniformly supported throughout the length of its barrel and to enable the joint to be made.

Pipes shall be laid on setting blocks only where a concrete surround or cradle is used.

Where pipes are required to be bedded directly on the trench bottom, the formation shall be trimmed and levelled to provide even bedding of the pipeline and shall be free from all extraneous matter that may damage the pipe, pipe coating or sleeving. Laying pipes directly on the trench bottom is not permitted.

No protective cap, disc or other appliance on the end of a pipe or fitting shall be removed permanently until the pipe or fitting that it protects is about to be jointed. Any exposed pipe ends shall be capped when pipelaying is not actively being carried out to prevent vermin or soil entering the pipework.

Pipes and fittings, including any lining or sheathing, shall be examined for damage and the joint surfaces and components shall be cleaned immediately before laying. Where repairs are required, they shall be carried out in accordance with the manufacturer's recommendations and agreed with the Client.

Suitable measures shall be taken to prevent soil or other material from entering pipes, and to anchor each pipe to prevent flotation or other movement before the works are complete.

Pipeline marker tape for water and wastewater pipes, in accordance with Clause 2.76, shall be laid on top of the bedding layer and where a tracer system is specified, it shall be continuous and adequately secured to valves and fittings. Where the gradient of the as-laid pipeline exceeds 5%, installation shall be uphill with sockets leading.

The Contractor shall prevent disturbance or softening of wet fine grained soils such as clays, silts and fine sands in the trench bottom, by proper drainage and by placing a blanket of coarse sand and gravel or other approved granular bedding material on the virgin formation as soon as it is uncovered. No traffic shall be allowed in the trench bottom until the blanket is in place. In very soft ground this blanket shall be additional to the normal bedding required for the pipe. Extra soft spots shall be hardened to the general condition of the bottom by tamping in granular material before continuing with the blanket.

Peat or boggy material below formation level shall be removed and replaced by broken stone or other approved stable filling material.

In special situations piling may be specified.

In mixed soils containing large boulders, stones or flints, any object which is near enough to the bottom to form a hard spot shall be removed and replaced by granular material.

Where the flow of ground water is likely to transport fine soil particles, water stops of puddle clay extending up through the bedding and surround fill shall be placed across the trench at intervals along the line.

All work shall be performed in the dry and during the construction of pipelines the Contractor will be required to provide adequate means, including pumping from specially constructed sump holes if necessary, to keep the open trenches free from water. By whatever means appear appropriate the Contractor shall arrange the discharge of trench drainage into natural watercourses and shall take all necessary precautions to ensure that no nuisance is thereby caused to downstream riparian owners. When no longer needed, temporary drains shall be sealed permanently by grouting, and any sumps formed for pumping ground water shall be filled with well compacted selected material as for the bedding.

It is expressly stipulated that the Contractor may not pollute the waters of streams, lakes or other water courses which are adjacent to the works, and if heavily silted water is pumped from the trenches, the discharge shall be so arranged that the silt will not foul watercourses into which the drainage is conveyed. Silt traps or other suitable means to a design to be approved by the Employer's Representative shall be constructed to assist in this matter.

15.2 SETTING OUT OF WATERMAINS, SEWERS AND OTHER PIPELINES

The Contractor shall be responsible for the proper setting out of the pipelines, which shall be laid to their proper levels and grades with the aid of a pipe laying laser.

In the case of twin pipe trenches a separate laser instrument shall be used on each pipeline. Pipelaying lasers shall be self-levelling with digital read out of grade and with an accuracy of not less than 0.01%.

Accessories shall include suitable base plates and targets for the smaller diameter pipes up to 400mm diameter. For the larger diameter pipes up to 1800mm diameter suitably fabricated supports and centering devices shall be provided to allow for accurate setting of the instruments either on the invert of the pipeline or on the centreline.

15.3 MATERIALS IN CONTACT WITH POTABLE WATER

All materials, substances and products in contact with potable water shall be on the Approved List published by the UK Drinking Water Inspectorate (or other equivalent European approval system). The Contractor shall provide a list of all substances, products and processes which he proposes to use and which may come into contact with potable water, and written confirmation of DWI approval (or other equivalent European approval). If the list submitted includes an unapproved substance, product or process the substitution of that unapproved substance, product or process with an approved one shall be at the Contractor's expense.



15.4 CONCRETE PIPES AND FITTINGS

Unreinforced and reinforced concrete pipes and fittings with flexible or rigid spigot and socket joints shall comply with IS 6: 2004 and IS EN 1916. Concrete fittings shall be manufactured to the same standard as the pipes and they shall be of approved dimensions.

All pipes and fittings shall have gasket-type flexible joints of spigot and socket or rebated form, unless otherwise specified in Section 1. Rubber joint rings shall be Type 2 and shall comply with BS EN 681-1 and shall be obtained from the pipe manufacturer.

The concrete mix for pipe manufacturing shall contain not less than 360 Kg. of cement per cubic metre of fully compacted concrete and shall have a maximum water content ratio of 0.45.

The Contractor shall ensure that, in addition to complying with the crushing strength requirements detailed in Section 1, concrete pipes supplied for installation by pipe-jacking techniques can withstand the thrusting forces to which they will be subjected during installation, without cracking or spalling. A certificate confirming that the pipes are suitable for jacking and indicating allowable distributed jacking forces shall be supplied. The characteristic strength of concrete used in the manufacture of pipes for jacking shall be not less than 65 N/sq.mm.

In areas where the Sub-Soil investigation shows aggressive soils the concrete mix for Concrete Pipes to be manufactured for pipeline construction in such areas shall contain not less than 330kg for 20mm maximum aggregate size and not less than 380kg for 10mm maximum aggregate size of Sulphate Resisting Cement (to BS 4027) per cubic metre of fully compacted concrete and shall have a maximum water cement ratio of 0.5.

The Concrete Mix used for the construction of the Concrete Surround to the same pipe length shall contain not less than 300kg of Sulphate Resisting Cement as already specified for concrete pipes, again in areas defined in the Sub-Soil Investigation as having aggressive soils.

15.5 PRESTRESSED CONCRETE PIPES AND FITTINGS

Prestressed concrete pressure pipes and fittings where specified shall comply with the relevant provisions of BS EN 639 and BS EN 642. Prestressed concrete pipes and fittings for drainage and sewerage purposes shall comply with the relevant provisions of BS 5911: Part 103 and BS 5911: Part 1.

Unless steam cured, no pipes or fittings shall leave the place of manufacture until they have been allowed to cure and mature under suitable conditions for a total period of not less than 28 days. The Contractor shall provide a Certificate or equivalent from the Manufacturer that confirms that the pipes or fittings have been allowed to cure and mature for the specified period. The surface finish shall be assessed in accordance with, and comply with, the provisions of BS 5911: Part 100: 1988 Clause 7.5 and BS 5911: Part 1. The permissible irregularity of internal surface shall be assessed in accordance and comply with the provisions of BS 5911-5:2004.

15.6 VITRIFIED CLAY PIPES

Vitrified Clay Pipes, Fittings and Joints shall comply with BS 65 or IS EN 295.

Extra chemically resistant pipes and fittings shall comply with the relevant provisions of BS 65 or IS EN 295.



Vitrified clay jacking pipes shall conform to IS EN 295-7.

15.7 DUCTILE IRON PRESSURE PIPELINES AND FITTINGS FOR WATERMAINS

Ductile Pipes, fittings and joints shall comply with the relevant provisions of IS EN 545 for potable water pipelines. They are to have approved compression ring flexible joints or flanged joints where indicated on Drawings or in Section 1.

All pipes and fittings shall be lined internally with sulphate resisting cement mortar to the requirements of IS EN 545 and shall have a factory applied epoxy seal coat to the cement mortar lining.

All pipes and fittings shall have a standard external protection of metallic zinc to a minimum of 200g/m² and a minimum of 70 um bitumen.

The pipes shall be sleeved, if specified in Section 1 for aggressive soils, with a factory applied polyethylene external sleeving system with a film thickness of not less than 200 um for corrosion protection.

Ductile Iron Pipelines shall, if specified in Section 1 for highly aggressive soils, be protected with a factory applied Heavy Duty Tape Wrap incorporating a bituminous layer with a PVC carrier. The joints shall be protected with a site applied Heavy Duty Hand Tape Wrap incorporating a bituminous layer with a PVC carrier. The Tape Wrap (both factory applied to pipes and site applied to joints) shall be applied with a minimum 55% overlap. The minimum PVC thickness of these Tape Wraps shall be 0.75mm with a minimum bitumen thickness of 0.75mm. The total tape thickness of these Tape Wraps shall be not less than 1.6mm. The Tapes shall be supplied on interleaved paper to minimum width 25mm wider than the Tape Wrap.

Split Puddle Flanges on Ductile Iron pipes are to be used only in locations where they are not required to provide an anchorage for the pipe. The flanges are to be fitted to the pipe using a suitable non-toxic metallic sheeting to provide a packing between flange and pipe body and caulked after fixing.

Puddle flanges which are required to provide anchorage for the pipe are to be integrally cast in welded Puddle Flanges.

All pipes and fittings shall have BSI Kitemark accreditation or equivalent.

15.8 DUCTILE IRON SEWER SYSTEM PRESSURE AND GRAVITY PIPELINES

Ductile Iron Pipes, Fittings and Joints for Pressure and Gravity Pipelines for Sewerage Systems shall conform to the following Standards:

IS EN 598	DI pipes, fittings, accessories and their joints for sewerage applications – requirements and test methods.
ISO 2531	Ductile Iron pipes fittings and accessories for pressure pipelines.
ISO 8179	Ductile Iron pipes – external zinc coating.
ISO 8180	Ductile Iron pipes – Polyethylene sleeving.
ISO 4179	Ductile Iron pipes for pressure applications – centrifugal cement mortar linings.

Pipes shall be protected internally by High Alumina Cement for sewage with a PH range of 4-12. Pipes shall be protected internally by polyurethane for sewage with a PH range of <4 or 13. Fittings shall be internally lined with epoxy to 250 microns. Socket areas which will come in contact with effluent shall be coated with a high strength epoxy paint.

Externally pipes shall be protected by a coating of metallic zinc to a minimum of 200g/m² and finished with an epoxy seal coat. Spigot ends of the pipes which come into contact with effluent shall be coated with a high strength epoxy paint.

Fittings shall be protected internally and externally with an epoxy coating of 250 microns (mean).

Additional external protection for pipes and fittings using polyethylene sleeving may be specified in aggressive ground conditions. In very aggressive conditions the pipes and fittings shall be tape wrapped as specified in Section 13.7 or to the Manufacturer's specification.

At entry and outlet from Access Chambers Special Manhole Collars shall be incorporated all in accordance with the Manufacturer's instructions.

15.9 CAST IRON PIPES AND FITTINGS

Cast Iron Pipes where specified shall comply with BS 4622 for Cast Iron Pipes for Water, Gas and Sewage. Cast Iron pipes, fittings and joints for rainwater and soil drainage shall comply with IS EN 1092 and BS EN 877.

Where flanged pipes are specified these shall comply with BS 4772 for Cast Iron Flanged Pipes and Flanged Fittings. Cast Iron Flanged Specials shall also be manufactured to BS 4772.

15.10 PVC PIPES AND FITTINGS

PVC pressure pipes, joints and fittings shall comply with the relevant provisions as set out below:

PVC Pipes and Fittings		
Materials	Pipe	Joints and Fittings
PVC-U (metric blue)	IS EN 1452-2	IS EN 1452-3
PVC-A	PAS 27	PAS 27
PVC-O	WIS 4-31-08 (12.5 bar and 16 bar only)	IS EN 1452-3

Pipes for potable water use shall be coloured blue.

Unplasticized PVC pipes, joints and fittings for gravity sewers and drains shall comply with the relevant provisions of BS 4660, BS 5481 or IS EN 1401-1.

Unplasticized PVC Sewer Pipes shall only be used in House Connection lines and in the connection of road gullies unless otherwise stated in Section 1.

Solvent cements for jointing unplasticised PVC pipes shall comply with BS 4346: Part 3 or IS EN 1452. For pipes and fittings complying with BS 4660, solvent cement may alternatively comply with BS 6209.

Solvent cements for jointing unplasticised PVC pipes shall not be used for below ground use.

Push-fit joints shall be spigot and socket.

Twin-walled thermoplastic pipe with external corrugations shall comply with WIS 4-35-01 and BS 4660. The jointing system shall be of the compression type and bi-directional. Twin-walled thermoplastic pipe shall meet the leak tightness requirements of method 4 of IS EN 1277.

15.11 POLYETHYLENE PIPES (MDPE AND HDPE)

Medium Density and High Density Polyethylene Pipes (MDPE and HDPE) shall comply with IS EN 12201 for Water Supply and IS EN 13244-2 for Drainage and Sewerage applications.

15.12 HIGH PERFORMANCE POLYETHYLENE PIPES (HPPE)

High Performance Polyethylene Pipes (HPPE) shall be made from the material which has been granted Department of Environment (UK) approval and shall be manufactured in accordance with Water Industry Specification 4-32-17 or equivalent.

This pipe system should be capable of performing within the requirements of the classification of P.E. 100 so as to enable the design of 16 bar and 10 bar systems.

15.13 GLASS REINFORCED PLASTICS (GRP) PIPES AND PRODUCTS

Glass Reinforced Plastics (GRP) Pipes, joints and fittings for use for Water Supply or Sewerage Systems shall comply with IS EN 1796 and IS EN 14364.

When used under the conditions for which they were designated non-metallic products in contact with or likely to come into contact with potable water shall comply with the requirements of BS 6920 Part 1.

GRP products incorporated into the works shall comply with the requirements of IS EN 14118 and BS 4994, and incorporating UV inhibition during manufacture.

Glass reinforcement shall be water resistant "E" type woven glass fibre to BS 3496 and BS 3749 with a minimal reinforcement content of 25-30%.

Vessels and tanks constructed from GRP shall be designed and fabricated in accordance with BS 4994.

15.14 ACRYLONITRILE – BUTADIENE – STYRENE (ABS) PIPES AND FITTINGS

Acrylonitrile-butadiene-styrene (ABS) pressure pipes and fittings shall comply with the relevant provisions of BS 5391, Part 1 and BS 5392, Part 1 respectively.

15.15 PIPES FOR LAND DRAINAGE AND TEMPORARY DRAINS

Pipes, joints and fittings for land drainage and temporary drains shall comply with the relevant provisions of the appropriate Standard as set out below:

Standards	
Type	Standard
“Perforated” or “Surface Water” vitrified clay pipes and fittings	IS EN 295:5 or BS 65
Concrete Porous Pipes for Under Drainage	BS 5911: Part 114
Clayware Field Drain Pipes	BS 1196
Plastics Pipes for use as Light Duty Sub-Soil Drains	BS 4962
“Land Drainage” category concrete pipes and fittings with ogee joints	BS 5911: Part 110

15.16 PIPES FOR DUCTS

Pipes, joints and fittings for exposed ducts for building services shall comply with the relevant provisions of the appropriate Standard as set out below:

Standards	
Type	Standard
Unplasticized PVC pipe	BS 3505 or BS 3506
Hollow steel sections (greater than 150mm OD)	IS EN 10210-2
Steel tubes (not greater than 150mm OD)	IS EN 10296-1 and IS EN 10305-4

Pipes, joints and fittings for buried ducts shall have flexible mechanical joints and comply with the relevant provisions of the appropriate Standard as set out following:

Standards	
Type	Standard
Vitrified Clay	BS 65
Unreinforced or reinforced concrete	BS 5911
Unplasticized PVC	BS 4660 or BS 5481 and IS EN 1401-1
Structured wall pipes	IS EN 50086-2-4

Cable ducts are to be laid with sand bed and surround giving a cover of not less than 80mm under and around the pipe.

All ducts terminating in buildings shall extend 150mm above slab level.

Drawcords shall be inserted in all ducts. After installation of the drawcord the duct shall be plugged and the cord fastened at each end of the duct. Draw Cord for duct threading shall be 8mm diameter, 3 strand hawser laid polypropylene rope complying with BS EN 696, BS EN 699, BS EN 700 and BS EN 701.

Separate ducts shall be laid to receive power and telemetry flowmeter cables.

Flowmeter cable ducts shall be uPVC Class B pipes to IS 123 (100mm duct 4.10mm minimum wall thickness), jointed with compression ring flexible joints and laid with sand bed and surround giving a cover of not less than 80mm under and around the pipe. Cable ducts should be protected until such time as they are brought into operation, to prevent the entry of vermin. The Contractor will ensure that:

- Each duct is cleaned, and its ends **sealed** using **end caps** or foam and plastic bags so as to avoid ingress of grit, stones and sediment which can block ducts and damage cables.
- ducts are installed as per the required standards shown.
- ducts are installed so as to achieve a minimum clearance of **300mm** from all other services is maintained.

15.17 PROPYLENE CO-POLYMER PRESSURE PIPES

Propylene co-polymer pressure pipe shall comply with the relevant provisions of BS 4991 and, where it is to be in contact with potable water, shall be Series 1.

15.18 PIPE JOINTING GENERALLY

Pipe jointing surfaces and components shall be kept clean and free from extraneous matter until the joints have been made or assembled. Care shall be taken to ensure that there is no ingress of grout or other extraneous material into the joint annulus after the joint has been made.

Where pipes with flexible joints are required to be laid to curves, the deflection of any joint as laid shall not exceed three quarters of the maximum deflection recommended by the Manufacturer. This is to allow residual deflection capacity in the event of settlement of bed or backfill material.

Where PE pipes are used; a fully welded system shall be used. Mechanical joints shall not be used unless approved in writing by the Employer.

Proprietary joints shall be made in accordance with the manufacturer's instructions.

The number of joints shall be minimised.

Where, as part of the work, the protective coating or lining to the existing pipe or the new pipe is damaged, it shall be made good, as appropriate for the protective coating or lining in accordance with this specification and the manufacturer's instructions.

For pressure mains where the gradient is steeper than 1 in 6 a self-restraining jointing system or thrust blocks shall be used. Where thrust blocks are proposed these shall be designed to suit



the loading from the main with appropriate thrust flanges and taking the local ground conditions into account.

Pipe jointing shall only be carried out by appropriately trained (in the relevant pipe material and jointing technique) and experienced personnel.

The pipe insertion depth into the socket shall be marked on the pipe to ensure full insertion.

Where lubricant is required to construct joints, the manufacturer's jointing lubricant, shall be used. On no account shall any non-approved lubricant be used for the jointing of any pipe or fitting. Any lubricant used on pipe systems for potable water shall be suitable to be in contact with water for human consumption and comply with the requirements of this Specification.

The torque loading to the bolts on all mechanical pipe fittings shall be to the limits as recommended by the manufacturer.

Gaskets used in flexible joints shall be provided by the manufacturer of the pipes and fittings the gaskets are to be used with.

15.19 WELDED JOINTS IN POLYETHYLENE PIPES

Fusion welded joints in PE80 and PE100 polyethylene pipes shall be made only between pipes having the same physical characteristics and in accordance with WIS 4-32-08:2002. The equipment to be used for electrofusion jointing is specified in WIS 4-32-08:2002. The equipment to be used for butt fusion jointing is specified in WIS 4-32-16:1998.

Where joints are being made onto existing polyethylene systems and the material types cannot be identified, approved mechanical type joints shall be used. Under no circumstances shall dissimilar polyethylene pipes, be jointed by fusion methods without specific instruction from the Client.

Where PE barrier or co-extruded pipes are used the jointing system adopted shall be in accordance with the pipe manufacturer's specification and all protective systems shall be made continuous across the joint.

The pipe section containing the completed weld shall achieve at least the same strength characteristics as the parent pipe.

Pipe jointing shall be carried out by appropriately trained and experience personnel. Training must be certified and equivalent to City & Guilds qualifications in Fabrication and Welding Engineering (Qual. No. 1781), NVQ Diploma in Fabrication and Welding Engineering (Qual. No. 1782), Welding Skills (Qual. No. 3268). Jointing personnel must have a minimum of one year's experience in successfully completing pipe welding under 'live' construction conditions.

All butt fusion jointing of polyethylene pipes shall be undertaken on an automatic butt fusion machine of a type approved by the pipe manufacturer and which has a complete data retrieval facility for all joints via a data printer, which enables the user to comply with IS EN ISO 9001:2008 – Quality management systems – Requirements.

Welds in polyethylene pipes shall be sampled, as specified in the Contract and shall meet the requirements of the PE tensile weld test as described in the Water Industry Specification No. 4-32-05 Appendix "G". All external weld beads shall be removed and inspected for compliance



with the fusion jointing procedure and testing requirements in this specification and WIS 4-32-08.

The Contractor shall be required to inspect all welds for himself and place each removed weld bead in an appropriate clear bag and duly labelled with the fusion welding machine ticket, as per Clause 5.8.6(A) above, and indicating where the weld bead has been removed from in relation to the chainage or location of the laid pipe. All bagged weld beads shall be stored at the Contractor's storage container and/or compound. The Client shall be allowed access to inspect the bagged weld beads at all times.

Butt-Fusion Joints

The method time and temperatures laid down by the material suppliers for the method of jointing shall be rigidly followed. In the case of PE80 and PE100 pipes dual pressure welding methods with a heater plate temperature of 230 °C shall be employed. The first joint of each days welding session shall be considered as a dummy joint, performed on spare lengths of pipe and discarded. This is to ensure that the welding plates are clean of any grease, dust or other contaminants before used for a permanent joint. A fitting or an area of pipe that has been through a complete heating cycle shall not be reheated. Where a joint has proved unsuccessful, the section shall be removed to 250mm either side of the joint and the operation restarted. The minimum permitted distance between any two fusion joints shall be four times the outside diameter of the pipe being jointed.

Bead widths to butt fusion joints shall be as detailed in the manufacturer's literature. A minimum of 20 minutes shall be allowed to elapse after completion of the joint before the removal of the external bead is permitted. External bead removal on pipes for insertion will be carried out using an approved tool specifically designed for the purpose.

All pipes shall be joined using electrofusion or butt-fusion welding techniques and equipment, except where specified otherwise. Hand welded joints will not be acceptable. Where butt-fusion welding is used, a fully automatic machine shall be used which shall:

- automate trimming of pipe faces
- automate determination of drag forces during all stages of jointing process
- have automatic incorrect heater temperature lock out
- have automatic heater plate ejection
- automate bead formation control
- warn of and record incomplete cooling times

In addition, the machine shall be capable of recording and storing weld specific parameters such as heater temperature, bead pressure, heat soak time, fusion pressure and actual and target cooling times. It shall also record the date, time, operator and joint number. This data shall be retrievable by a data capture unit and supplied to the Client in the form of a CD for downloading to a personal computer. All joints shall be de-beaded externally with the removed beads numbered and retained for future records. All butt fused welds shall be undertaken in an enclosure (e.g. tent) to minimise the effects of wind and rain on the jointing process and to prevent contamination from wind borne dust. Where electrofusion couplers are used, the pipe shall be first mounted in the appropriate clamps to prevent pipe movement during the jointing cycle. Only fully automatic electrofusion machines and couplers with automatic fusion time controllers shall be used. The fusion machines shall be capable of recording and storing weld specific parameters such as target and actual fusion times together with the date, time, operator

and joint number. This data shall be retrievable by a data capture unit and supplied to the Client in the form of a CD for downloading to a personal computer. All service connections to PE pipe shall be made using electrofusion methods to ensure a completely welded system. Mechanical connection of services will not be permitted. All butt-fused and electro-fused joints shall be labelled with a unique number. Records of the locations of these joints shall be kept and submitted with an as laid drawings and records after scheme completion. Preparation of pipe ends for electro-fusion jointing shall be carried out using approved equipment. Hand preparation will not be allowed.

All personnel carrying out pipe jointing shall have appropriate training in health and safety and shall follow all safety procedures laid down for welding. In particular the provisions of the Safety Health and Welfare at Work Act 2005 (SI No. 10 of 2005), the Safety Health and Welfare at Work (Construction) Regulations 2013 (SI No. 291 of 2013), Safety Health and Welfare at Work (General Application) Regulations 2007-2013 shall be adhered to in the provision of welding for jointing purposes. The relevant sections of the regulations relating to welding include the use of appropriate PPE, control of vibration and noise, working in confined spaces, working with gases.

For electrofusion jointing, the short term burst test for assessing the tolerance of electrofusion welds to contamination as outlined in WIS 4-32-08:2002 Appendix A shall be carried out each time an electrofusion coupler is assembled and for each pipe diameter in the Contract. This testing shall be carried out before any jointing takes place. A test report in accordance with Section A.6 of Appendix A shall be completed and forwarded to the Client.

For electrofusion jointing, the assessment of toughness test outlined in WIS 4-32-08:2002 Appendix C (double cantilever cleavage test) shall be carried out on samples of welds made on site. Test joints shall be made prior to commencement on site using the certified welder and approved welding equipment. It is a requirement for this testing to be carried out on every pipe diameter to be used in the contract.

For butt fusion jointing, the assessment of toughness test outlined in WIS 4-32-08:2002 Appendix B (Tensile test) shall be carried out on samples of welds made on site. Test joints shall be made prior to commencement on site using the certified welder and approved welding equipment. It is a requirement for this testing to be carried out on every pipe diameter to be used in the contract.

Auditing and testing of welded joints in polyethylene pipelines shall be carried out as follows: Each installation team and welder shall be audited by the Client's Site Staff on a weekly basis or other frequency approved by the Client. The audit will use a standard checklist to ensure that all the correct equipment and working practices are being utilised. All butt fusion joints shall be de-beaded and the bead referenced and kept for inspection. Beads shall be examined upon removal for signs of defects or splitting along the length of the bead joint. Butt fusion welds and electro-fusion welds shall be cut out from the works completed and subjected to a destructive test, as indicated by the Client on site. All sample welds shall be clearly labelled and referenced. 1 no. butt-fusion weld per butt-fusion crew per week and 1 no. electrofusion weld per electrofusion crew per week shall be cut out and taken for testing by the Contractor. This minimum frequency of destructive testing shall be increased at the discretion of the Client should significant failure rates occur. The destructive weld testing and analysis shall be carried out by a specialist and accredited testing organisation. The contractor shall provide details of his proposed testing organisation to the Client for review and approval prior to any testing being undertaken. The Contractor shall arrange for the selected samples to be tested in accordance with WIS 4- 32-08 Appendix B, C and D by an accredited laboratory (which is accredited by the Irish national Accreditation Board or equivalent) and a test report in accordance with WIS 4-32-08 provided to the Client within 1 week of the sample joint being taken. The provision of the



sample and all costs associated with their provision including restoring the watermain to service and reinstatement will be borne by the Contractor.

15.20 FLANGED JOINTS

Flanges for pipes and pipeline fittings shall, unless otherwise specified in Section 1, comply with BS EN 1092 Part 1 for 16 bar nominal pressure rating.

Bolt threads shall be lubricated with a lubricant approved by the manufacturer prior to installation. Flanges shall be properly aligned before any bolts are tightened. Bolts shall be tightened using a torque wrench or other controlled tensioning device (recently calibrated) in a cross bolt tightening pattern in line with the manufacturer's instructions.

15.21 GASKETS FOR FLANGED JOINTS

Gaskets for flanged pipe joints shall be of the inside bolt circle type. The dimensions of gaskets shall comply with IS EN 1514-1. Gaskets shall be manufactured from material complying with the provisions of BS EN 681. For potable water, gaskets shall be Type WA with a hardness range of 76-84. Gaskets shall be suitable for the pressure rating of the flanged pipe. Any special requirements for the type of flange gasket are specified in Section 1.

15.22 OGEE JOINTED CONCRETE PIPES

Ogee Jointed Concrete Pipes shall comply with IS 166: for Concrete Surface Water Pipes.

Ogee joints shall be so made that any specified joining material fills the joint cavity. Any surplus joining material extruded inside the barrel shall be trimmed off and, where practicable, pointed on completion. The jointing material for ogee joints shall be class M1 (SRPC) mortar.

15.23 WELDED JOINTS IN STEEL PIPES

The process of welding carbon steel and stainless steel pipelines shall be in accordance with BS 4515-1 and BS 4515-2, respectively.

The ends of pipes shall be cut and prepared, and be free from fins, planar defects, tears and other surface defects, prior to welding. Cleaning to base metal shall extend for at least 25mm from the end of the pipe on both internal and external faces.

The alignment of abutting pipe ends shall be such as to minimise the internal offset between surfaces.

Details of the proposed welding and welding repair procedures shall be given to the Employer by the contractor in the form of a Welding Procedure Specification (WPS). Prior to commencement of production, test welds using these procedures shall be made under simulated Site conditions in the presence of the Employer.

Welders shall be qualified in accordance with I.S. EN 9606- 1 and welders shall only make welds for which they are qualified.

Butt and fillet welded joints shall be tested using non-destructive techniques, unless it is necessary to use destructive testing to achieve adequate interpretation. The testing of the



welds is to be carried out by x ray or other form of NDT such as Material Particle Inspection for 100% of the joints and an Ultra Sound test on minimum 50% of the joints.

A welding procedure specification (WPS) to EN ISO 15609 is required to be prepared and submitted whenever a welding operation is to be carried out, it shall be presented in the format as set out in Annex A of the standard and contain all necessary information to make a weld.

Where butt joints are being used, the bores of the ends of adjacent pipes shall preferably match exactly.

Where a sloping branch has to be connected directly to the main, the angle between the centre line of the main and that of the branch shall whenever possible be not less than 60°. Where the angle is unavoidably less than 60°, details of joint design and fabrication shall be agreed between the contracting parties.

After a successful test of the welded joint, clean the weld area back to bare metal and apply the appropriate coating repair to match the pipe coating.

Where proprietary “Fabriweld II” type joints have been used on a pipeline the testing criteria is as follows: after welding is completed, carry out a pressure test of the annulus via the ¼” BSP connection using an inert gas e.g. CO₂. A test pressure of 6 Bar shall be applied for 15 minutes without loss of pressure.

15.24 CEMENT MORTAR JOINTS

In making yarn and mortar joints for pipes or fittings, the spigot shall be entered into the socket of the last pipe laid until it bears on the back face of the socket and it shall be centred in the socket. Two turns of tarred yarn shall then be caulked into the back of the socket and Class M12 cement mortar shall be pressed into the joint to fill the socket and shall be bevelled off at 45 degrees from the outside edge of the socket.

15.25 RUN LEAD JOINTS

Run lead joints shall be made by forcing home strands of white sterilised jute piping yarn, with proper irons, to the back of the socket cavity leaving a space of 75mm (60mm for pipes of 300mm nominal bore and below) measured from the socket face. The socket face shall then be encircled by a suitable clip or gasket and the joint cavity filled in solid with molten lead poured in one running. After cooling, the lead shall be set up with proper caulking tools and neatly finished with the face of the lead 2mm back from the socket face. In the case of pipes over 750mm diameter, the socket and spigot shall be heated before the joint is run.

15.26 PROTECTION OF FERROUS PIPES, JOINTS AND FITTINGS

Ferrous pipes, fittings and couplings shall be specified with factory applied corrosion protection systems appropriate for their conditions of installation.

Where additional external protection is required to joints and fittings, they shall be cleaned and all loose rust removed before protection is applied. External protection shall comprise:

P1 - The application of a thin continuous coating of petroleum paste over the whole area to be protected as a primer. Where bolt heads, nuts, flanges and other projections arise, a profiling mastic shall be used to give a smooth external profile. The joint or fitting shall be wrapped with



a protective tape. The minimum application shall be a spiral wrap using 55% overlap. The tape shall extend along 150 mm of the barrel of the pipe on each side of the joint or fitting.

or

P2 - The application of a continuous coating of bitumen primer over the whole area to be protected. Where bolt heads, nuts, flanges and other projections arise, a profiling mastic shall be used to give a smooth external profile. The joint or fitting shall be wrapped with a self-adhesive, cold applied, rubber bitumen tape with a PVC backing. The minimum application shall be a spiral wrap using 55% overlap. The tape shall extend along 150mm of the barrel of the pipe on each side of the joint or fitting.

or

P3 - The application of heat shrink sleeves.

Completion of internal and external protection of steel pipes shall be provided where pipes have a bituminous, epoxy or any other type of protective coating in which a gap has been left for the joint to be made. The joint and any damage to the protective coating shall be made good.

Cathodic protection of pipes, joints and fittings shall comprise either impressed current or sacrificial anode.

Pipework and fittings which are to be exposed to air are to be protected externally after installation with black bitumen paint to BS 3416, film thickness 100 micron applied in two coats.

Where pipes, fittings, integral fasteners and nuts, bolts and washers have been coated prior to supply in accordance with WIS 4-52-01 and WIS 4-52-03, no further corrosion protection shall be required.

15.27 JOINT RINGS

Rubber Joint Rings for watermains and drainage purposes shall be Types 1 and 2 respectively, complying with the relevant provisions of BS 7874, and shall be obtained from the pipe manufacturer. Additionally, the Contractor shall supply to the Employer's Representative a certificate confirming that the material to be used for joint rings for water mains complies with the recommendations in Information and Guidance Sheet 4-40-01 published by the Standard Technical Committee on Sewers and Water Mains.

15.28 JOINT LUBRICANTS

Joint lubricants for sliding joints shall have no deleterious effects on either the joint rings or pipes, and shall be unaffected by the liquid to be conveyed. Lubricants to be used for jointing water mains shall not impart on water taste, colour or any effect known to be injurious to health and shall be resistant to bacterial growth.

Only lubricants recommended by the pipe manufacturers should be used.

15.29 MECHANICAL COUPLINGS FOR PIPELINES AND FITTINGS

Mechanical couplings and repair clamps for iron pipes shall comply with WIS 4-21-02.



Mechanical joints and fittings for polyethylene pipes in nominal size 90mm or above for use with cold potable water shall comply with WIS 4-24-01. Mechanical joints and fittings for polyethylene pipes less than or equal to nominal size below 63mm for use with cold potable water shall comply with WIS 4-32-11 or IS EN 1254-3.

Fittings for PE80 (MDPE) and PE100 (HDPE) shall be Type 2, fit for the purpose, end load restraining except for unusual locations and have an internal pipe support.

All fittings shall be protected against corrosion by the application of a polymeric barrier coating in accordance with WIS 4-52-01. All internal and external surfaces shall be coated to Class B as a minimum.

All fasteners shall be protected from corrosion by the application of zinc and a polymeric barrier coating in accordance with WIS 4-52-03.

15.30 CUTTING PIPES

Pipes shall be cut by a method which provides a clean square profile, without splitting or fracturing the pipe wall, and which causes minimum damage to any protective coating. Where necessary, the cut ends of pipes shall be formed to the tapers and chamfers suitable for the type of joint to be used, and any protective coatings shall be made good and the ends sealed in accordance with the manufacturer's instructions.

Where ductile iron pipes are to be cut to form non-standard lengths, the Contractor shall comply with the manufacturer's recommendations in respect of ovality correction and tolerances to the cut spigot end. Pipes of DN greater than 300 conforming to IS EN598 or IS EN 545 to be cut shall be clearly marked by the manufacturer of their suitability for cutting on site unless the manufacturer declares that all pipes irrespective of diameter are suitable for cutting.

Where concrete pipes are cut, any exposed reinforcement shall be sealed with an epoxy resin mortar.

Pre-stressed concrete pipes shall not be cut on site.

Appropriate safety precautions shall be taken when cutting asbestos cement pipes.

15.31 PIPE BEDDING

Granular bedding for pipes shall be constructed by spreading and compacting Type "A" granular material over the full width of the pipe trench. After the pipes have been laid, additional material shall, if required, be placed and compacted equally on each side of the pipes and, where practicable, this shall be done in sequence with the removal of the trench supports.

Each pipe shall be set to the proper line and gradient. Any adjustment should be carried out such that the pipes finally rest evenly on the adjusted bedding throughout the length of their barrels.

The minimum thickness of granular material below the barrel of the pipe shall be:

- 200mm for pipes up to 450mm diameter;
- 300mm for pipes from 500mm diameter upwards;

- In rock or mixed soils containing rock bands, boulders or other hard spots the thickness of granular material shall be increased by 100mm;

Type "A" granular material shall be placed by hand in the excavation below the level of the pipe barrel and shall be tamped and rammed by hand in layers not exceeding 150mm thick before compaction to provide a dense well compacted bed free from soft spots throughout the length of the pipeline between joint and sling holes.

Where socketed or sleeve jointed pipes are specified the bed shall be cut away and removed at each socket or sleeve to give a clearance of at least 50mm or 100mm for trenches in material designated as Hard Material.

Where specified in Volume A1, stanks shall be constructed in the pipe trench to inhibit the flow of groundwater along the granular bedding and pipe surround. Stanks shall be formed around pipelines on either side of stream crossings.

The stanks shall be constructed of either clay, which shall be puddled, placed, and compacted around the pipe, or a lean mix concrete which shall be placed and compacted around the pipe, over a length specified in Volume A1. The requirement in both cases is that the stank shall surround the pipe to the bottom and to the full width of the excavated trench to form a barrier within the granular bed and surround and protrude into the backfill material above by an amount specified in Volume A1.

In bad ground conditions where the migration of the pipe granular surround into the ground may occur, the surround shall be wrapped in geotextile membrane.

Where granular bedding is required, it shall be placed and compacted in layers not exceeding 150mm before compaction. Compaction shall be carried out with hand rammers in 150mm layers.

15.32 GRANULAR PIPE SURROUND

Pipe surround material shall, where required, be placed and compacted over the full width of the trench in layers not exceeding 150 mm before compaction, to a finished thickness of between 100 mm to 300 mm above the crown of the pipes or as specified in Volume A1.

Where trenching excavators or similar narrow trenching techniques are employed for open dig laying of pipelines, the minimum gap between the pipe barrel and side of the trench shall be 50mm for pipe diameters of 280mm or less, and 75mm for pipes greater than 280mm diameter. Prior approval shall be obtained from the Employer before undertaking narrow trenching Techniques outlined in this clause.

After the pipes have been properly bedded and tested Type "A" granular material shall be carefully placed into the spaces between the pipe and the sides of the trench to the level of half pipe. The Type "A" material shall be thoroughly packed and rammed by careful hand tamping in layers not exceeding 150mm thick before compaction. The placing and the tamping of the material shall proceed equally on both sides of the pipe.

Granular material Type "A" shall be placed and compacted as pipe surround over the full width of the trench in layers not exceeding 150mm before compaction to a minimum finished thickness of 300mm above the crown of the pipes.

Where practical, this shall be done in sequence with the removal of the trench supports.



15.33 PIPE SURROUND WITH TYPE “B” MATERIAL

Type “B” fill material shall, where specified, (in fields only) be placed and compacted over the full width of the trench, in layers not exceeding 150mm before compaction to a minimum finished thickness of 300mm above the crown of the pipes.

15.34 TYPE “A” GRANULAR MATERIAL

Granular material Type “A” for bedding, haunch and surrounds to pipes shall be a free draining material consisting of aggregates from natural sources complying with the relevant provision of IS EN 12620:2002.

Type “A” Granular Material shall have a Compaction Fraction Value not exceeding 0.15 and shall consist of an aggregate with a size and grading as shown on the following Table:

Granular Material Type “A”		
	Aggregate Size (mm)	
Nominal Bore of Pipe (mm)	Single Size	Graded
100	10	--
150	10 or 14	14 to 5
225 – 300	10, 14 or 20	14 to 5 or 20 to 5
375 – 525	14 – 20	14 to 5 or 20 to 5
Exceeding 525	14, 20 or 40	14 to 5 or 20 to 5 or 40 to 5

Where PVC-U pipes are used the recommendations of the particular Manufacturers given in writing shall, subject to the Employer’s Representative’s approval, be the governing factor in the choice of bed and surround material.

Where PVC-A pipes are used the recommendations of the particular Manufacturers given in writing shall, subject to the Employer’s Representative’s approval, be the governing factor in the choice of bed and surround material. In general, for PVC-A pipes granular material for the pipe bed should be nominal size single 10mm or 5 to 10mm graded.

Pipe bedding and fill material to concrete pipes shall not contain more than 0.3 per cent sulphate expressed as sulphur trioxide.

15.35 SELECTED BACKFILL MATERIAL TYPE “B”

Selected backfill Type “B” whether selected from locally excavated material or imported shall consist of uniform readily compatible material free from vegetable matter, building rubbish and frozen material or materials susceptible to spontaneous combustion. It shall exclude clay of liquid limit greater than 80 and/or plastic limit greater than 55, materials of excessively high moisture content, clay lumps, retained on a 75mm sieve and stones retained on a 37.5mm sieve.

15.36 TESTING OF PIPE BEDDING AND SURROUND MATERIAL

For testing pipe bedding and surround material, a representative sample of about 40 Kg. shall be heaped onto a clean surface and quartered to obtain approximately 10 Kg. The moisture content of the sample should not differ materially from that of the main body of material, at the time of use in the trench.

A 150mm internal diameter open ended cylinder, 250mm high, shall be placed on a firm flat surface and loosely filled, without tamping, from the 10 Kg. sample. Any surplus material shall be struck off level with the top of the cylinder. The area around the filled cylinder shall be cleared of all surplus material and the cylinder then filled clear of its contents and placed alongside the material.

Approximately one quarter of the material shall then be placed into the cylinder and compacted by tamping vigorously with a 40mm diameter metal rammer weighing about 1 Kg. until no further compaction can be obtained. This operation shall then be repeated for each of the remaining quarters, tamping the final surface as level as possible.

The distance from the top of the cylinder to the surface of the final layer shall then be measured and this value, divided by the height of the cylinder, shall be taken as the Compaction Fraction.

The Compaction Fraction (C.F.) Value and Maximum Particle Size shall be in accordance with the Table as follows:

Requirements for Pipe Bedding Materials					
Pipe Nominal (DN)	Size	Max. Particle Size Mm	Class of Bedding (see notes)	Suitable Materials	
				Either Aggregate to IS EN 12620	Or having a CF value:-
100		10	S	10mm nominal single size	0.25 max
150		15	S	10 or 14mm nominal single size or 14 to 5mm graded	0.15 max
225 to 525		20	S	10, 14 or 20mm nominal single size or 14 to 5 graded or 20 to 5 graded	0.15 max
Over 525		40	S	10, 14, 20 or 40mm nominal single size crushed rock or 14 to 5 graded or 20 to 5 graded or 40 to 5 graded	0.15 max

NOTES:

- Class S bedding is 360 degree granular bed and surround (refer to Clauses 13.31 and 13.32 above)
- The greater the CF value of granular bedding materials the greater care in compaction is required.
- In wet soils the migration of fine soil particles with ground water into the voids of the bedding may be minimised by surrounding the granular material with filter fabric.

Extract from "Simplified Tables of External Loads on Buried Pipelines" by TRL HMSO.

15.37 CONCRETE PROTECTION TO PIPES

Pipes to be bedded on or cradled with concrete shall be supported on precast concrete setting blocks, the top face of each block being covered with two layers of compressible packing in accordance with Clause 13.38.

Concrete provided as a protection to pipes shall be grade C16/20 placed to the required depth in one operation. Where pipes with flexible joints are used, concrete protection shall be interrupted over its full cross section at each pipe joint by a shaped compressible filler in accordance with Clause 13.38.

Where pipes are protected by a concrete slab placed above the pipe, this shall span the pipe trench and extend a minimum of 300 mm both sides, widening the trench above the pipe surround. There shall be a minimum of 150 mm of surround between the crown of the pipe and underside of the slab.

Concrete protection to pipes shall be well vibrated, rammed and worked under and around the pipe. The top surface shall have a spade finish. All necessary measures shall be taken to prevent floatation of pipes during placing of concrete protection.

Rapid hardening cement shall not be used in concrete for the protection of plastic pipes.

Plastic pipes are to be wrapped with a layer of plastic sheeting complying with WIS 4-08-02 (Specification for Bedding and Sidefill Materials for Buried Pipes) before being surrounded by concrete.

No back filling of the trench shall be carried out until the concrete has reached a cube strength of 10 Newtons per square millimetre.

NOTE: Concrete Specification for use in aggressive soils.

Concreting of bedding, haunching, arch or surrounding shall not be carried out until the pipes have been jointed and inspected. The concrete shall be tamped or vibrated into place under the pipe and the concrete shall be in full contact with the underside of the barrel of the pipe throughout its length. The concrete shall be homogenous mass. There shall be no horizontal construction joint in the concrete below the level of the half pipe.



15.38 COMPRESSIBLE FILLER AND PACKING FOR PIPELINES

Compressible filler for interrupting concrete protection to pipelines shall consist of bitumen impregnated insulating board to BS EN 120 and BS EN 317. The thickness of compressible filler shall be as follows:

Compressible and Packing for Pipelines	
Nominal Bore of Pipe (mm)	Thickness of Compressible Filler (mm)
Less than 450	18
450 – 1200	36
Exceeding 1200	54

Compressible packing for use between pipes and precast concrete setting blocks shall consist of bitumen damp proof sheeting complying with BS 743, Type G.

Bituminous materials shall not be put into contact with plastic pipes.

15.39 PRECAST CONCRETE SETTING BLOCKS FOR PIPES

Precast setting blocks for pipes shall have rectangular faces, with sufficient plan area to prevent punching of the blinding concrete or Final Surface and to provide an adequate seating for the pipes. They shall be manufactured from Grade C16/20 concrete using the same type of cement as in the adjacent concrete bed, and be cast in an approved mould.

Blocks shall not be used until they have achieved a cube strength of 13.5 N/Sq.mm.

15.40 CLAY PUDDLE

Clay puddle shall be impervious to water, and be free from sand, grit, stones and other deleterious matter.

The clay on being dug shall be exposed to the air for at least 24 hours and thereafter shall be worked with water into a consistency suitable for punning. A roll of clay 300mm long and 40mm in diameter shall support its own weight when suspended from one end.

15.41 DEPTH OF COVER ON WATERMAINS

The minimum depth of the cover on watermains measured from the finished ground surface to the top of the pipe barrel shall be as follows:

Minimum Depth of Watermains	
Nominal Diameter	Depth of cover over barrel of pipe
250mm or less	900mm
300mm to 400mm	1050mm

450mm to 500mm	1200mm
600mm to 900mm	1300mm
1000mm to 1500mm	1500mm

Where pipes are laid in footpaths or road margins whose surfaces are higher than the adjacent road, the cover is to be measured from road level.

Where the specified cover cannot be achieved owing to ground conditions encountered, the works specified in Section 1 or shown on the Contract Drawings shall be carried out as directed by the Employers Representative. In any event the Contractor shall accept the risk for the ground conditions encountered and the Contract Sum will not be adjusted owing to the installation of, or connections to, numerous smaller diameter watermain over bridges or culverts in order to achieve the hydraulic pipe capacity as outlined in the Works Requirements.

15.42 TRENCH WIDTHS – WATERMAINS

Trenches for watermain are to be excavated to widths which fall within the limits shown on the following Table:

Trench Widths – Watermain				
Nominal Dia	Internal	Minimum width of trench (mm)	Maximum width of trench permitted (mm)	Nominal Width of Trench (for measurement purposes)
Up to 150mm		450mm	Not Specified	450mm
175mm to 300mm		Nominal Dia. Plus 300mm	Nominal Dia. Plus 400mm	Nominal Dia. Plus 350mm
350mm to 400mm		Nominal Dia. Plus 400mm	Nominal Dia. Plus 500mm	Nominal Dia. Plus 450mm
450mm to 900mm		Nominal Dia. Plus 500mm	Nominal dia. Plus 600mm	Nominal Dia. Plus 550mm
1000mm to 1500mm		Nominal Dia. Plus 900mm	Nominal Dia. Plus 1100mm	Nominal Dia. Plus 1000mm

Trenches are to have the minimum width specified for their full depth. The maximum width permissible is to be measured between undisturbed sides at a level 300mm above the crown of the pipe, and extra width above this level will not contravene this Specification.

If the Contractor finds it convenient or necessary to excavate trenches to greater widths from a point 300mm over the crown of the pipe, permission to enable him to do so will not be unreasonably withheld, but no payment will be made for an excavation wider than those herein specified, and for any extra material for bedding or surround and no temporary or permanent restorations will be paid for beyond the maximum width of trench hereinbefore specified plus 300mm on either side to allow for breaking surface and later knitting in.

15.43 TRENCH WIDTHS – SEWERS AND STORM WATER PIPES

From the bottom of the trench to a level of 300mm above the crown of the pipe, trench widths shall not be less than the minimum nor greater than the maximum figures shown in the Table below.

The minimum width is that width between the faces of the soil required to ensure the correct placing and compaction of bedding materials equally on either side of the pipe. All sheeting and supports are to be outside this width. The maximum width is that width between the faces of the soil which has been used in the structural design of the pipeline and it includes an allowance for sheeting and tolerance.

Trench Widths		
Nominal Pipe Diameter mm	Minimum Trench Width mm	Maximum Trench Width mm
100	430	630
150	490	690
225	580	780
300	680	880
375	950	1150
450	1030	1230
525	1120	1320
600	1240	1440
675	1330	1530
750	1400	1600
900	1920	2120
1050	2100	2300
1200	2225	2600
1350	2400	2800
1500	2500	3000
1650	2600	3200
1800	2800	3400

If the Contractor finds it convenient or necessary to excavate trenches to greater widths from a point 300mm over the crown of the pipe, permission to enable him to do so will not be unreasonably withheld, but no payment will be made for any excavation wider than those herein specified, and for any extra material for bedding or surround and no temporary or permanent restorations will be paid for beyond the maximum width of trench hereinbefore specified plus 300mm on either side to allow for breaking surface and later knitting in.

15.44 THRUST BLOCKS

Except where welded steel pipelines, welded polyethylene pipelines or self-anchoring joints are used thrust from bends and branches in pressure pipelines shall be resisted by concrete thrust blocks cast in contact with undisturbed ground.

Any additional excavation required to accommodate thrust blocks shall be carried out after the bend or branch is in position and the thrust face shall be trimmed back to remove all loose or weathered material immediately prior to concreting.

Thrust blocks shall be allowed to develop adequate strength before any internal pressure is applied to the pipeline.

Rapid hardening cement shall not be used in concrete for thrust blocks to plastic pipes.

Plastic pipes shall be wrapped with a layer of plastic sheeting complying with WIS 4-08-02 before being surrounded by concrete.

Where connections to existing mains incorporate the casting of thrust or other support blocks, the temporary support shall be provided to pipework until such time as the concrete has cured sufficiently to resist the effects of foreseeable pressure in the affected mains.

The depth of cover to concrete blocks shall not be less than 600 mm, unless otherwise stated in Volume A1.

Where a concrete surround to the pipe barrel is to be provided as anchorage, a means shall be provided to transmit the load to the concrete, e.g., via an integral stub flange or similar fitting to form a flange.

The Contractor shall not remove or interfere with any thrust block, restraint or support on a live main, valve or fitting unless adequate temporary restraints or supports have been provided.

Concrete support blocks shall be cast to hydrant tees and sluice valves installed in plastic pipes in order to resist the turning forces imposed on the fittings during use. Support blocks shall be cast in such a manner so as not to interfere with the operation or maintenance of the apparatus.

All pressure pipelines, where the pressure is to be resisted by concrete thrust blocks, are to be securely anchored at tees, dead ends, bends, tapers, sluice valves and in all locations where movement due to thrust arising from internal pressure is likely to occur. The thrust blocks shall be adequate to resist all such thrust arising during the normal use of the pipeline and during testing. The anchor blocks are to be blocks of plain or reinforced concrete Grade C16/20 (20mm) in accordance with the details specified in Section 1 and shown on the Drawings.

The thrust block face shall be set against undisturbed soil. The height, (h), of the thrust block shall be equal to or less than half the total depth to the bottom of the block, (Ht), but not less than the pipe diameter. The height, (h), of the thrust block shall be such that the block width (b) varies between one and two times the height (h). The thrust block dimensions referred to above are shown on the Drawings.

15.45 CAST IN SITU MANHOLES / ACCESS CHAMBERS

Manholes shall be constructed in the locations and with the invert levels shown respectively on the Layout Plans and the Longitudinal Sections included in the Drawings. Manholes for pipelines up to and including 450mm nominal diameter will be a standard manhole type as shown on the Typical Details Drawings. The walls and bases of these manholes will be constructed in mass concrete up to depths of 5.0 metres unless specified, otherwise in Section 1. The roof slabs shall be reinforced as shown on the Drawings.

At depths greater than 5.0 metres the Contract may require an increase in the wall thickness and/or the reinforcing of the walls and base. Special type manholes where applicable have been detailed on the Working Drawings. Manholes for pipelines greater than 450mm diameter are separately detailed on the Drawings and shall be in reinforced concrete work.

The floors, walls and roofs of the manholes shall be constructed with Grade C28/35 Concrete reinforced as detailed and with a minimum cement content of 360 kg/cu.m., except where ground conditions require a higher grade of concrete as may be specified in Section 1. For joints in the manhole walls located 2 metres below the ground level and otherwise as required by the Employer's Representative 240mm high water stops shall be incorporated.

The internal wall surfaces of all manholes above the level of the benching shall be finished with a Class F2 finish so as to present a uniformly clean finish, free from fins, rough spots, cavities or depressions.

Manhole shafts as detailed on the Typical Detail Drawings shall only be constructed where the completed length of shaft will exceed 1.0 metre.

In areas of soft ground or fill, the ground shall be excavated to a firm strata and backfilled to the formation level of the manhole with Grade C12/15 concrete.

Backdrop manholes shall be constructed complete with rodding eye and vertical drop with a tumbling bay on the incoming sewer. The tumbling bay and drop pipe shall be of precast concrete and shall be of the same diameter as the incoming sewer. The drop shall terminate with a 90-degree spigot and socket bend complete with a make-up length of pipe, all of the same diameter. The backdrop pipe, tumbling bay and 90 degree bend shall be surrounded with Concrete Grade C28/35 to a minimum thickness of 150mm and shall be finished with a fairfaced surface externally. A 6mm thick stainless steel splash plate shall be bolted to the manhole wall using 4 No. 6mm diameter stainless steel rawl-bolts.

15.46 PRECAST CONCRETE ACCESS CHAMBERS AND MANHOLES

Precast concrete access units shall comply with the relevant provisions of IS EN 1917 and BS 5911: Part 4. Units which bed onto bases, or onto which cover slabs or reducing slabs sit, shall be manufactured so that imposed vertical loads are transmitted directly to the full wall thickness of the unit. For joints between units and the underside of slabs spigot-ended sections shall only be used where the soffit of the slab is recessed to receive them.

The use of precast concrete manholes shall be limited to pipe diameters up to and including 450mm in diameter unless otherwise specified in Section 1. They shall not be constructed in any other circumstances without the permission in writing of the Employer's Representative. They shall be constructed to BS 5911 as fully watertight chambers and shall be fully backed for their entire depth with Concrete Grade C16/20 to a minimum thickness of 150mm. Backing concrete



shall be shuttered to provide a fairfaced finish. The height of each concrete pour shall not exceed 2 metres. Each construction joint shall break joint with that of the chamber or shaft sections by at least 150mm.

Precast concrete chambers, manholes and shaft sections shall be constructed with step irons, ladders or slabs aligned correctly.

Precast concrete chamber sections for valves and meters shall be interlocking and comply with IS EN 1917 and BS 5911: Part 3.

Joints shall be made so that the required jointing material completely fills the joint cavity. Any surplus jointing material extruded inside the chamber or shaft shall be trimmed off and joints shall be pointed on completion. The jointing material shall be Butyl Rubber Sealant.

Manhole shafts as detailed on the Typical Detail Drawings shall only be constructed where the completed length of shaft will exceed 1.0 metres.

In areas of soft ground or fill, the ground shall be excavated to a firm strata and backfilled to the formation level of the manhole with Grade C12/15 concrete.

15.47 SURFACE BOXES AND GUARDS

Small and large surface boxes shall comply with the relevant provisions of BS 5834: Part 2 and 3, respectively, or WIS 4-37-01.

If hinged lids are provided the hinge pins shall be of a minimal diameter of 8mm and made from stainless steel or copper alloy to prevent corrosion. Other means of retention of surface boxes shall be resistant to corrosion.

Guards and foundation units for underground stopvalves shall comply with the relevant provisions of BS 5834: Part 1 or WIS 4-37-01.

Covers for the surface boxes on watermains shall have either the word "WATER", "UISCE" or the letter "W" cast on the top surface in 75mm letters as applicable. Covers for other applications shall similarly be marked: FH (fire hydrant), WO (washout hydrant), SV (sluice valve) and AV (air valve).

Covers and frames to be installed in carriageways or other areas with frequent passage of vehicles shall be to the minimal grade stated in IS EN 124 or Grade A to BS 5834: 1985.

Covers and frames to be installed in all other areas shall be a minimal Grade of B125 to IS EN 124: 1994, or Grade B to BS 5834: 1985.

Precast concrete sections for chambers and base units for buried waterworks apparatus up to and including 600 x 450mm clear opening shall comply with BS 5834: Part 1 and 4. All sections shall be Grade A as defined in that Standard.

Chambers of materials other than precast concrete shall meet the loading requirements in BS 5834: 1985.

In addition to the requirements of the above, domestic water meter boxes shall be of the waterproof type and shall contain an integral shut off valve on the upstream side together with an integrated non-return valve. They shall be suitable for use with concentric type flowmeters.

They shall be adjustable for height and slope. They shall comply with requirements of V210 meters or similar approved by the Employers Representative.

Surface boxes and guards providing direct access to areas of potable water shall be Loss Prevention Council (LPC) 5 compliant.

Where the Contractor encounters “old” non domestic meter connections they shall be responsible for logging and storing the old non compatible flowmeter, recording the final read on the meter and liaising with the Local Authority Non Domestic Meter Section to arrange the installation of a new meter.

15.48 PRECAST CONCRETE SLABS AND COVER FRAME SEATING RINGS

Precast concrete slabs and cover frame seating rings shall comply with the relevant provisions of IS EN 1917 and BS 5911: Part 3.

15.49 PLASTIC CHAMBERS AND RINGS

Plastic chambers and rings shall comply with BS 7158.

15.50 CHANNELS AND BENCHING

In general channels in manholes shall be formed by placing half pipe sections at the base of the manholes and to the same gradient as the outgoing sewers. In the case of the standard type manhole on the small diameter sewers the manhole base will be constructed after laying the sewer line and with the pipe channel directly on the base. In the case of manholes on sewer lines greater than 450mm diameter the manhole base shall first be constructed and the half pipe sections will then be laid to correct level and gradient and supported off the base with suitable concrete support blocks and the channel shall be firmly bedded in concrete along its length when forming the benching. The Contractor shall submit details on his proposed methods of construction of manholes to the Employer’s Representative.

Benching shall be neatly keyed to the half pipe sections and shall rise vertically for a distance of 150mm above the crown of the outgoing sewer. From this point the benching shall slope upwards to the walls of the manholes at an even gradient of 1 in 20. The vertical and sloping portions of the benchings shall meet in a sharp curve with a radius as shown on the Drawings for the different manhole size. Benching shall be rendered in 2:1 sand – cement mortar with a smooth trowelled finish. The rendering shall have a minimum thickness of 25mm and the surface shall be lightly punned by wooden beaters and floated to true planes throughout and thoroughly worked and polished with plasterers irons.

Concrete used to form benchings shall be Grade C20/25 and with a minimum cement content of 325 kg/cu.m and placed so as to give a smooth uniform finish.

In the cases where there is a change in pipe diameter it will not be possible to use half pipe sections to form the channel inverts. In the case of standard type manholes, the benching shall first be roughly formed and then rendered with a sand/cement mortar. In the case of manholes on larger diameter pipelines, which is above 450mm diameter, the benching shall be constructed by using suitable formwork and finished to give a Class F3 finish.

Details for changes in pipe diameter and for lateral sewers of a small diameter are shown on the Drawings. In general, the crowns of all incoming pipes shall be at the same level as the crown of



the outgoing pipe. This shall be achieved by having a steeper gradient of the channel invert across the manhole or by having a step in invert levels or a combination of both. If there is a difference in levels between the invert and the incoming and outgoing pipes greater than 600mm a drop manhole will be required. Such drop manholes are detailed in the Drawings.

Where possible, main channel inverts for pipes up to and including 300mm diameter shall be pre-cast concrete channels or where the sewer is constructed of steel or ductile iron pipes, the channels may be of the same material.

Branch bends up to and including 150mm diameter shall be half section curved in the direction of flow and set to deliver over the main channel invert. Branch bends over 150mm diameter shall be curved in the direction of flow and shall be formed in 2:1 sand-cement mortar with a smooth trowelled finish. Spaces between branch bends shall be completely filled with concrete and the faces above the main and branch channel inverts shall be trowelled smooth.

Where there is no change of diameter between the inlet pipe and outlet pipe the invert shall follow the same gradient as the outlet pipe.

Manhole inverts shall be fitted with smooth flow channels to accommodate the flow from the inlet pipe(s) to the outlet pipe. For straight through manholes, with similar size inlet and outlet sewers, an open channel or half round pipe section, bedded in cement sand mortar, may be used. Otherwise, the manhole invert shall be formed with cast in situ concrete, C25/30, 20mm aggregate size, finished with a 1:3 cement sand mortar.

The channel benching shall be brought up vertically to the height of the highest pipe crown entering or leaving the manhole. The benching shall be neatly rounded off and sloped to the manhole walls at a gradient as outlined in the Contract. A level landing platform shall be provided at the base of access ladders or step-irons, if such are provided.

Where inverts and benchings are to be formed of in-situ concrete or high strength concrete, topping (granolithic finish) is required. The invert and benching shall be formed in Grade C25/30 concrete with a screeded finish or rough finish, as required, and the concrete topping shall be applied as soon as practicable thereafter.

Pre-cast concrete bases, incorporating pre-formed channels and benching, may be used. Such units shall be in accordance with the provisions of IS EN 1917 and BS 5911 – Part 3:2010. Where there is more than one incoming sewer discharging to the manhole, the benching shall be so shaped as to guide the flow in the direction of the outgoing sewer.

Where the inverts of both manhole and sewer are constructed of brickwork, there shall be no break in bond between the two.

For inverts greater than 450mm diameter, the inverts and benching shall be formed in normal weight concrete containing 10mm nominal maximum size of aggregate, and shall be given a fair worked finish. The invert may also be formed from cut pipework if approved by the Client, with the benching formed and finished as described above.

15.51 WATERTIGHTNESS OF MANHOLES AND CHAMBERS

Manholes and chambers shall be substantially watertight, with no discernible flow of water penetrating the works.



Manholes and access chambers shall be subject to tests similar to those specified for water retaining structures.

All manholes shall be tested after construction by means of a water test. Manholes shall be substantially watertight with no discernible water loss. Infiltration tests shall be carried out on all manholes after backfilling. The maximum infiltration shall be less than 0.1 litres per hour per square meter of internal surface area of the manhole. All visible leaks from or inflow to the manhole shall be repaired.

15.52 PIPES AND JOINTS ADJACENT TO STRUCTURES

Except where the construction is by tunnelling, heading or pipe-jacking, a flexible joint shall be provided as close as is feasible to the outside face of any structure into which the pipe is built, compatible with the satisfactory completion and subsequent movement of the joint.

The length of the next pipe (rocker pipe) away from the structure should not exceed 0.6 metres for pipes up to 600mm nominal bore, 1 metre for pipes up to 750mm nominal bore and 1.25 metre for pipes greater than 750mm nominal bore except where otherwise shown on the Drawings.

A pipeline may, where practicable, be laid through a manhole and the crown broken out to the half diameter, provided flexible joints are situated on each side, no further than 600mm from the inner face of the manhole wall, and that adjacent pipes comply with paragraph 2 of this Clause.

Pipes built into a structure shall be supported by a concrete bed and haunch up to the springline of pipe.

Pipes shall be built in monolithically with the manhole and made fully watertight. A rocker pipe shall be provided immediately after the pipes in and out of the manholes.

Where Ductile Iron pipes are built into manholes or chambers the pipes in and out of the manholes shall be as short as practicable and shall consist of double spigot pipe with puddle flange or flange and spigot pipe with puddle flange. A double spigot rocker pipe and two couplings shall be provided immediately after the double spigot pipe with puddle flange or flange and spigot pipe with puddle flange in and out of the manhole. In general pipes built into structures shall be installed in accordance with manufacturer's requirements.

15.53 SETTING MANHOLE COVERS AND FRAMES

Manhole frames shall be set to level, bedded and haunched externally over the base and sides of the frame with mortar, in accordance with the manufacturer's instructions. The frame shall be seated on at least two courses of Class B engineering bricks set in C50/60 mortar, on precast concrete masonry units or on precast concrete cover frame seating rings to regulate the distance between the top of the cover and the top rung to no greater than 675 mm. A mortar fillet shall be provided where the corners to an opening in a slab are chamfered and the brickwork is not flush with the edges of the opening.

Frames for all manholes covers shall be bedded in polyester resin mortar in accordance with the manufacturer's instructions where the cover is sited in a roadway or highway.

Installation of surface box frames and covers shall comply with the specification set out in BS 7903.



Recessed covers and frames shall be filled with a minimum Grade C 25/30 concrete containing 10mm nominal maximum size of aggregate at least 28 days prior to setting in position.

Bricks used underneath manhole frames shall conform to National Roads Authority Series 2400 Specification. 5.21.6 (A) Manhole, surface box and boundary box frames shall be bedded in epoxy mortar on two courses of Class B engineering brickwork or precast concrete gully slabs.

15.54 MANHOLE / ACCESS CHAMBER ANCILLARIES

For standard type manholes up to 3.0 metres in depth rungs shall be fixed to the wall at 300mm intervals vertically. For standard type manholes greater than 3.0 metres in depth and for manholes on large diameter pipelines galvanised mild steel ladders will be used in place of rungs. For manholes on pipeline of diameter greater than or equal to 900mm access shall be provided to the invert channel by placing rungs in a rebated section of the benching with dimensions 500mm wide by 200mm deep or alternatively by constructing toe holes in the benching of dimensions 150 x 150 x 150 deep in stepped fashion at 300mm intervals vertically as shown on the Drawings.

On manholes on large diameter pipelines (greater than or equal to 600mm) hand rails, as per Clause 13.57, 900mm high shall be provided at the top of the benching and parallel to the pipe channel where there is headroom greater than 1.0 metre as measured from the benching to the soffit of the roof slab.

For manholes on pipelines of diameter greater than or equal to 525mm safety chains shall be fitted on the downstream side of the manhole as per Clause 13.57.

15.55 MANHOLE RUNGS AND LADDERS

Step Irons / Rungs for manholes and other chambers shall be Type D Class 1, complying with the requirements of IS EN 13101:2002.

Approved hot dipped galvanised mild steel rungs 25mm in diameter and 300mm in length shall be securely fixed into the walls as shown on the Detail Drawings at vertical intervals of 300mm and with the uppermost rung 600 to 900mm from the top of the manhole cover. Rungs are not required where the depth to benching is less than 900mm and the diameter of the largest pipe is less than 450mm. Channels greater than 750 in depth shall be provide with recessed rungs built into channel benching and have a handrail or post within easy reach. Rungs shall have both ends split and lugged and the entire rung shall be galvanised as described in BS EN ISO 1461 to a minimum mass of 720 grammes per square metre. In the alternative Manhole Rungs may be Plastic Coated Aluminium.

For the larger and deeper Access Chambers / Manholes access shall be by means of Mild Steel Ladders hot dipped galvanised after fabrication in accordance with IS EN ISO 1461 shall be provide in place of rungs. Ladders shall comply with the relevant provisions of BS 4211, Class A and PD 970. Stringers of ladders shall be not less than 63mm x 12mm at centres of 300mm; rungs shall be not less than 25mm in diameter and shall be securely shouldered into the stringers at intervals of 300mm centre to centre. The minimum distance of a ladder from the wall shall be not less than 112mm. Stringers supported from the manhole wall shall be at maximum 2.0m centres and shall be bolted to cleats to facilitate removal. Rungs shall be serrated.



15.56 LADDERS – GENERAL

All ladders shall comply with any dimensional provisions of BS 4211, Class A and PD 970.

Mild steel ladders for vertical fixing shall comply with the relevant provisions of BS 5395. After fabrication, mild steel ladders shall be hot dip galvanised in accordance with IS EN ISO 1461.

Stainless steel ladders for vertical fixing shall be fabricated from Grade 316S31 steel complying with BS 970, Part 1 and BS EN 10084, BS EN 10085, BS EN 10087, BS EN 10095, BS EN 10250, BS EN 10029, BS EN 10048, BS EN 10051, BS EN 10258 or BS EN 10259.

Aluminium ladders for vertical fixing shall be fabricated from Grade 6082 aluminium complying with BS EN 515, BS EN 573-3 and 4, BS EN 755-1 to 9 and BS EN 12020-1 and 2.

After fabrication, aluminium ladders shall be anodised in accordance with IS EN 12373-1: 2001.

GRP ladders shall be manufactured and tested in accordance with BS EN 131.

All ladders shall generally be complete with safety cages to similar Specification.

15.57 MANHOLE SAFETY CHAINS AND HANDRAILS

Mild steel safety chain shall be 8mm nominal size Grade M(4) non-calibrated chain, Type 1, complying with BS EN 818-1. After manufacture, mild steel safety chains shall be hot dip galvanised in accordance with IS EN ISO 1460 and IS EN ISO 1461.

Stainless steel safety chain shall be manufactured from Grade 316S31 steel complying with BS 970, Part 1. Chain links shall be welded and have an internal length not exceeding 45mm and an internal width of between 12mm and 18mm. The fins caused by welding shall be removed and the weld shall be smoothly finished all round.

When tested in accordance with BS EN 818-1, each chain shall withstand a breaking force of 30kN and a proof force of 15kN.

All manholes on sewers of 525mm diameter and over shall be provided with safety chains for placing across the mouth of the sewer on the downstream side where men are at work. Safety chains shall be permanently fixed into the manhole wall. On the other side 2 No. 16mm diameter hook type rawl bolts, shall be built into the positions indicated to allow placement of chain on either as required.

Double handrailing 43mm diameter of modular type as described on the Drawings hot-dip galvanised to BS EN ISO 1461 to a minimum mass of 720 grammes per square metre shall be provided on the edges of all benchings, platforms etc.

The handrailing system shall comprise of stanchions at maximum intervals of 1.2m. Heavy duty tubular handrailing sections with an outside diameter of 43mm and manufactured from tubing with a wall thickness of not less than 3.25mm shall be used throughout. The stanchions shall be made up using heavy duty circular baseplates along with ball joint connections for the mid rail and top rail of the handrailing system. The circular baseplates shall have a minimum diameter of 135mm and a thickness of 15mm. The shank of the handrailing stanchions shall have a diameter of 50mm and shall be manufactured from tubular section with a minimum wall thickness of 6.35mm. The receiving balls at mid rail and top rail level shall be formed from a single machined piece and shall have an outside diameter of not less than 90mm. Where

handrailing is fitted to the side of the manhole, only “palm type” mounting plates will be acceptable. Each of the stanchions shall be bolted to the concrete using 3 No. M12 x 70mm Gr. 316 stainless steel sockets into which Gr. 316 stainless steel holding bolts shall be set so that only the hexagonal head of the bolt will be visible when the handrailing is fixed in its final position.

15.58 STANDARD MANHOLE COVERS AND FRAMES

Manhole covers and frames shall comply in respect of materials and workmanship with EN 124 for Cast Iron Road Furniture.

All manhole covers and frames shall be constructed of cast-iron, shall be suitable for heavy duty and shall be capable of carrying a 11.5 tonne Wheel Load unless specifically indicated to the contrary and shall comply in all respects with the requirements of EN 124. Covers, which shall be lockable, shall be of non-rocking type and 600mm x 600mm minimum clear opening and shall be Class D400 to EN 124.

Manhole Covers and Frames, which are specified as being sealed, shall be Class D400 to EN 124 ductile iron with 6 No. M12 stainless steel bolts, neoprene sealing ring and 600mm diameter minimum clear opening.

Manhole covers and frames shall be supplied coated by dipping in a cold black bitumen material. Cover design shall be approved by the Employer’s Representative prior to ordering.

All access covers shall have closed keyways and in addition all access covers must be complete with approved locking system.

Manhole covers and frames shall be fixed in the positions indicated. Frames shall be solidly bedded in sand/cement mortar (2:1) so that the covers when in position are fair and even with adjacent surfaces. Where indicated on the Drawings or described in the Specification, frames shall be bedded on from one to three courses of engineering brickwork in cement mortar. Where manhole covers are likely to be subject to heavy traffic frames shall be bedded with Pyrabed Frame Mortar applied in accordance with the Manufacturer’s instructions. An equivalent proven system will also be acceptable.

For manholes on sewer lines up to and including 450mm diameter non-rocking Class D400 double triangular covers and frames in Ductile Iron with 600mm square openings are specified throughout. For access chambers on the larger diameter pipelines non-rocking Class D400 covers and frames in Ductile Iron with rectangular clear opening of minimum dimensions 1200mm x 600mm and with triangular sections are specified throughout.

Access covers for house connections shall have Class D400 and 600mm x 450mm clear openings where vehicular access is possible. For locations inaccessible to motor vehicles on house connection lines Class B125 covers and frames in Ductile Iron and with 600mm x 450mm openings shall be permitted.

15.59 LARGE DIAMETER PIPELINE MANHOLE COVERS

On large diameter pipelines (greater than 525mm) Heavy Duty lockable Class D400 double three point suspension non rocking coated cast-iron covers and frames shall be provided and bolted to the concrete roof upstand.



15.60 CONNECTIONS TO SEWERS AND MANHOLES

Transfer of Existing Connections to new Sewers shall be carried out using “Y” Junctions or “T” Junctions where appropriate and fixed in position as the work proceeds. Connections to existing sewers shall also be carried out using “Y” Junctions or “T” Junctions where appropriate.

Saddle connections to existing sewers shall only be allowed when the internal diameter of the major pipe is at least 150mm greater than the internal diameter of the branch pipe.

The ends of connections and pipes not required for immediate use shall be closed with purpose made stoppers, discs or joiners. The position of all junctions shall be recorded by the Contractor by measurement from the access manhole / chamber immediately downstream and notified to the Employer’s Representative before backfilling is commenced.

Pipe saddles for concrete sewers, where approved for use by the Employer’s representative, shall be bedded in Class M1 mortar and a mortar fillet formed to give a cover of at least 50mm to the base of the saddle. Pipe saddles for Ductile Iron Sewers shall be applied and fixed in accordance with the Manufacturer’s instructions. Pipe saddles for uPVC pipes, where approved for use by the Employer’s Representative, shall be purpose made from uPVC and shall either be of a mechanical clip-on type or shall be fixed with an appropriate solvent cement. Pipe saddle connections will only be allowed on the approval of the Employer’s Representative.

Where a connection without a saddle is to be made to an existing sewer, the pipes shall be splay cut to give an oblique junction, so that the discharge is in the direction of flow in the main sewer. The connecting pipe shall be of such a length that the pipe rests on the outside barrel of the main sewer with no projection inside the main sewer. The pipe joint shall then be pointed in mortar externally and internally where practicable. This type of connection will only be allowed on the approval of the Employer’s Representative.

Where interconnection is required between an existing manhole and a proposed manhole the existing manhole shall be reconstructed from base to cover in accordance with the relevant Clauses of this Section 13 unless the base of the existing manhole has provision made for the connection in the form of appropriately sized channels and properly formed benching.

Precautions shall be taken to prevent debris entering existing or new sewers. Where material does enter sewers, it shall be reported to the Client. In such cases, the Client may require a CCTV survey be carried out and/or any debris or material be removed from the sewer.

Where connections are to be made to pipes that require the pipe to be cut, the hole shall be of the correct size for the saddle using a trepanning cutting machine.

As far as practicable, junctions and service connections shall be built in for all planned users when sewers are constructed to avoid damage to the sewer by installing connections at a later date when the system is live. Where it is necessary to make a post-construction connection the upstream end of any unused connection, it shall be sealed until required. Where there is a manhole adjacent, the connection shall be made to the manhole. Where there is no manhole, it may be necessary to construct a new manhole.

The vertical angle between the service connecting pipe and the horizontal pipe shall be greater than 0° and not more than 60°.

Where the connection is being made to a sewer with a nominal internal diameter of 300mm diameter or less, connections shall be made using 45° angle or 90° angle curved square



junctions. Connections made with junction fittings shall be made by cutting the existing pipe, inserting the junction fitting, and jointing with flexible repair couplings or slip couplers.

Where the connection is being made to a sewer with a nominal internal diameter greater than 300 mm: (a) where the diameter of the connecting pipe is greater than half the diameter of the sewer, an access manhole shall be constructed to form the connection point; or, (b) where the diameter of the connecting pipe is less than or equal to half the diameter of the sewer, then the connection shall be made using a preformed saddle fitting with a slow bend between the saddle and the connecting sewer/drain.

Connections made with saddle fittings to concrete pipes shall be made by cutting and safely removing a core from the pipe and jointing the saddle fitting to the pipe in accordance with the manufacturer's instructions to ensure a watertight joint. The connecting pipe shall not protrude into the sewer. Connections to PVC or structured wall pipes shall be achieved by installing junction connection pieces as the pipe.

15.61 JUNCTIONS AND LATERALS ON SEWERS

Junctions and laterals shall be effectively sealed with an end cap, the location of which shall be positively indicated. Junctions and laterals provide a service connection from the main sewer to the boundary of properties.

End caps on junctions and laterals shall be secured by stakes and concrete. Marker tape shall be laid between the location peg and end cap of the lateral.

Records of depth and location of junctions at the sealed ends of laterals shall be recorded and a copy of the record provided to the Client as work proceeds.

Laterals shall be laid from the junctions to the boundary of the properties.

15.62 MARKER AND INDICATOR POSTS

Marker and indicator posts shall be erected to show the location of valves, outfalls, and other fittings, changes of direction and at field boundaries.

Permanent ground markers shall be constructed at locations shown. A schedule of co-ordinates of the ground markers shall be supplied with the as-laid records and submitted to the Client for retention in the Client's asset records.

Marker posts shall be placed at field boundaries and in open country, and shall be at intervals of not more than one kilometre.

Installation of indicator plates shall comply with the specification set out in BS 7903.

Hydrant indicator plates shall be single hydrant indicator plates with fixed black letters complying with BS 3251 except that the plates shall conform to colour reference no. 309 (canary yellow) in BS 381C.

Sluice valve, scour valve and air valve indicator plates shall comply with the specification for hydrant indicator plates with fixed letters in accordance with BS 3251 except that they shall be coloured white and, instead of the letter H, shall bear the letters SV, ScV and AV respectively.

15.63 SEWERS AND MANHOLES TO BE ABANDONED

Where sewers are to be abandoned and/or abandoned and replaced by a new sewer, a final CCTV Survey of the existing sewer shall be carried out on completion of all diversions and connections to the new sewer to confirm that all connections have been dealt with. Prior to abandoning sewer pipes by filling with grout, the sewer shall be cleared of all water. The material for filling shall be as specified in Section 1.

Abandoned sewers shall be filled with cement grout, lean mix or foam concrete. The lowest point of the abandoned length shall be suitably sealed and the filling operation shall commence from that point and continue progressively so as to fill all voids completely. Where manholes are to be abandoned, the existing covers and frames shall be removed, shafts broken down to a level 1m below cover level and the remaining void filled with lean mix or foamed concrete.

Abandoned manhole surfaces shall be reinstated to maintain the surrounding surface.

The locations of abandoned sewers and manholes shall be provided to the Client on as built drawings and records. Existing foul sewers shall be jetted clean prior to filling.

15.64 LAYING DUCTILE IRON PIPES

Ductile Iron Pipes are to be laid on a smooth bed and surrounded as described. The bottom of the trench is first to be carefully levelled and all hard objects such as stones, rock projections or tree trunks are to be removed. Joint holes are to be made by additional excavation of the trench and pipe barrels are to rest over their entire length on the firm bed of the trench. Filling of the bottom of the trench to bring it level with high spots will not be permitted and such high spots are to be reduced to the general level. On no account shall stones or other hard objects be used in the bed below the pipes in order to locate them in position.

When laying through rock, the trench is to be excavated to a depth of an extra 80mm and a level underbed of type "A" granular material, 80mm thick, provided. The pipe shall be haunched with similar material and then completely surrounded with same adequately compacted and to a minimum depth of 300mm over the pipe barrel.

15.64.1 Joints on Ductile Iron Pipes

Ductile Iron Pipes are normally to have "Tyton", "Stantyte" or similar approved compression ring flexible joints. The joints are to be made as instructed by the Manufacturers.

It is permissible to have a horizontal or vertical deflection at a "Tyton" joint provided that such deflection does not exceed the following:

Joints on Ductile Iron Pipes	
Nominal Diameter of Pipe mm	Maximum Angle of Deflection
80 – 300mm	5 Deg.
350 – 600mm	4 Deg.

It is permissible to have an ultimate horizontal or vertical deflection at a "Stantyte" joint provided that such ultimate deflection does not exceed the following:

Joints on Ductile Iron Pipes	
Nominal Diameter of Pipe mm	Maximum Angle of Deflection
Pipes 700mm and over	4 Deg.
Fittings 700mm and over	3 Deg.

In special circumstances, such as the making of joints between new and old pipelines, the use of “lead” joints may be instructed or permitted.

The deflection at installation is not to exceed half of that ultimately allowable.

15.64.2 Specials and Fittings on Ductile Iron Pipelines

Pipe specials are to be Steel or Ductile Iron with joints to match the joints on the main pipeline except where shown otherwise on the Drawings. Fittings are to be concrete lined and externally protected as elsewhere specified.

15.64.3 Trench Widths for Ductile Iron Pipelines

Trenches for Ductile Iron Pipelines are to be of the widths already specified for Watermains or Sewers depending on the application specified.

15.65 LAYING PVC-U PIPES

The trenches in which PVC-U pipes are to be laid shall be excavated to such a depth to allow the pipes to be laid on a prepared underbed. The trench bottom should be carefully examined for the presence of hard objects such as stones, rock projections, or tree roots, and if any such objects are present they should be removed. In uniform, relatively soft, fine grained soil, free of such hard objects, the underbed when lightly compacted should have a thickness of not less than 100mm or one quarter of the pipe diameter, whichever is greater.

Where the trench is through rock or through materials which show the recurrence of the above mentioned hard objects, allowance should be made in the cutting of the trench for an additional thickness of underbed of at least 50mm. The prepared underbed should consist of a fine grained material in size. An excess of fine particles which might impede drainage or compaction should be avoided. In all cases the underbed should be to the correct gradient and should provide uniform support to the pipe over its full length. Special care should be taken when handling and laying PVC-U pipes at temperatures below 10°C, to avoid impact damage. Pipes should not be laid, cut to length, or tapped when the temperature is 0°C or below.

15.65.1 Jointing PVC-U Pipes

Joints in PVC-U pipes shall be made using fixed seal couplers. Only lubricants approved by the pipe manufacturers should be used, and on no account should oils or grease be used as they may attack the seals. The couplers and pipe ends should be clean when a joint is being made and no grit or dirt should be trapped behind the sealing rings. The pipe should be pushed fully home in the coupler as indicated by the homemark on the pipe end, which should be marked on the pipe and before the joint is made.



15.65.2 Fittings and Specials on PVC-U Pipes

All tee-pieces, sluice valves, meters, and other fittings (with the exception of bends where they are available in PVC-U) should be flanged Cast Iron fittings with suitable flanged adapters (which should also have fixed seals) to connect them to the main pipeline. If tee pieces are available with fixed seals suitable for connection to PVC-U pipes, these may be used also. The conditions mentioned above for jointing PVC-U pipes also apply to the connections of Cast Iron fittings to PVC-U pipes.

All junctions between cast iron and ductile iron pipes and fittings and hard PVC pipes are to be made with special cast iron adapters or couplers all in accordance with the Manufacturer's instructions. All of the instructions contained in the Industrial Research "Recommendations for the Handling and Installation of Un-Plasticized PVC Pipe" shall be regarded as minimum requirements for the purpose of the Specification.

15.65.3 Widths of Trenches for PVC-U Pipes

When laying PVC-U pipes the trenches are to be open to a width of the pipe outside diameter plus 300mm.

15.66 LAYING HIGH DENSITY POLYETHYLENE PIPES (HDPE)

High Density Polyethylene Pipes are to be laid on a smooth bed. When laying through rock the trench is to be excavated to a depth of an extra 100mm and a level underbed of sand gravel or soil provided.

15.66.1 Jointing High Density Polyethylene Pipes

High Density Polyethylene Pipes are to be jointed by butt fusion welding, electrofusion welding, mechanical compression fittings or push fast fittings all in accordance with the Manufacturer's instructions and/or as specified in Volume A1 of this specification. The joints to be used must have the prior written approval of the Employer's Representative.

Bends of 45 Deg. or sharper are to be anchored by blocks of Grade C12/15 concrete. The concrete block is to be inserted under and around the pipe and between it and the side of the trench on the outside of the bend. The bends shall be wrapped in approved heavy gauge visqueen or other suitable wrapping prior to the pouring of the concrete. All junctions between cast iron or ductile iron pipes and fittings and High Density Polyethylene pipes are to be made with special cast iron adapters or couplers all in accordance with the Manufacturer's instructions.

15.66.2 Fittings on High Density Polyethylene Pipelines

All tee-pieces, sluice valves, meters and other fittings on High Density Polyethylene Pipelines are to be flanged C.I. fittings with suitable flanged adapters to connect them to the main pipeline. All fittings are to be supported on base pads of concrete Grade C12/15.

15.67 LAYING HIGH PERFORMANCE POLYETHYLENE PIPES (HPPE)

The trenches in which HPPE pipes are to be laid shall be excavated generally to the depths specified already and depending on pipe diameters all so as to allow the pipes to be laid on the prepared underbed already described for other pipe systems. Procedures similar to those



specified for HDPE and PVC-U pipes shall be carefully followed for trench excavation and preparation.

15.67.1 Jointing HPPE Pipes

Pipes shall be Butt Fusion jointed as already described in Clause 13.19 hereinbefore or Electrofusion jointed (IS EN 12201 Part 3 and WIS 4-32-08).

15.67.2 Fittings and Specials on HPPE Pipes

Jointing of fittings to HPPE pipes shall be either by electrofusion or butt fusion methods where these fittings are available from the manufacturer. Such fittings would generally include couplers, reducers, tapping tees, bends, tees and end caps. Sluice valves and meters should be flanged C.I. fittings with suitable flanged adaptors, pupped flanges or similar (which should also have fixed seals) to connect them to the main pipeline.

15.67.3 Widths of Trenches for HPPE Pipes

Trenches for HPPE Pipes are to be of the widths already specified for Watermains generally.

15.68 LAYING AND BEDDING GLASS REINFORCED PLASTICS (GRP) PIPES

GRP pipes shall be laid and bedded strictly in accordance with the Manufacturer's Instructions and Guidelines and with particular reference to Sub-Section Four: Construction of British Standard Code of Practice for Pipelines B.S. 8010 Section 2.5 Glass Reinforced Thermosetting Plastics.

GRP Pipes shall be laid in Class B bedding as described below.

In special circumstances, such as going through peaty soil or in other situations in which a granular surround would not in the opinion of the Employer's Representative, give effective support to the pipe, modified forms of bedding and/or the addition of special supports or anchorages may be ordered.

Class B Bedding: When Class B bedding is specified, the pipe is to be laid on a compacted granular bed of thickness "h" mm below the barrel of the pipe and after the pipe is placed in position this granular bed is to be increased in thickness by a further "h1" mm and compacted. Dimension "h" is to be greater in rock, boulders or stony soil than in uniform soils.

The dimensions "h" and "h1" for the different sizes of pipes and soil conditions are as follows:

Laying & Bedding Glass Reinforced Plastics (GRP) Pipes			
Dia. Of Pipe mm	Dimension "h" Rock, Boulders, stony ground mm	Dimension "h" Uniform Ground mm	Dimension "h1" All Grounds mm
Up to 300	150	100	50
350 to 450	150	100	100

500 to 700	200	150	150
750 to 900	300	200	150
1000 to 1500	400	300	200

The material in the bed is to be Type “A” self-draining gravel or broken stone.

When scouring of the bed from under the pipe may be likely to occur due to site conditions, precautions to prevent loss of support to the pipeline, such as the installation of water flow barriers / plugs in the bed and surround over the width of the trench, shall be taken.

15.68.1 Jointing GRP Pipes

GRP pipes shall be jointed by means of flexible joints strictly in compliance with the Manufacturers jointing instructions. The basic requirements specified in BS Code of Practice BS 8010 Section 2.5 Sub-Section Four must also be adhered to.

Bends of 45 Deg. or sharper are to be anchored by blocks of Grade C12/15 concrete. The concrete block is to be inserted under and around the pipe and between it and the side of the trench on the outside of the bend. The bends shall be wrapped in approved heavy gauge Visqueen or other suitable wrapping prior to the pouring of the concrete. All junctions between cast iron and ductile iron pipes and fittings and GRP pipes are to be made with special cast iron adaptors or couplers all in accordance with the Manufacturer’s Instructions.

15.68.2 Handling of GRP Pipes

In handling, transporting, offloading, stacking, storing or stringing of GRP pipes, the Manufacturer’s instructions and recommendations are to be carefully complied with and recommendations of BS Code of Practice B.S. 8010: Section 2.5 are to be achieved.

15.68.3 Trench Widths – GRP Watermains

While the Manufacturer’s advice should be sought in relation to trench widths generally trenches for GRP pipes are to be excavated to widths which fall within those shown in Clause 13.42 hereinbefore.

15.68.4 Fittings on GRP Pipelines

All tee-pieces, sluice valves, meters and other fittings on GRP Pipelines are to be flanged C.I. fittings with suitable flanged adapters to connect them to the main pipeline. All fittings are to be supported on base pads of concrete Grade C12/15.

15.69 TOLERANCES FOR PIPELINES

The line and level of any pipeline shall not deviate from that described in the Contract by more than 20 mm and any combination of such deviations shall not create a reverse gradient in a gravity sewer.

Where a pipe jacking is being carried out the line may not deviate by more than 75mm and the level may not deviate by more than 50mm, in any case the deviation in level shall not be such as to cause a back fall in a gravity sewer.

15.70 SLUICE VALVES AND SCOUR VALVES

Sluice Valves and Scour Valves shall comply with the requirements of IS EN 1074 (B.S. 5163) and have a 16 Bar Rating unless otherwise detailed in the contract and have N.P. 16 flanges. Valves are to be inside screw valves with non-rising spindles. The spindles of underground valves shall be fitted with cast iron caps secured with set screws or pins, while valves above ground shall be fitted with cast iron hand wheels, on which the direction of opening is to be marked. All valves are to be clockwise closing unless otherwise stated in Section 1.

Valves are to be hydraulically tested during manufacture in accordance with IS EN 1074 (B.S. 5163) and a manufacturer's test certificate shall be produced for each valve on request. All sluice valves are to be flanged unless otherwise specified.

Where necessary valves shall be fitted with extension spindles or universal joint operating rods and headstocks or spindle caps as appropriate. All valves shall be closed and open-end tested.

All un-machined surfaces of valves shall be supplied with a protective coating of a non-toxic bituminous composition applied by a hot-dipping process. Machined surfaces, liable to rusting, shall be well covered with a rust preventative composition.

All valves shall be clearly marked with the appropriate schedule reference number. Large items shall be so marked in two places for ease of identification.

In addition, a plate shall be fitted on all valves and engraved with the information listed in BS 5163, Clause 37.

15.71 AIR VALVES

Air Valves shall be the product of an approved manufacturer and shall have bodies and covers of best tough cast iron, with flanged inlets of the size specified. Air valves shall be suitable for the proposed application in potable water or sewage / sludge systems.

Double Orifice Air Valves shall have a large and a small air escape orifice, with plastic, polypropylene or vulcanite balls and rubber seatings. They shall be fitted with screw down type isolating valve having a forged bronze screwed spindle with cast iron cap and gunmetal valve and seat.

The small orifice shall be capable of permitting the escape of air under the maximum working pressures appropriate to the Class of pipe and the Valves shall be tested during manufacture to at least 50% in excess of the maximum working pressure.

Kinetic Air Valves where specified are to be mounted on butterfly isolating valves. They are to have flanged inlets of not less than 80mm diameter.

15.72 INSTALLATION OF AIR VALVES

Air Valves are to be installed on top of the main with flanged on double socket tee-pieces. The tee pieces are to be supported on concrete pads 150mm thick and 150mm longer and wider than the tee piece. The air valve chambers shall be constructed in accordance with the appropriate drawing.

The inlet diameter shall be in accordance with the Table set out as follows:

Installation of Air Valves			
Dia. Of Main	Dia. Of Branch	Bore of Valve Inlet	Minimum Clear Opening of Surface Box
Up to 200mm	80mm	80mm	600mm x 300mm
200mm to 400mm	80mm	80mm	600mm x 300mm
400mm to 600mm	80mm	80mm	600mm x 300mm
600mm to 900mm	100mm	100mm	750mm x 500mm
1000mm to 1500mm	150mm	150mm	900mm x 600mm

15.73 INSTALLATION OF SCOUR VALVES

Scour Valves are to be installed on branches from the mains to the details shown on the Drawings. The valves are to be sluice valves. The scours are to discharge to a watercourse or other suitable outlet as shown on the Drawings. Where scour pipes discharge to a watercourse they are to have concrete blocks of not less than 0.25 cubic metres of Grade C16/20 concrete encasing the outlet end of the pipe. The scour outlet pipes are to be PVC-U Class B pipes unless otherwise specified and are to be laid at a minimum uniform gradient of 1 to 100.

The sizes of the scour are to be in accordance with the following Table unless otherwise shown on the Drawings.

Installation of Scour Valves	
Diameter of Main	Diameter of Scour Branch
80mm, 100mm, 150mm, 200mm	80mm
250mm, 300mm, 350mm	100mm
400mm, 450mm, 500mm	150mm
600mm, 750mm, 800mm	200mm
1000mm to 1500mm	200mm

15.74 HYDRANTS

Hydrants, hydrant boxes and covers shall comply with the relevant provisions of BS 750. Hydrants shall be screw down streamline pattern with 80mm inlets and 63mm male thread outlets. Hydrants shall close in a clockwise direction.

Hydrant box covers shall be provided in recesses for lifting keys.

Hydrant indicator plates shall comply with relevant provisions of BS 3251.

The surfaces of all the hydrant components shall be protected from corrosion either by the nature of their material of construction or by coating in accordance with WIS 4-52-01. Internal

water wetting surfaces shall be coated to Class A standard; all other surfaces shall be coated to Class B.

The frame and cover shall be Grade A to BS 750 and have a clear opening of not less than 380 x 230mm.

Installation of underground washouts, fire hydrants, surface box frames, covers and indicator plates shall comply with the specification set out in BS 5306: Part 1.

15.75 PRESSURE REDUCING VALVES

Pressure Reducing Valves shall be capable of maintaining a variable inlet to constant outlet pressure, variable inlet to more than one constant outlet pressure and variable inlet to constant outlet pressure to also cover excessive pressure drop.

The valves shall be capable of being adjusted manually, by electric/solenoid, remote control and microprocessor or servo system. The inlet/outlet end connections of direct acting valves shall be male BSPT. The base of pilot operated valves shall be designed so that when the valve is placed on a pallet for transport or on a flat surface prior to installation the valve remains stable in its normal orientation. The body flange dimensions of pilot operated valves shall comply with BS 4504: 1989 for metric valve or BS 10:1962 for imperial valves, or as specified. Pressure tappings (valved female rectus connector) for monitoring purposes, shall be provided on the inlet and outlet of pilot operated valves. Pressure gauges to BS 1780 shall be provided and installed on the inlet and outlet of the PRV, be filled with glycerine and shall have a minimum dial diameter of 100mm.

Production hydrostatic pressure tests shall be in accordance with the relevant provisions of BS 6755: Part 1: 1986, except that the valve shall be coated prior to testing.

All materials, coatings and lubricants shall comply with the appropriate British Standard WIS or equivalent. No metals shall be used in contact with each other that are likely to lead to dezincification or dissimilar metal corrosion. The body and end connections of direct acting valves shall be gunmetal to BS 1400 or equivalent. The body of pilot operated valves shall be cast iron to BS EN 1561 Grade EN-GJL-450 minimum or equivalent, or ductile iron to BS EN 1563 Grade EN-GJS-450-10 minimum or equivalent. Gaskets, 'o' rings and other rubber sealing materials shall be manufactured from material complying with the provisions of BS EN 681-1: 1996 Issue 2 December 1998; Type WA. The material for flange gaskets shall have hardness within the range 75-85 IRHD.

Valves and fittings, excluding those made of stainless steel or other non-corroding materials, shall be protected against corrosion by the application of a polymeric barrier coating in accordance with WIS No. 4-52-01. Internal surfaces shall be coated to Class A standard and external surfaces to Class B standard minimum.

All non-stainless steel fasteners shall be protected from corrosion by the application of zinc and a polymeric barrier coating in accordance with WIS No. 4-52-03. Bolts are to be 100% coated. The manufacturer must ensure that, after final coating, the nuts will run freely on the bolts. Provided the nut is not tightened, this action must not damage the coating.

Open pipe end connections shall be supplied capped/plugged to prevent contamination of the pipes by debris or vermin prior to installation.



Tenderers shall provide pressure/discharge graphs, as well as the recommended discharge when the valves are in the fully open position. Tenderers shall state, for each valve, the guaranteed range of performance.

Testing criteria and product performance shall be supplied to the Employer's Representative on request, together with results of testing carried out to determine compliance with the specification. If requested, the contractor will be expected to submit samples of their product.

Strainers shall be installed upstream of Pressure Reducing Valves.

Pressure reducing valves shall be installed strictly in accordance with the details shown on Contract Drawings.

15.76 SERVICE FITTINGS

Pressure tappings to water mains shall, unless otherwise specified, be carried out by means of a right angled screw down ferrule of non-ferrous material in combination with a saddle piece. The saddle and ferrule shall be set on the main so that the service pipe leads off in line with the main before curving around to its intended course.

Service connections to hard PVC, High Density Polyethylene Pipe and High Performance Polyethylene Pipe shall be made by using the saddles and ferrules recommended by the Pipe Manufacturers. Where PVC saddles are used the fittings shall consist of the combined PVC Saddle and Self Tapping Ferrule.

Tappings are to be made in conjunction with all electromagnetic flowmeter installations, in association with contract drawing. The tappings will be transferred in a suitable duct to the kiosk and shall be connected to a ¼ turn valve for isolation purposes and a BSP male mechanical connection.

15.77 SERVICE PIPES

Service Pipes where required are to be laid with a minimum cover of 600mm. They are to be laid on a smooth bed and to be covered to a depth of at least 100mm with fine material.

Polyethylene Pipes shall comply with I.S. EN 12201 for the transportation of potable water under pressure.

Malleable Copper pipes where approved for use shall conform to IS EN 1057: 1996 and fittings for use in conjunction with these shall conform to IS EN 1254 Part 1 (capillary) or Part 2 Type B (manipulative).

15.78 CLOSURE UNITS OF WATERMAINS

- Where pipes of non-standard lengths are required to close gaps in watermains, these shall be provided and arranged as recommended by the Pipe Manufacturers.
- On Ductile Iron Watermains the closure sets are to consist of three pieces, as provided by the Manufacturer, the middle piece being plain ended and jointed with Couplings. After the pipeline has been tested, the couplings are to be wrapped and protected externally as specified for external wrapping of Ductile Iron Pipes (refer Clause 13.7).



- Closure units will be required at the approaches to some of the valves and fittings, and possibly at the approaches to Valve or Control Houses / Chambers, where in most cases the position can be varied only slightly within the boundaries of the lands acquired. There is, however, sufficient flexibility available in the location of the Valve Houses / Chambers both in the longitudinal direction of the pipeline and at right angles to it to enable the houses / chambers to be so located that the only non-standard lengths required in most cases will be half lengths.

Closure units will be required at some bends, at approaches to some river crossings, and at other locations including sections where pipe-laying gangs meet. This latter point should be carefully chosen beforehand in order to avoid haphazard or awkward Closure Units.

The Contractor is to include, for normal pipelaying, for the provision of all closure units as and where required.

15.79 INDICATOR PLATES

All sluice valves, scour valves, air valves and hydrants are to have indicator plates fixed overground on a nearby wall or concrete post. The indicator plates for sluice valves, scour valves and air valves are to be cast iron plates 225mm x 150mm in size and with the letters S.V.; Sc.V.; or A.V. as appropriate raised thereon. The letters are to be painted black and the background white. The Sluice Valve indicator shall also show by means of an arrow the direction of opening. Indicator plates for hydrants are to be of a type and pattern approved by the Employer's Representative and the colour for fire hydrant plates shall be in accordance with BS 3251 (black letters on a yellow background). They are to incorporate a panel showing in each case in metric units, the information specified in BS 750. The figures in the panels are to be removable and are to be finally fixed in position when the plate is being installed. Where plates are mounted on concrete pillars, these are to be 300mm wide x 100mm deep x 600mm high over ground surface and not less than 1300mm overall length.

15.80 MARKER TAPE

A Blue Colour Detectable marker tape shall be used over Watermains while a Brown Colour Detectable marker tape shall be used for foul Sewers and White / Blue shall be used for Surface Water Pipelines.

Marker tape for buried cables shall be yellow PVC or polyethylene mesh or ribbon at least 150mm wide printed with the words "ELECTRICAL CABLE" in bold capital letters throughout its length and at intervals not exceeding 700mm.

Other marker tape shall be as follows:

Telecommunication	Green
Gas	Red
Cable TV	Red, Blue, Green, Chevron
Others	Black / White

Where marker tape is removed during excavation from existing services it shall be replaced during the backfilling process.



15.81 VENTILATING COLUMNS

Ventilating columns shall be of steel 150mm in diameter and standing 7.60m high overground with cast iron ornamental bases 1200mm high. The steel shaft shall consist of galvanised steel tube not less than 5mm thick terminating at the top with a copper wire ball having 10 B.W.G. vertical wires, and 14 B.W.G. spirals. The tube shall be painted externally and internally once before erection, internal painting being executed with the aid of long arm brushes or a drag.

The base of the column shall be of heavy cast iron. It shall have an air tight door giving access to a chained removable dust box. The whole shall finally be painted with approved bitumastic paint of suitable shade and with two coat work to the satisfaction of the Employer's Representative.

The column shall be buried in the ground to a depth of 800mm and shall be surrounded with a block of concrete 900mm square and 900mm deep with Grade C20/25 concrete. The shaft shall be connected to the sewers and manholes with suitable short lengths of 150mm dia. Concrete or uPVC pipe. After erection of the base the tube shall be set level therein plumbed and grouted.

15.82 ROAD GULLIES

Road gully gratings and frames shall comply with IS EN 124 for Road Furniture and shall be Class D400 throughout. Precast concrete gullies and gully cover slabs shall comply with the relevant provisions of BS 5911: Part 6. PVC-U gullies shall comply with BS 4660. Gullies shall be lockable.

Gullies connected to surface water drains shall be untrapped. They shall have an outlet diameter of 150mm and shall be 375mm internal diameter by 750mm deep.

Gullies shall be bedded and surrounded to a minimum thickness of 150mm in Concrete Grade C16/20 up to and flush with the top of the gully. Gully gratings shall be placed and bedded in 12mm of 2:1 sand cement mortar on top of gullies and positioned to suit adjacent road surfaces.

Gratings on frames shall be of non-rock design with hinged and dished gratings. Gratings and frames shall be supplied coated by dipping in a cold black bitumen material complying with B.S. 3416.

The upper surface of gully gratings shall be flat. Slots in gratings or between gratings and frames shall not be orientated parallel to the direction of traffic. Gratings shall be bedded with the hinges on the side nearest on-coming traffic.

Connections from road gullies shall be by means of flexibly jointed precast concrete pipe 150mm diameter encased in concrete Grade C16/20 with discontinuity at the joint. Preformed oblique branches shall be provided on the main sewer.

15.83 SEWER LININGS

Sewer linings shall comply with the relevant provisions of the appropriate Water Industry Specification (WIS) as set out in the following Table:

Sewer Linings	
Type	WIS

Glassfibre reinforced cement (GRC)	4-12-04
Precast gunite	4-12-05
Precast and in-situ ferrocement	4-12-06
Polyethylene (PE) pipes (non-pressure applications)	4-32-05
Glassfibre reinforced plastics (GRP)	4-34-02
Cured-in-place pipe (CIPP)	4-34-04
Polyester resin concrete (PRC)	4-34-05

15.84 PRECAST CONCRETE BOX CULVERTS

Precast concrete box culverts shall comply with the Box Culvert Association standard specification 'Pre-Cast Concrete Box Culverts'.

15.85 ELECTROMAGNETIC FLOWMETERS

Battery Powered Electromagnetic Flowmeters

Where required to be installed, Battery Powered Electromagnetic flowmeters shall comply with the following specification.

Electromagnetic Flowmeters	
Senor	Type
Flanges	ISO (B54504) PN16
Electrodes	Stainless Steel 316
Lining	Suitable for use with potable water (UKWFBS Listed)
Power Supply	Battery
Accuracy	To ISO 4064 Class B and Class C for both accuracy and max min flow rates

Electromagnetic Flowmeters	
Temperature Ranges	Type
Ambient	-20°C – 60°C
Process	-10°C – 70°C
Conductivity	>50uS/cm
Battery powered units should be supplied with earthing rings	

Electromagnetic Flowmeters	
Transmitter	Type
The Transmitter shall be remote with 15m of cable factory polled to the sensor	
Housing	IP68 (NEMA 6P) rated
LCD Display	To ISO 4064 showing: • Forward flow Reverse Total • NET Total • Date • Flow Rate • Time • Velocity
Flow Units	Metric
Language	English
Outputs	-20ma Digital
Cable Entry	20mm Plastic Glands IP 67 Rated (IP68 after Polling)
Calibration	Certificate of 3-point calibration shall be carried out on a NAMAS approved test rig.

Flowmeters are to be installed as shown in the Contract Drawings. The flowmeter shall have an electronic display unit mounted remote from the flowmeter sensor and shall be housed within a kiosk as specified in Clause 13.85 of the Specification. A minimum cable length of 15m shall be provided for each flowmeter though the Contractor shall be responsible for confirming on site the length of cable required for each meter installation.

A meter marker post shall be provided for each meter site at a location to be agreed with the Engineer. A metallic warning marker plate shall be installed directly above the meter in order to provide future protection for the meter and a means of location by a metal detector. The Contractor shall ensure that the warning plate shall in no way interfere with the electromagnetic properties of the flowmeter or cable. Cable ducts shall be uPVC Class B pipes to IS 123 (100mm duct 4.10mm minimum wall thickness), jointed with compression ring flexible joints and laid with sand bed and surround giving a cover of not less than 80mm under and around the pipe. Cable ducts should be protected until such time as they are brought into operation, to prevent the entry of vermin.

On completion of installation of each electro-magnetic water meter the Contractor shall:

- Arrange to have the meter correctly calibrated and commissioned and brought into operation by the supplier. The Contractor shall supply to the Employer's Representative a commissioning certificate for each meter. During commissioning of meters the following shall be carried out:

- A signal cable shall be wired from within the transmitter and terminated in a connector block external to the transmitter housing.
- The cable mentioned under item (a) above shall be clearly labelled as a signal cable.
- Each meter shall be enabled to measure forward and reverse flow and the forward and reverse flow shall be visible on the integrator.
- A typed weatherproof label shall be placed on the transmitter to state the person who commissioned the meter, the date the meter was commissioned, the number of meter units per pulse, and the signal carried by each of the wires in the cable.

Certification of payment for each electro-magnetic water meter installation shall be made when the Employer is satisfied that the meter is commissioned and that correct data is being recorded from the meter site.

Mains Powered Electromagnetic Flowmeters

Where required to be installed, mains powered electromagnetic flowmeters shall comply with the requirements of IS EN 14154:2005, ISO 4064 and BS 5728 Class B Specifications and the following specification. Flowmeters shall be buried and installed strictly in accordance with the details shown on Contract Drawing No. 1032100-01-02-D-25.

The flowmeters shall be mains powered with an electronic display unit mounted remote from the flowmeter sensor. The electronic display unit shall be housed within a kiosk as specified in Clauses 13.85 of the Specification. The remote transmitter shall have facilities for analogue and pulse signals to represent flows in both forward and reverse directions. The remote transmitter must be capable of displaying flow rates, flow volumes (in both forward and reverse directions) and relevant alarms states.

The flowmeter shall be submersible in water and rated to IP68. The flowmeters shall have NP16 flanges to I.S. EN 1759-1:2005 covering flanges and their joint - Circular flanges for pipes, valves, fittings and accessories, Class designated - Part 1: Steel flanges and ISO7005. The flowmeter shall be provided with a unique meter calibration certificate issued by a UK Accredited test rig or equivalent.

A minimum cable length of 15m shall be provided for each flowmeter which shall be fitted / potted to the flowmeter sensor at the place of manufacture except where longer cables are required. The Contractor shall note that he is strictly forbidden from jointing the cable or re-potting the cable on site, except under specific instruction from the Employers Representative.

During installation the Contractor will leave a minimum of 1m cable slack at the proposed meter transmitter in order to compensate for cable pulling/retraction. Cable shall be 20mm armoured and plastic glanded at each termination point. Calibration certificates must be supplied with the flowmeters and will be provided to the Engineer as the meters are installed. As a condition of the commissioning process, calibration factors shall be checked against the meter certificate.

In order to verify the flowmeter accuracy, the flowmeter must be capable of being calibrated insitu and to this end the Contractor will provide on request to the Engineer a method statement on how the meter will be calibrated.



The Contractor shall be responsible for confirming on site the length of cable required for each meter installation.

A meter marker post shall be provided for each meter site at a location to be agreed with the Engineer. A metallic warning marker plate shall be installed directly above the meter in order to provide future protection for the meter and a means of location by a metal detector. The Contractor shall ensure that the warning plate shall in no way interfere with the electromagnetic properties of the flowmeter or cable.

15.86 FLOWMETER INSTRUMENTATION KIOSKS

The Local Authority will supply flowmeter instrumentation kiosks to the Contractor to install when creating the base plinth. The Contractor shall construct a concrete plinth (not smaller than 500mm by 350mm) at each flowmeter and install the kiosk at a suitable location agreed with the Employers Representative. Ducts from pressure tapplings and flow meter cables shall be centred in the kiosk and left flush with the kiosk base when cured.

Kiosks and associated fixtures, fittings and apparatus are to be installed as shown on the Contract Drawings.

15.87 HANDRAILS AND BALUSTERS

Handrails and balusters shall be manufactured from material complying with the relevant provisions of the appropriate British Standard as set out below. Protective barriers shall comply with the provisions of BS 6180 for Building – use Category 6.

Handrails & Balusters								
	Handrails				Balusters			
Material	Solid		Tubular		Solid		Tubular	
	Standard	Grade	Standard	Grade	Standard	Grade	Standard	Grade
Mild Steel	BS EN 100025	S275	BS 1387 or BS EN 10296-1 and BS EN 10297	- HFW 2	BS EN 100025	S275	BS 1387 or BS EN 10296-1 and BS EN 10297	- HFW 2
Stainless Steel	BS 970 Part 1 and BS EN 10084, BS EN 10085, BS EN 10087,	316S 311.4 401	BS 6323 Part 8	LW17 KM	BS 970 Part 1 and BS EN 10084, BS EN 10085, BS EN 10087, BS EN 10088,	316S3 1 1.44 01	BS 6323 Part 8	LW17 KM

	BS EN 10088, BS EN 10095, BS EN 10250-4				BS EN 10095, BS EN 10250-4			
Aluminium	BS EN 1559-1 and 4	6082	BS EN 1559-1 and 4 BS EN 515 and BS EN 573-3 and 4	6082	BS EN 1559-1 and 4	6082	BS EN 1559-1 and 4 BS EN 515 and BS EN 573-3 and 4	6082

After manufacture, mild steel and aluminium handrails and balusters, shall be hot dip galvanised or anodised, as appropriate, in accordance with IS EN ISO 1461 or BS 1615, Grade AA25, GRP handrails and balusters shall comply with the provisions of BS 6180.

15.88 GENERAL TESTING OF PRESSURE PIPELINES

The entire pipeline shall be pressure tested in accordance with BS EN 805.

Gauges used for testing pressure pipelines shall either be of the conventional circular type, not less than 200mm diameter, calibrated in metres head of water, or shall have a digital indicator capable of reading increments of 0.1 metre head. Before any gauge is used, the Contractor shall arrange for it to be checked independently, and a dated certificate of its accuracy shall be provided.

The pipelines shall be tested in lengths determined by the Course of Construction in accordance with a Programme approved by the Employer's Representative. Initially the testing will be carried out on Sections of maximum length of 500 metres and shall be inclusive of the communication pipes. The Contractors shall be deemed to have included in his rates for all temporary restraints required to facilitate the testing of pipelines. The section of pipeline to be tested shall consist of one class of pipe only.

Before testing, valves shall be checked and sealed, the Sections of main filled with water and the air released. After having been filled, pipelines shall be left under working pressure for a period of 24 hours so as to achieve conditions as stable as possible for testing.

The pressure in the pipeline shall then be raised steadily until the specified test pressure is reached in the highest part of the section and the pressure shall be maintained at this level, by pumping if necessary for a period of one hour. Care should be taken to ensure that no point on the pipeline is subjected to more than twice the normal working pressure for the class of pipe under test. The pump shall then be disconnected, and no further water shall be permitted to enter the pipeline for a further period of one hour. At the end of this period the original pressure shall be restored by pumping and the loss measured by drawing off water from the pipeline until the pressure as at the end of the test is again reached.

Where a new pipeline is to connect to an operational pipeline, the final connection shall be inspected visually under normal operating pressure and there shall be no visible leakage.

15.89 TESTING OF PVC-U PRESSURE PIPES

In the case of PVC-U pipes the criteria to be applied in determining the result of a test should be:

No appreciable loss of pressure over a period of 30 minutes.

The maximum allowable leakage from the main, which has been subjected to the test pressure and allowed to stand under pressure for 24 hours, should not exceed 100ml per mm nominal pipe size per km. This is measured by the volume of “make up” water required.

The Working Pressures and the Testing Pressures for the Classes of PVC-U are stated in the following Table:

Testing of PVC-U Pressure Pipes				
Pipe Class	Working Pressure		Test Pressure	
	Metres Head	PSI	Metres Head	PSI
B	60	85	90	123
C	90	123	135	192
D	120	170	180	256

15.90 TESTING OF DUCTILE IRON PRESSURE PIPES

The testing of Ductile Iron pressure pipelines shall be carried out in accordance with BS 8010 Part 2 – Code of Practice for “Design, Construction and Installation of Pipelines on Land. Section 2.1 Ductile Iron”.

The test pressure for ductile iron pipes, fittings and flanged joints shall not be less than the greater of:

Working pressure + 5 bar

Maximum pressure under surge conditions.

Where fittings have restricted test pressure ratings the test pressure shall not exceed 1.5 x maximum allowable working pressure. Anchor gaskets have a restricted working pressure rating depending on diameter and will be subject to a maximum test pressure of working pressure + 5 bar.

A minimum period of 24 hours shall be allowed between filling the pipeline and applying the test pressure to allow for absorption of water in the cement mortar linings.

The acceptable standard of loss in ductile iron pipelines is 0.02 litres / mm of nominal bore per km per 24 hours per bar pressure.



15.91 TESTING OF POLYETHYLENE PRESSURE PIPES

The testing of polyethylene pressure pipelines shall be carried out in accordance with the procedures in the Water Industry Information and Guidance Note, IGN 4-01-03, 'Pressure Testing of Pressure Pipes and Fittings for Use by Public Water Suppliers'.

15.92 TESTING OF PVC-A PRESSURE PIPES

The testing procedure for PVC-A pressure pipelines shall be carried out in accordance with the procedures in the Water Industry Information and Guidance Note, IGN 4-01-03, 'Pressure Testing of Pressure Pipes and Fittings for Use by Public Water Suppliers'.

15.93 CLEANING OF PIPELINES

On completion of construction, and before any sterilisation of watermain or before any connections are made to sewers internal surfaces of pipelines shall be cleaned thoroughly in such a way as to remove all oil, grit and other deleterious matter without damage or danger to the pipes.

15.94 PRECAUTIONS PRIOR TO TESTING PIPELINES

Before testing any pipeline, the Contractor shall ensure that it is anchored adequately and that thrusts from bends, branch outlets or from the pipeline ends are transmitted to solid ground or to a suitable temporary anchorage.

Open ends shall be stopped with plugs, caps or blank flanges properly jointed. The Contractor shall ensure that the pipelines are tested in a safe manner. Testing against closed valves shall not be permitted.

15.95 NOTIFICATION OF TEST

The Contractor shall notify the Employer's Representative at least one clear working day beforehand of his intention to test a section of pipeline.

15.96 TESTING GRAVITY PIPELINES

Gravity pipelines laid in open cut shall be tested after they are jointed and before any concreting or backfilling is commenced, other than such as may be necessary for structural stability whilst under test.

The pipelines shall be tested by means of an air or water test or by a visual examination, in lengths determined by the course of construction, in accordance with a programme approved by the Employer's Representative. A further test shall be carried out after the backfilling is complete.

In general pipelines of nominal diameter less than 450mm will be tested by means of a Water Test. In the case of larger sewers of nominal diameter 450mm or over or where in inaccessible portions of the works water for testing pipelines cannot be conveniently provided, an air test may on the approval of the Employer's Representative, be substituted for the Water Test.



15.97 WATER TEST FOR GRAVITY PIPELINES

The test pressure for gravity pipelines shall be not less than 1.2 metres head of water above the pipe soffit at the highest point and no greater than 6 metres head at the lowest point of the section. Steeply graded pipelines shall be tested in stages in cases where the maximum head, as stated above, would be exceeded if the whole section were tested in one length.

The pipeline shall be filled with water and a minimum period of two hours shall be allowed for absorption, after which water shall be added from a measuring vessel, at intervals of 10 minutes and the quality required to maintain the original water level noted. Unless otherwise specified, the length of pipeline shall be accepted if the quality of water added over a 30 minute period is less than 0.5 litre per lineal metre per metre of nominal bore.

Notwithstanding the satisfactory completion of the above test, if there is any discernible leakage of water from any pipe or joint, the pipe shall be replaced and/or the joint remade, as appropriate, and the test repeated until leakage is stopped.

15.98 AIR TEST FOR GRAVITY PIPELINES

Gravity pipelines to be air tested shall have air pumped in by suitable means until a pressure of 100mm head of water is indicated in a U-tube connected to the system. The pipelines shall be accepted if the air pressure remains above 95mm head of water after a period of 5 minutes without further pumping following a period for requisite stabilisation. Failure to pass the test shall not preclude acceptance of the pipeline if a successful water test, ordered by the Employer's Representative, can subsequently be carried out in accordance with Clause 13.96.

15.99 INSPECTION OF GRAVITY PIPELINES

CCTV inspections shall comply with the Model Contract Document for Sewer Condition Inspection, published by The Foundation for Water Research.

A CCTV inspection shall be carried out on all gravity sewers and in addition to the CCTV inspection a man-entry visual inspection shall be carried out on sewers of 900mm nominal diameter or over. Where internal inspection of pipelines by closed circuit television is required, the Contractor shall provide all necessary equipment, including suitable covered accommodation for viewing the monitor screen, together with personnel experienced in the operation of the equipment and interpretation of results.

The intensity of illumination within the pipe and the rate of draw of the camera shall be such as to allow a proper examination of the inside of the pipe. Provision shall be made for the movement of the camera to be stopped and its position recorded and for permanent photographs to be taken at any point requested by the Employer's Representative.

For the visual inspection of gravity sewer lines of nominal diameter 900mm or over the Contractor shall provide lighting by means of generator or otherwise. The Contractor shall include for having Photographs taken in the pipelines in conjunction with the visual inspection at the locations required by the Employer's Representative but based on two photographs at intervals of 25 metres. The Contractor shall also provide assistance for the carrying out of such visual inspection.



15.100 INFILTRATION

Gravity pipelines and manholes shall be tested for infiltration after backfilling. All inlets to the system shall be effectively closed, and any residual flow shall be deemed to be infiltration.

The pipeline, including manholes shall be accepted as satisfactory if the infiltration, including infiltration into manholes, in 30 minutes does not exceed 0.5 litre per linear metre per metre of nominal bore. Notwithstanding the satisfactory completion of the above test, if there is any discernible flow of water entering the pipeline at a point which can be located either by visual or CCTV inspection, the Contractor shall take such measures as are necessary to stop such infiltration.

15.101 SWABBING OF WATERMAINS

On completion of the hydraulic test on water mains, foam swabs, soaked in chlorine, shall be passed through the main for final cleansing a sufficient number of times to achieve clear wash water. The swabs shall be driven by water fed into the main by an approved system of temporary pipework which must incorporate a double check valve to ensure there is no possibility of back-siphonage into the existing main.

Swabs for cleaning watermains shall be solid, cylindrical polyurethane foam in accordance with BS EN ISO 845 and BS 3379. Recovery of the swabs shall be witnessed by the Employer's Representative Site Staff.

Swabs have a density of 20 – 25 kg/m³, minimum tensile strength 95 kN/m² and a hardness (at 50% deflection to BS 4443 Parts 1, 2 and 4) of 19 to 23 kg. The diameter of the swab shall be as follows:

- Hard swabs: nominal bore of main.
- Soft swabs for mains less than 200 mm: nominal bore + 50mm.
- Soft swabs for mains greater than 200 mm: nominal bore + 75mm.

The length of the swab shall be 1.5 times its diameter.

Clear wash water shall be defined as having a turbidity of less than 1 NTU (Nephelometric Turbidity Units).

15.102 STERILISATION OF WATERMAINS

This Clause applies to any works involving the installation of new watermains, the rehabilitation of existing watermains, repairs to, connections to or working on existing watermains. In undertaking any such works the Contractor shall apply the hygiene measures and flush and sterilise watermains in accordance with the relevant measures of the following documents:

- “European Communities (Drinking Water) (No. 2) Regulations, 2007 (S.I. 278 of 2007) A Handbook on Implementation of the Regulations for Water Services Authorities for Public Water Supplies” published by the Environmental Protection Agency in 2010 (ISBN: 978-1-84095-349-7). Section 12.4 New Mains, Repaired Mains and Re-Lined Mains.

- “Principles of Water Supply Hygiene Document” published by Water UK in April 2010 and current Technical Guidance Notes published by Water UK.

The Contractor shall prepare Operating Procedures / Method Statements that set out the measures to be taken which are relevant and specific to the works being undertaken under the Contract.

The Contractor, prior to making connections or executing any works on a watermain or service reservoir that is being used to supply water, shall coordinate the works with the Sanitary Authority / Water Services Authority and shall comply with any procedures of the authority relating to such works.

The Contractor shall thoroughly flush out and sterilise all the watermain in the system, and during the flushing and sterilising any connections which may have been made to the mains shall be closed.

The flushing and sterilising shall continue until the Employer’s Representative is satisfied that all foreign matter of deleterious character has been entirely removed from the mains or rendered innocuous.

For sterilisation, liquid chlorine, dry chlorine, or calcium hypochlorite may be used, and the various supply and distribution systems shall be divided into convenient sections and systematically treated with sterilant.

Chlorine shall be injected at such a rate that the residual chlorine available at the discharge point shall be at least 10 parts per million. When such a residual has been recorded the inlet and scour valves shall be closed and the mixture shall be allowed to stand in the mains for at least two hours. The outlet sluice valve or scour valve shall then be opened and the section of main treated shall be thoroughly flushed out before chlorination of the next section is commenced.

15.103 CLEANING OF STRUCTURES

On completion of construction and before any sterilisation, internal surfaces of structures designed to retain an aqueous liquid shall be cleaned thoroughly in such a way as to remove all oil, grit and other deleterious matter.

15.104 DISPOSAL OF WATER FOR CLEANING, TESTING OR DISINFECTION

Facilities shall be provided for the removal and disposal of water used for disinfection, swabbing or testing. Discharge to sewers shall not take place without the consent of the Wastewater Treatment Plant Operator. Water used in cleaning, testing or disinfection of structures or pipelines shall be rendered safe prior to discharge to the environment. Following a water test, pipelines and structures shall be emptied, as far as is practicable.

15.105 WATER FOR TESTING AND FOR CONSTRUCTION PURPOSES

The Contractor shall by whatever means he finds possible, provide for the supply of all water necessary for construction and in testing of the works as well as for headquarters office use and in sanitary accommodation for workpeople where appropriate.



The existing Water Supply Scheme cannot be assumed by the Contractor as a source of water supply for construction and in testing of the works as well as for office use and in sanitary accommodation for workpeople, unless otherwise specified in Section 1.

The Local Authority will however co-operate in supplying water only if at the time of construction or testing it is readily available and surplus to their own requirements. Provided always that the Contractor shall pay all charges levied on him by the Local Authority for the making of tappings, and also that the Contractor shall himself, supply, lay and subsequently remove all requisite piping which shall be approved by the Employer's Representative Site Staff as to quality and suitability of jointing.

Provided also that the Local Authority shall not be bound to afford such a supply of water, if by virtue of such action the efficiency of the general waterworks is in jeopardy, or if it appears to the Employer's Representative Site Staff that the provision of such a supply may interfere with or endanger the power and responsibility of the Local Authority to maintain and fulfil its obligations to supply the surrounding districts with water.

In such circumstances the Contractor would have to make alternative arrangements for water supply for testing purposes.

In locations where water mains are not adjacent to the works the Contractor shall at his own expense independently supply all necessary water for all purposes in connection with the Contract. In so providing his own independent water supply, the Contractor shall not interfere with existing water rights and shall in the event of his abstracting water from any stream, headrace, tailrace, well or pond, save the Council harmless against any claim for loss of water, and from all costs, charges and expenses arising out of or in respect of such claims, real or alleged.

15.106 OPENING, BACKFILLING AND REINSTATEMENT OF TRENCHES

The opening, backfilling and reinstatement of trenches in public roads shall be carried out in accordance with the Guidelines for the Opening, Backfilling and Reinstatement of Openings in Public Roads 2017 and amendments published by Department of Transport.

Due regard should be given to the HSA publication entitled "A GUIDE TO SAFETY IN EXCAVATIONS" dated January 2007 and the requirements listed therein, which may be downloaded from <http://publications.hsa.ie>.

The Contractor shall agree the precise line of the pipeline with the Road Authority before the commencement of construction.

Existing services exposed during trench excavation shall be wrapped in 12mm neoprene rubber, or similar approved, before backfilling.

The Contractor shall submit to the Local Authority Roads Department As-Constructed drawings detailing the line and depth of the installed pipework and chambers. Details of the dates of excavation / temporary reinstatement and final reinstatement shall be provided by the Contractor to the Local Authority Roads Department including confirmation in writing that the trench reinstatement complies in full with the Guidelines for Opening, Backfilling and Reinstatement of Openings in Public Roads 2017 and amendments published by Department of Transport.



All material excavated for pipelines in public roads and road margins, with the exception of road surfacing material, which complies with the Specification as being suitable for, re-use, shall be removed to spoil continuously as excavation proceeds.

15.107 BACKFILLING – GENERAL

Backfilling shall, wherever practicable, be undertaken immediately the specified operations (laying, jointing, testing, haunching and surrounding watermain, sewers and other pipelines and final approval of the work as being in compliance with the appropriate sections of the Specification) preceding it, have been completed. Backfilling shall not, however, be commenced until the works to be covered have achieved a strength sufficient to withstand all loading imposed thereon.

15.108 REINSTATEMENT

The Contractor is to temporarily and permanently restore all surfaces, unless otherwise specified in Section 1, and maintain these surfaces for the duration of the Contract and of the period of maintenance.

Temporary reinstatement where specified is defined as the first stage of a two-stage reinstatement procedure where a dense bitumen macadam course is laid over a granular sub-base. The temporary reinstatement must be maintained for a minimum consolidation period of six months, before permanent reinstatement is carried out, and shall seal and maintain the area of backfill and provide a safe and serviceable surface for vehicles and other road users.

Permanent reinstatement where specified is defined as the second stage of a two-stage reinstatement procedure where the temporary reinstatement is removed and the permanent pavement reinstatement is completed. Permanent reinstatement where specified shall be carried out by using materials fully in compliance with the requirements of the Guidelines for the Opening, Backfilling and Reinstatement of Openings in Public Roads 2017 and amendments published by Department of Transport. Permanent reinstatement shall only be carried out after a minimum consolidation period of six months has elapsed since the temporary reinstatement was placed. Approval to proceed with the permanent reinstatement will be subject to the approval of the Employer's Representative. The Contractor shall maintain accurate records of when the temporary reinstatement was placed on each section of works and shall forward these records to the Employer's Representative.

Prior to the placing of temporary and permanent reinstatement, the Contractor shall saw cut the edges of all existing road surfaces and foundations and shall seal the exposed edges. Any breaking of road surfaces leaving irregular edges will not be permitted.

The width for temporary and permanent reinstatement shall be the maximum width of trench for each pipe size plus 300mm on either side to allow for breaking surface and later knitting in.

If through the improper use of machinery or through carelessness or for any other avoidable cause, the Contractor disturbs a greater width of road than that defined above he shall be responsible for the proper restoration of such extra width at his own expense.

Surface Dressing, to Clause 919 of the NRA Specification for Road Works, shall, unless otherwise specified in Section 1, be an inverted double dressing, as defined in the IAT Guidelines for Surface Dressing in Ireland, with 6mm and 14mm chipping size. The design and application of the surface dressing shall comply with the IAT Guidelines for Surface Dressing in Ireland.



The temporary restoration of surfaces shall be carried out as soon as possible after backfilling and consolidation has been completed but not more than one week from the time when that particular section of trench has been backfilled. When the excavations have been filled and rammed to thorough consolidation as hereinbefore specified to within such distance of the surface as is required for the reinstatement of the surface according to its particular class and after the existing surface on either side of the trench has been saw-cut for future knitting in, Surface Restoration shall be executed as detailed in the guidelines for Opening, Backfilling and Reinstatement of Openings in Public Roads 2017 and amendments published by Department of Transport.

15.109 MATERIALS FOR BACKFILLING AND REINSTATEMENT

Materials for backfilling and reinstatement shall be in accordance with those detailed on the Reinstatement Drawings of the Guidelines for the Opening, Backfilling and Reinstatement of Openings in Public Roads 2017 and amendments published by Department of Transport.

Compaction of backfill material shall be carried out in accordance with the Guidelines for the Opening, Backfilling and Reinstatement of Openings in Public Roads 2017 and amendments published by Department of Transport.

15.110 BACKFILLING OF TRENCHES IN FIELDS

Excavations in grass verges, medians, fields and lawns, shall be backfilled and reinstated in accordance with standard drawing SD14 of the Guidelines for the Opening, Backfilling and Reinstatement of Openings in Public Roads 2017 and amendments published by Department of Transport.

15.111 SETTLEMENT IN TEMPORARY RESTORATION

Failure to operate and maintain compaction equipment in accordance with manufacturer's schedules and recommended practices results in inadequate compaction with serious implications for the short term performance of individual structural layers and the long term integrity of the entire reinstatement. All compaction equipment covered by this Specification must be frequently checked, adjusted and maintained, as necessary, in accordance with the manufacturer's recommended practices, in order to ensure that the manufacturer's recommended operating frequency is maintained throughout each compaction operation. All compaction equipment covered by this specification must be used in accordance with the manufacturer's recommended operating procedures.

The Contractor shall maintain a constant and careful vigilance over the temporary surfaces constructed by him in accordance with foregoing clauses, and shall be responsible for their appearance during the settlement period.

As and when depressions occur in the temporary restoration these shall be promptly filled by the Contractor at his own expense to a level flush with adjacent surfaces and sealed.

If in the opinion of the Employer's Representative the Contractor fails to make good all such temporary reinstatement without delay the Employer's Representative shall be at liberty to get the work done by other means and to deduct expenses thereof from any monies that are, or may be due to him, or to obtain the said expense from the Contractor or from his sureties.



15.112 PROTECTION OF RESTORED SURFACES

After road surfaces over trenches have been temporarily restored and until such time as the permanent road restoration is undertaken the Contractor shall provide and maintain suitable fluorescent warning signs for traffic on all road approaches to the work. On each approach road at least two warning signs are to be provided, one close to the work and the other suitably sited approximately 100m away or otherwise as directed or approved. Special speed limits must be enforced on all temporary reinstatement as specified in Section 1.

Where pipelines are in road margins, similar arrangements are to be made and in addition warning signs at intervals of not more than 30m are to be provided on soft shoulders and maintained until consolidation is complete.

Where pipelines are on private property, the Contractor shall provide and maintain sound temporary fences on both sides of the wayleave until restoration of the surfaces over the wayleave area are deemed by the Employer's Representative to be complete. The fences shall be proof against cattle, sheep or other stock or pedestrian as required by the landowner.

Restoration of trenches in fields or gardens will not be deemed complete until the growth of grass is sufficiently sturdy to withstand normal usage of livestock or farm traffic or until four months has elapsed since seeding, whichever is the longer.

Contractors shall also provide fenced access passes across the trench, where required by the landowners for the passage of livestock and other traffic and these passes shall where necessary have suitable temporary paving, which shall be removed by the Contractor before the end of the Contract.

15.113 QUALITY CONTROL OF BACKFILL AND REINSTATEMENT MATERIALS

Testing of materials used for backfilling and reinstatement shall be carried out in accordance with Section 6.10 of the Guidelines for the Opening, Backfilling and Reinstatement of Openings in Public Roads 2017 and amendments published by Department of Transport.

15.114 METAL PLATES

Metal plates shall be provided with all non-metallic pipelines and ducting at a spacing of 25m intervals and over each connection point not characterised by a junction box / manhole or other visible feature. The plates shall be a minimum of 125mm by 125mm and galvanised. The depth of installation shall be 300mm below the final surface.



16.0 SERVICE DUCTING

16.1 ESB DUCTING

The main ESB supply to the site to be by means of ducting rather than overhead cables. All ducting to comply with the following documents:

ESB Networks Electrical Services Guidebook, Revision 5 (Jan 2014)

Standard Specification for ESB Networks MV/LV Networks Ducting

Duct Specifications of LV Cable for Non-Domestic Connections

ESB National Code of Practice for Customer Interface 4th Edition 2008

Approved Material Suppliers for Housing Schemes & MV Substation Buildings

The Contractor shall be required to provide 125mm PVC ducts with draw cords in trenches 900mm deep as shown on the drawings. Minimum duct spacing shall be 75mm for up to two ducts in any layer and 150mm for more than two ducts in any layer. Minimum clearance to other services (apart from large pipelines or high-pressure pipes) shall be 300mm.

Service ducts shall generally be uPVC single wall pipes with a minimum wall thickness of 3.8mm complying with Class B or better of BS 3506.

Where ducts are shown or specified as HDPE, they shall be single wall pipes with a minimum wall thickness of 5mm complying with IS EN 50086-2-4.

Where specified as being required by a particular utility provider (e.g. ESB Networks), ducts shall be uPVC single wall pipes with a minimum wall thickness of 3.8mm complying with Class B or better of BS 3506.

Ducts shall be manufactured from 100% virgin material.

Ducts shall be of 'Normal' duty in accordance with IS EN 50086-2.

Ducts shall comply with IS EN 50086-2 in terms of duct deformation (<5% deformation requirement for 450N loading on 200mm sample) and impact resistance requirements (no crack for 5kg striker, 12 samples and 570mm fall height >28 Joules).

Ducts shall have a smooth low friction inner surface completely free of ripples, sharp edges and protrusions. Friction coefficient <0.28.

Duct ovality to be 2.00mm max.

Ducts shall be constructed in 6.6m lengths (approximately) with a socket at one end and a corresponding spigot at the other with the plain end bevelled to allow easy jointing of ducts on site.

ESB wiring tape shown to be placed above the ducts when laid, again 150mm below finished ground level. All ducts shall be laid in accordance with any further requirements of the Electricity Supply Board. Provision to be made for the placing of ducts to the ESB switch room located within the basement.



All ductwork and pipes as shown on the accompanying drawings is to be surrounded with pea gravel to at least 150mm above top of pipe/duct.

Where external ducts enter buildings, they shall be sealed using a watertight multi-cable transit sealing system. This shall include rubber split insert sleeves to ensure able separation & a high quality silicone-based sealant layer. The system used shall be RISE Duct Seal system by CSD Sealing Systems or equal and approved. Polyurethane expanding foam is not acceptable as a watertight opening sealing system.

Ducts shall have a circumferential mark to indicate the correct push-in distance for duct jointing for spigot and socket joints.

The colour coding of service ducts shall generally conform to I.S. 370:2007.

Long radius bends only shall be used with a minimum Duct Bend Radius of 1.2m for all bends.

16.2 TELECOMMUNICATIONS DUCTING

Ducts and installation shall comply with the Department of Public Enterprise publication "Recommendations for Underground Telecommunications Cable Works".

The Contractor shall be required to provide 100mm PVC ducts and 40mm "heavy gauge" hydrodare pipe with draw cords as shown on the drawings. The normal depth of cover below ground to ducts to be 750mm in roadways and 400mm in footpaths. Marking tape to be laid 150mm above all main ducts.

Ducts and joint boxes to be located the required clearance distance from ESB ducts and watermain in accordance with Telecommunications Company Specification.

Telecommunications ducts along the main runs shall be plug-and-socket air-tight and water-tight to facilitate the blowing of fibre optic cables.

All ductwork and pipes as shown on the accompanying drawings to be surrounded with pea gravel to at least 150mm above top of pipe/duct.

16.3 GAS

Gas pipework and tanks to be supplied and installed in accordance with "Code of practice for gas transmission pipelines and pipeline installations I.S. 328:2003" and Gas Networks Ireland Documents "Guidelines for Designers & Builders Industrial & Commercial (Non-Domestic) Sites" and "Guidelines for Designers & Builders Commercial Domestic Sites". All ductwork and pipes as shown on the accompanying drawings is to be surrounded with sand or pea gravel to at least 150mm above top of pipe/duct. The minimum trench width shall be the outside diameter of the pipe plus 300mm.

16.4 COLOUR CODE FOR BURIED PLASTIC PIPING

All buried pipes are to be installed in accordance with I.S. 370:2007 – "Colour code for buried plastics piping".

Colour fastness of 1 year minimum is required so as to provide 12 month storage period.



In addition to colour coding, the ducts shall be stamped with the words “Danger Electricity Cables”, “Public Lighting”, “Telecommunications Cables”, “Traffic Cables” etc. as appropriate printed in large block capitals continuously along their length, to the approval of the Engineer. Legends shall be minimum 18mm high black lettering at maximum 1m intervals.

Materials shall contain pigments and UV stabilisers to provide maximum colour stability and weathering. All pigments shall be of high purity and shall resist leeching in contact with soil acids.

16.5 SUBSTATION BUILDINGS

Substations are to be installed in accordance with the current version of the documents entitled, “ESB Networks national Code of Practice for Customer Interface” ESB Networks Company Standards For MV Substation Buildings and “ESB Networks Specification No. 13320 – MV Substation Buildings”. Any deviation from standard ESB Drawings and Specifications must be explicitly agreed in writing by the ESB.



Tunnelling and Shafts

16.6 NOT USED



17.0 BOUNDARIES, FENCING, LANDSCAPING AND OPEN SPACE

17.1 BOUNDARY WALLS

Any damage caused to the existing boundary walls and fences during the works is to be reinstated to its original state at the Contractor's own expense.

17.2 FENCING

The Contractor shall ensure that unauthorised persons and livestock are effectively excluded from the works. Where the type and locations of temporary site fencing are described in the contract, the Contractor shall erect such fencing as soon as he is given possession of the relevant portion of the site. The Contractor shall regularly inspect and maintain all such fencing, any defects being made good without delay. Access shall be provided in temporary site fencing as necessary for the use of the occupiers of adjacent lands. Temporary site fencing shall remain in position until either it is replaced by permanent fencing or the works are sufficiently completed to enable that portion of the site to be brought into use.

Specifications are detailed hereunder for (a) ordinary type and (b) unclimbable type concrete post and chain link fencing.

17.3 CORNER OR END POSTS – ORDINARY TYPE

Corner or end straining posts shall be 2.10 metres long, 175mm x 175mm at the base and 125mm x 125mm at the top reinforced with 4 No. 12mm mild steel round bars helically bound with approved binding wire. Suitable indents shall be formed in the posts to take the struts. Five holes for wires shall be placed in the posts at intervals of 300mm commencing 75mm from the top.

17.4 STRUTS – ORDINARY TYPE

Struts shall be 1.5 metres long 100mm x 100mm in section and reinforced with 4 No. 6mm bars similarly bound and similarly holed for wires. Earth plates against which struts abut shall be 375mm x 75mm thick, suitably indented to receive the struts.

17.5 INTERMEDIATE POSTS – ORDINARY TYPE

Intermediate Posts shall be 1.95 metres long, 125mm at the base and 75mm x 75mm at the top, reinforced with 4 No. 10mm bars similarly bound and holed at the same intervals as the straining posts to receive the wires.

17.6 END POSTS – UNCLIMBABLE TYPE

End unclimbable straining posts shall be 175mm x 175mm at the base, 125mm x 125mm at the top of the vertical portion and tapering to 100mm x 100mm at the outer end of the curve. The posts shall be 3 metres long in vertical overall height, and shall be reinforced with 4 No. 12mm mild steel round bars – helically bound with approved binding wire.

A suitable indent shall be formed in the post to take the strut. Six holes for wires shall be placed in the posts at intervals of 300mm commencing 150mm above the ground level or 900mm from the bottom of the post.

17.7 STRUTS – UNCLIMBABLE TYPE

Struts for unclimbable fences shall be 2.40 metres long, 100mm x 100mm in section and reinforced with 4 No. 10mm bars, similarly bound. The struts shall be suitably holed to receive wires before specified for end posts. Earth plates against which struts abut shall be 375mm x 375mm x 75mm thick suitably indented to receive the struts.

17.8 INTERMEDIATE POSTS – UNCLIMBABLE TYPE

Intermediate unclimbable posts shall be 150mm x 150mm at the base, 100mm x 100mm at the top of the vertical portion, and tapering to 75mm x 75mm at the outer end of the curve. The posts shall be 3 metres long in overall vertical height, and shall be reinforced with 4 No. 10mm bars bound as before described. Six holes shall be placed in the posts at intervals of 300mm commencing 150mm above ground level or 75mm from the bottom of the post.

17.9 WIRES AND SPACERS

Wires shall be No. 10 S.W.G. high tensile galvanised steel, with plastic coating having an ultimate strength of 70 tons per square inch (110 kfg/mm²). Spacers shall be galvanised 15 B.W.G. metal corrugated in section and attached to the wires with galvanised clips. In the case of ordinary type fencing five lines of this wire shall be provided, whereas six lines are required in the case of the unclimbable fence. Additional in the case of the unclimbable fence, four rows of strong 4 point, 75mm thickset galvanised barbed wire shall be attached to the curved portions of the posts well tied and braced.

Erection of Post and Mesh Fencing

1. The concrete for construction of reinforced concrete posts shall be Grade C16/20 concrete, subject to a reduction of the maximum size of aggregate to 10mm and to the use of rapid hardening cement.

The posts shall be cast in oiled timber or steel moulds and shall be cured for at least one month before placing in the fence.

2. When chainlink mesh is required it shall be woven from wire complying with IS 126 and plastic covered. Unless otherwise stated chainlink mesh shall have a 50mm mesh size and be woven from 10 S.W.G. mild steel wire. Chainlink mesh shall be secured to horizontal line wire with 14 S.W.G. mild steel wire galvanised to BS 443 at intervals of 150mm on the top wire and at intervals not greater than 450mm on two other wires, one of which shall occur at the bottom and the other approximately in the middle of the mesh.
3. The fittings for the fences shall be as shown on the Drawings and comply with the following requirements. Where galvanising is specified, it shall comply with IS EN ISO 1461.

- a. Eye bolt strainers shall consist of bolts of 250mm overall length x 10mm diameter sufficiently threaded and fitted with a nut and washer. They shall be galvanised.
- b. Ring nut fittings for the threaded ends of eye bolts shall be galvanised.
- c. Winding bracket strainers shall be of suitable design, manufactured from mild steel flat not less than 400mm x 3mm and shall be fitted with a winder of 15mm minimum diameter, and with a ferrule or ratchet winder. Winding brackets shall be galvanised.

The Employer's Representative may permit the omission of fire strainers. In such case the wire shall be strained using a "monkey" wire strainer in a manner directed by the Employer's Representative.

4. Straining posts and nuts and earth plates shall be set at the corners of the sites as shown on the Drawings. Each straining post shall be set 750mm into the ground and surrounded with 0.5 cubic metres of Grade C12/15 concrete. Intermediate posts shall be set 600mm into the ground at intervals not exceeding 3.00 metres and surrounded with 0.25 cubic metres of Grade C16/20 concrete. Three lines of wire as specified shall be run at intervals of 300mm c/c measured from the top of the posts. They shall be attached to galvanised eye bolts in the straining post at one end, and to the galvanised ratchet winders in the straining post at the other end, and pulled taut. Three spacers shall be clipped to the wire in each bay between the posts. It will be regarded of the utmost importance that rigidity and good alignment is obtained throughout and the Contractor must satisfy the Employer's Representative in this regard before payment is made.
5. A reinforced concrete sill measuring 125mm wide x 225mm high shall be constructed with the top at finished ground level. It shall be complete with 3.55mm diameter galvanised wire staples set into it as shown, and at 750mm centre to centre. The bottom line wire to which the chain link mesh fencing shall be fixed shall be threaded through the staples all as shown in the Drawings.

17.10 PALISADE FENCING

Palisade security type fencing shall be to BS 1722 – Part 12, 2.4m high above ground, consisting of main support posts 102 x 44 RSJ embedded in concrete foundations 600mm deep at centres not exceeding 2,750mm. Pales 3mm thickness shall be fixed by fully welding to 2 No. 50 x 50 RSA horizontal rails. Connecting bolts from support post to panels to be hidden from view on the outer side of the fence. Material to be finished in Plas Galv finish, i.e. plastic coated or selected colour over hot dipped galvanised finish.

A continuous 450mm deep and 450mm wide concrete Grade C20/25 footing shall be provided beneath the fence, with joints at 2,750mm centres laid on a compacted hardcore base.

Main support posts shall be embedded in Concrete Grade C20/25 footings measuring 600mm by 600mm by 750mm deep.

17.11 PERMANENT FENCING

Please refer to the Architects Specification for exact details.

Typically permanent fencing shall comply with the relevant provisions of the appropriate part of BS 1722 or to the Irish Standard as set out in the following Table:-

IS	Part of BS 1722	Type of Fencing
130	Chain Link Fences	
-	2	Woven Wire Fences
-	3	Strained Wire Fences
-	4	Cleft Chestnut Pale Fences
-	5	Close Boarded Fences and Wooden Palisade Fences
-	7	Wooden Post and Rail Fences
-	8	Mild Steel (Low Carbon Steel) Continuous Bar Fences
-	9	Mild Steel (Low Carbon Steel) Fences with Round or Square Verticals and Flat Posts and Horizontals
203	Anti-Intruder Chain Link Fences	
-	11	Woven Wood and Lap Boarded Panel Fences
-	12	Steel Palisade Fences
-	13	Chain Link Fences for Tennis Court Surrounds
-	14	Open Mesh Steel Panel Fences
-	16	Organic Powder Coatings to be Used as a Plastic Finish to Components and Mesh

All timber for permanent fencing shall be given preservative treatment in accordance with the provisions of the relevant Part of BS 1722.

17.12 LANDSCAPING

Grading of general landscaped areas to be carried out to subsoil level. Costs to be included for all aspects of landscaping including topsoil and planting as specified on Landscaping drawing.

Grass seeding shall be carried out in accordance with British Standard specification 4428; 1989, entitled "Code of Practice for General Landscape Operations", Section 5. Topsoil shall conform to the description of topsoil set out in British Standard Specification No. 3882; 2007, entitled "Specification for Topsoil". Topsoil shall be good quality medium topsoil loam, easily moulded when moist. It must not include subsoil, excessive proportions of clay, sand, chalk or lime, nor

may it include rubbish or other extraneous material, pernicious weeds or couch grass whether roots or top growth, or roots of trees or shrubs. A minimum depth of 150mm of topsoil is required.

17.13 IMPORTED TOPSOIL AND TURF

Imported topsoil shall comply with BS 3882 and be of light or medium texture, having a pH value of between 6.0 and 7.5. Imported topsoil shall not contain stones greater than 50mm in size, or have a total stone content exceeding 10 per cent by mass.

All areas for planting or grassing to be deep ploughed to a depth of 600mm in parallel runs at 1200 c/c using a 75 dia. Mole.

Imported turf shall comply with BS 3969:1998 and be delivered to the site within 24 hours of lifting (18 hours in spring and summer). Constituent grasses and their proportions shall comply with the provisions of BS 3969: 1998, Clause 3. Good practice dictates that turves shall be green when cut, they shall be kept moist and shall be re-laid in suitable weather conditions. The level of topsoil beneath the turves shall be such that the final grass surface after compaction shall be flush with the adjoining grass surface.

17.14 GRASS SEED

Grass seed shall be a tested blend of named varieties and certificates of purity and germination shall be provided. The blend shall consist of one of the following mixtures or other approved.

Variety	Percentage by Mass			
	Mixture 1	Mixture 2	Mixture 3	Mixture 4
Dwarf Levy Perennial Ryegrass	20-30	-	-	-
Smooth-Stalked Meadow Grass	25-35	-	20-30	0-15
Rough Stalked Meadow Grass	-	15-25	-	-
Creeping Red Fescue	30-40	40-50	35-45	20-50
Fine Leaved Sheep's Fescue	-	-	10-20	10-40
Browntop Bent	5-15	5-15	5-15	0-10
Crested Dogstail	-	-	5-15	-
Timothy	-	20-30	-	-
White Clover	-	-	-	0-10

Spread at rate of 50 g/m² during suitable calm weather, equal sowing in transverse directions deeded to be raked or chain harrowed after sowing.

Grass areas will be accepted as practically complete when more than 80% has germinated.



17.15 FERTILISER

Fertilisers shall consist of compounds containing urea nitrogen, phosphoric acid and potash in the proportion by mass set out as follows:

Fertiliser			
Description	General Purpose	Pre-Seeding	Post Establishment
Urea Nitrogen	5%	-	46%
Phosphoric Acid	15%	21%	-
Potash	15%	12%	-
Rate for Spreading	70g/m ²	70g/m ²	40g/m ²
Time for Spreading	Immediately after completion of soil moving and spreading	4 days before seeding	First spring after establishment of grass seed

17.16 TREES AND SHRUBS

Trees and shrubs shall comply with the relevant provisions of the appropriate Standard as set out below:-

Trees and Shrubs	
Type	Standard
Ordinary nursery stock	BS 3936, Part 1
Semi-mature trees	BS 4043
Advanced Nursery Stock	BS 4043
Forest Transplants	BS 3936 Part 4 and HMSO – Bulletin No. 14
Tree Planting	BS 4428
Work Near Trees in relation to Design Demolition & Construction	BS 5837

Existing hedges to be retained shall where possible be left intact. Where damage to the hedge is unavoidable to facilitate the works such damage shall be kept to the absolute minimum and shall not in any case extend beyond the extent of the works area.

The Contractor is to replace the damaged portion of the hedge with plants of the same type at the original spacings. The replacement plants are to be as mature as possible but in any event not less than two years old. They are to be carefully nurtured until a strong and sturdy growth

exists. Shrubs, Bushes and Small Trees of value are to be dealt with in a similar manner to Hedges.

17.17 LAND DRAINS

The positions of all land drains intercepted and disturbed shall be prominently marked at every point of intersection with the work. The Contractor shall record these positions, depths, pipe diameters and the types of construction, and a copy of these records shall be given to the Employer's Representative. Care shall be taken during the progress of the Works to prevent the disturbance of markers.

Prior to the permanent reinstatement of land drainage the Contractor shall clear the ends of existing drains, where intercepted by excavations, and shall afford facilities to the Employer's Representative and the landowner or occupier to inspect them and determine the extent of replacement that may be necessary.

The backfill of intercepting excavations shall be compacted in 200mm layers, to give a firm bearing immediately before replacement pipes are laid, and shall be brought up to the level of the underside of the land drains or of any support to be provided.

The affected land drains shall be cut back into firm ground until, in each case, a section is exposed which is unaffected by the Works.

Replacement pipes or support beams shall bear on undisturbed ground for at least 500mm at each end. The replacement pipes shall be of the same internal diameter as the sections of drain, which they replace, and shall be properly connected at each end.

Records shall be kept of all drainage system reinstatement work carried out and a copy shall be given to the Employer's Representative.

17.18 OPEN SPACE

All areas marked as Public amenity or open space on the site layout drawing are to be graded to the appropriate level, top soiled and seeded.

17.19 CAST STONE

Cast stone shall comply with the relevant provisions of BS 1217.

Reconstructed stone masonry units shall comply with the relevant provisions of BS 6457 and BS 1217.

17.20 COPING UNITS

Precast concrete, cast stone, clayware, natural stone and slate coping units shall comply with the relevant provisions of BS 5642, Part 2. Slate coping units shall be Type B unless otherwise described in the Contract.

17.21 FIELD GATES

1. Timber Field gates, posts and fittings shall comply with the relevant provisions of BS 3470.



2. All timber for field gates and posts shall be given preservative treatment in accordance with the provisions of BS 3470.
3. All fittings and steel field gates and posts shall be hot dip galvanised in accordance with IS EN ISO 1460.

17.22 STILES, BRIDLE GATES AND KISSING GATES

1. Stiles, bridle gates and kissing gates shall comply with the relevant provisions of BS 5709.
2. All timber for stiles, bridle gates, kissing gates and posts shall be given preservative treatment in accordance with the provisions of BS 5709.
3. All fittings and steel stiles, bridle gates, kissing gates and posts shall be hot dip galvanised in accordance with IS EN ISO 1460.
4. Concrete for surrounding the bases of posts shall be Grade C16/20 unless otherwise specified.

18.0 SYNTHETIC PITCHES

18.1 NOT USED



19.0 NATURAL GRASS PITCHES

19.1 NOT USED

20.0 ATHLETICS TRACK AND FIELD FACILITIES

20.1 NOT USED

21.0 WATERMAIN REHABILITATION

For Irish Water Projects please refer to the latest version of the General Civil Engineering Specification IW-TEC-300-01 and the latest version of IW-TEC-800-05.

22.0 ROADS AND FOOTWAYS

22.1 FOOTPATHS

All unbound granular fill materials to be used under floors, rafts, foundations or other structures in the ground, roads, footpaths or other pavements, shall conform with the requirements of IS EN 13242 and Table E.1 from Annex E of SR21, in addition to any other requirements specified in other sections of this specification. Similarly, all aggregate for use in concrete, for whatever purpose, shall at least comply with these requirements, in addition to all other requirements in this specification.

Only natural crushed rock aggregates shall be used under any concrete structure, including floors, rafts or other foundations, road pavements or footpaths.

Prior to first use from any source, the Contractor shall obtain from the supplier confirmation of the material having been tested from the specific source (including the particular extraction section of the quarry in accordance with the practice recommended in SR21) and provide certification as evidence of such testing confirming that the materials conform to the requirements set out above. The Contractor shall not supply any materials from any different source (or different extraction source from a quarry) unless appropriate testing in accordance with the above requirements has been carried out and certification provided.

For the avoidance of doubt, the above requirements in relation to fill material, shall apply to all fill material directly underneath any of the elements identified, and any fill materials within 500mm to any side of any such elements.

All footpaths to be laid with a minimum cross-fall of 1/40. Where adjacent to roadways this slope shall be towards the roadway.

Footways should have a sub-base, of minimum thickness 100mm, and should be of in-situ concrete construction, 100mm in depth generally, but increasing to 150mm (and with 1 layer of A252 mesh reinforcement or as detailed) where adjacent to roadways or where there is vehicular access.

An air entraining agent shall be incorporated in the concrete used in the construction of at least the top 50mm of paving to be used as a running surface. The total quality of air in air-entrained concrete for paving shall be 4.5% +/- 1.5% by volume of the mix. Additional admixtures shall not be used in concrete containing an air entraining agent.

The finishes of the concrete path will be a “spike rolled” finish (or as detailed), with bull nosed edges to transverse joints.

All steps and ramps to comply with parts K and M of the Building Regulations. Handrails to be provided to all ramps in accordance with the Building Regulations.

22.2 FOUNDATIONS FOR FOOTWAYS

Foundations for footways shall consist of Type 1 granular sub-base material spread evenly and compacted in layers of not more than 100mm thickness.

Compaction to the correct levels shall be carried out using a vibratory roller having a static load of at least 1000 kg/metre width of roll.



22.3 WHEEL WASH

A wheel wash system is to be provided at the entrance to site prior to construction works commencing. The wash shall be positioned such that all vehicles exiting the site must pass through. All public roads and footpaths shall be cleaned to an appropriate standard daily.

22.4 TACTILE PAVING

Tactile paving slabs shall be used at areas that are specified "Crossings". The footpath shall be dropped to an appropriate level and the paving slabs shall be of a colour as required by the Department of Transport in accordance with Section 13.3 of the "*Traffic Management Guidelines*".

22.5 ROADS

All roads to be constructed in accordance with levels and falls as specified on road Layout Plan and appropriate attached sections. All line markings including pedestrian crossing, directional arrows, stop, yield, etc. to roads is to be carried out by specialist domestic line marking Contractor and is to be included in the contract sum.

22.6 ROADWORKS

Roadworks, materials and workmanship shall comply with the relevant section of the "Specification for Roadworks Series" issued by Transport Infrastructure Ireland.

Kerbs, edgings, channels and quadrants shall be laid and bedded on a layer of Class M1 mortar, either on the concrete carriageway or on a Grade 20 concrete foundation, as detailed on the Drawings. They shall be butt-joined except where otherwise shown in the Contract, save that where laid on concrete carriageways they shall be provided with joints coincident with the carriageway movement joints, of width and with filler identical to that used in the carriageway joints. All kerbs shall be backed with Grade 20 (ST4) concrete.

22.7 ROAD FORMATIONS

The road formation shall be the surface obtained after completion of any earthworks. Formations, immediately before being covered with sub-base or road base material, shall be clean, free from mud and slurry and properly shaped and compacted to an even and uniform surface.

The preparation and surface treatment of formation shall be carried out after the reinstatement of any excavations for services.

All exposed formations shall be inspected by the Engineer and no sub-base material shall be placed until the formation has been approved by the Engineer.

Once the formation has been prepared constructional traffic shall not be allowed to run thereon without the permission of the Engineer.

To avoid deterioration of the sub-grade the final 150mm of excavation to formation level shall not be affected until the Contractor is ready to place the sub-base materials on the prepared formation. The method used to affect the final excavation to formation level shall be approved

by the Engineer and the Contractor shall not carry out this work in weather which would cause serious deterioration of the formation.

The formation shall be finally shaped and regulated to the prescribed level parallel to the finished surface level of the road and thereafter it shall not be subjected to any constructional or other traffic until the road surfacing has been laid and opened to traffic.

Where peat or other soft unsuitable material is encountered at formation level or immediately thereunder, it shall be excavated to such level and widths as may be directed by the Engineer. The material arising from these excavations will be disposed of in a suitable location, provided by the Contractor and to the approval of the Engineer. The voids thus formed shall be backfilled with approved materials compacted to the satisfaction of the Engineer.

Before any foundation work is begun all drains and other underground service shall wherever possible be fully completed.

22.8 SUB-BASE CONSTRUCTION

Within 48 hours of completion of a road formation, granular sub-base material shall be spread and compacted to the required thickness. Compaction shall be carried out in accordance with the following Table "Table 6/4 Method Compaction for Earthworks Materials: Plant and Methods" taken from TII Publication CC-SPW-00600 Specification for Road Works Series 600 - Earthworks. All granular materials to be in accordance with Clause 804 of CC-SPW-00900 Road Pavements – Bituminous Materials by the TII.

Sub-Base Construction				
Type of Compaction Plant	Category	Number of Passes for Layers not greater than		
		110mm	150mm	225mm
Smooth wheeled roller (or vibratory roller operating without vibration)	Mass per metre width of roll: over 2700kg up to 5400 kg	16	unsuitable	unsuitable
Pneumatic-tyred roller	Mass per wheel: over 4000 kg up to 6000 kg	12	unsuitable	unsuitable
	over 6000 kg up to 8000 kg	12	unsuitable	unsuitable
	over 8000 kg up to 12000 kg	10	16	unsuitable
	over 12000 kg	8	12	unsuitable
Vibratory roller	Mass per metre width of a vibratory roll:			

	over 1300 kg up to 1800 kg	6	16	unsuitable
	over 1800 kg up to 2300 kg	4	6	12
	over 2300 kg up to 2900 kg	3	5	11
	over 2900 kg up to 3600 kg	3	5	10
	over 3600 kg up to 4300 kg	2	4	8
	over 4300 kg up to 5000 kg	2	4	7
	over 5000 kg	2	3	6
Vibrating plate compactor	Mass per m² of base plate:			
	over 1400 kg up to 1800 kg	8	unsuitable	unsuitable
	over 1800 kg up to 2100 kg	5	8	unsuitable
	over 2100 kg	3	6	12
Vibro-tamper	Mass:			
	over 50 kg up to 65 kg	4	8	unsuitable
	over 65 kg up to 75 kg	3	6	12
	over 75 kg up to 100 kg	2	4	10
	over 100 kg	2	4	10
Power rammer	Mass:			
	100 kg up to 500 kg	5	8	unsuitable
	over 500 kg	5	8	14
Smooth wheeled roller (or vibratory roller operating without vibration)	Mass per metre width of roll:			
	over 2700kg up to 5400 kg	16	unsuitable	unsuitable
Pneumatic-tyred roller	Mass per wheel:			
	over 4000 kg up to 6000 kg	12	unsuitable	unsuitable
	over 6000 kg up to 8000 kg	12	unsuitable	unsuitable
	over 8000 kg up to 12000 kg	10	16	unsuitable
	over 12000 kg	8	12	unsuitable

Vibratory roller	Mass per metre width of a vibratory roll:			
	over 1300 kg up to 1800 kg	6	16	unsuitable
	over 1800 kg up to 2300 kg	4	6	12
	over 2300 kg up to 2900 kg	3	5	11

22.9 WET MIX MACADAM CONSTRUCTION

Wet mix macadam shall be spread evenly on the sub-base and compacted in layers of not more than 200mm thickness.

Spreading shall be undertaken concurrently with placing. Compaction shall be completed as soon as possible after the material has been spread. All works to be carried out in accordance with CC-SPW-00900 - Specification for Road Works Series 900 - Road Pavements - Bituminous Materials

22.10 LEAN CONCRETE CONSTRUCTION

Lean concrete for roads shall be spread evenly on the sub-base and laid in compacted in layers of not more than 200mm thickness.

Spreading shall be undertaken concurrently with placing. Compaction shall be completed as soon as possible after the material has been spread and carried out in accordance with the CC-SPW-01000 Specification for Road Works Series 1000. The maximum period of time between mixing of the materials and final compacting of any given material shall be two hours.

Where practicable, joints against hardened material shall be avoided. Where such joints are unavoidable, the hardened material shall be cut back vertically for the full depth of the layer before placing any further adjacent material.

Lean concrete shall be cured for a period of not less than seven days. No vehicular traffic shall be allowed to run on the base during this time.

22.11 LAYING COATED MACADAM

Transportation, laying and compaction of all coated macadam shall be carried out in accordance with the relevant provisions set out in the CC-SPW-00900 - Specification for Road Works Series 900 - Road Pavements - Bituminous Materials

A two-course bituminous macadam surfacing shall be laid over the sub-base where specified. It shall consist of a macadam base course in accordance with BS 4987 rolled with a power roller to a consolidated thickness of 63mm. A second course of bituminous macadam, in accordance with the CC-SPW-00900 - Specification for Road Works Series 900 - Road Pavements - Bituminous Materials, is to be laid over and rolled with a power roller to a consolidated thickness of 25mm giving 88mm consolidated in the two layers.

Alternatively, a single coat of 50mm thick to BS 4987 shall be used where specified.

22.12 LAYING ROLLED ASPHALT (HOT PROCESS)

Transportation, laying and compaction of rolled asphalt (hot process) shall be carried out in accordance with the relevant provisions set out in the CC-SPW-00900 - Specification for Road Works Series 900 - Road Pavements - Bituminous Materials.

22.13 WATERPROOF UNDERLAY FOR CONCRETE CARRIAGEWAYS

Waterproof underlay shall consist of waterproof paper or impermeable plastic sheeting laid to provide a membrane immediately below the concrete. Overlaps shall be not less than 300mm and precautions shall be taken to prevent ponding on the membrane.

22.14 REINFORCEMENT OF CONCRETE CARRIAGEWAYS

Reinforcement in concrete carriageways shall be so placed that, after compaction of the concrete, its cover below the finished surface of the slab is 50mm (plus 10mm) and that it terminates 50mm (plus 10mm) from the edges of the slab and all preformed joints in the concrete.

Transverse joints between mats of steel fabric reinforcement, the longitudinal bars shall overlap by at least 40 times the bar diameter provided that such overlap shall not in any case be less than 450mm. Mats shall be placed so as to maintain the same spacing between edge longitudinal bars as in the body of the mat.

Reinforcement shall be positioned above dowel bars and tie bars irrespective of the tolerances on position.

22.15 LAYING CONCRETE CARRIAGEWAYS

Placing, compacting and finishing of concrete in carriageways shall be carried out as rapidly as possible and shall be so arranged that, in any transverse section, the time for completion of mixing the first batch of concrete to completion of compaction of that section shall not exceed two hours.

Carriageway surfaces shall have a Screeded Finish, which shall be brushed transversely with a medium textured wire broom to produce a lightly brush marked finish, with a 100mm arris trowelled finish to sides and at joints.

Surface irregularities shall not exceed 3mm when checked with a three-metre straight edge.

22.16 LAYING KERBS AND CHANNELS

Kerbs, edgings, channels and quadrants shall be laid and bedded on a layer of Class M1 mortar, either on the concrete carriageway or on a Grade C16/20 concrete foundation, as detailed on the Drawings. They shall be butt-joined except where otherwise shown in the Contract, save that where laid on concrete carriageways they shall be provided with joints coincident with the



carriageway movement joints, of width and with filler identical to that used in the carriageway joints. All kerbs shall be backed with Grade C16/20 concrete.

For radii of 12 metres or less, kerbs and channels of the appropriate radius shall be used. Alignment of kerbs and channels shall not deviate from that shown on the Drawings by more than 10mm with no lipping of visible faces.

22.17 TOLERANCES FOR FINISHED CARRIAGEWAY SURFACES

Finished surfaces at each stage of road construction shall not vary from the levels shown on the Drawings by more than the following permissible deviations:

Tolerances for Finished Carriageway Surfaces	
Surface	Permissible Deviation mm
Formation and Sub-base	25
Base	15
Wearing Surface or Slab Surface	5

The combination of permitted tolerances in the levels of different pavement courses shall not result in a reduction of thickness of the pavement, excluding the sub-base, by more than 15mm from the specified thickness, or a reduction in the thickness of the bituminous wearing course by more than 5mm from that specified, and the maximum allowable irregularity of the wearing surface below a 3m straight edge shall be 3mm.

Combinations of reverse tolerances shall not result in ponding of surface water.

22.18 ROAD MARKINGS

The location for permanent road markings, road studs and delineators will be in accordance with the latest version of the Department of Transport's Traffic Signs Manual and the CC-SPW-01200 - Specification for Road Works Series 1200 - Traffic Signs and Road Markings, and as shown on the appropriate drawings.

Road markings shall comply with the latest revision of the Transport Infrastructure Ireland publication 'CC-SPW-01200 Specification for Road Works Series 1200 - Traffic Signs and Road Markings'. The quality of the material and workmanship shall comply with the requirements of all relevant European Standards including EN1436, EN 1423, EN 1424 and EN 1871. Any aspects of the work or materials not covered by a European Standard shall comply with the Specification below.

The Road Marking Specialist shall provide a guarantee that any markings will perform to the standards set out below for a minimum period of 2 years (after opening the road to traffic) and shall make good any deficiencies which arise in that period at his expense. The following properties of the markings are required to be covered by the guarantee:

- Durability
- Reflectivity
- Luminance Factor

- Chromaticity
- Skid Resistance

Notwithstanding the performance requirements of this specification, the minimum thickness of markings laid under 'specification (b)' shall be 2.5mm.

For the purpose of assessing compliance with the specification, the thickness shall be measured by using a suitable micrometer gauge, or callipers on samples of markings laid on steel plates placed beneath the application machine during the laying operations. The thickness laid on the plate shall be representative of the thickness of material laid on the road.

Unless otherwise directed by the Employer's Representative, all markings shall be reflectorised by the application of glass beads to the surface of the marking material.

In the case of reflectorised markings solid glass beads, 400 g/m² to 500 g/m² from the machine shall be applied by pressure concurrently with the laying of the line with sufficient velocity to ensure retention in the surface of the line. The solid glass beads so sprayed shall give uniform cover and immediate reflectivity over the whole surface of the marking. (On screen-applied markings where pressure application is not practicable, gravity application will be permitted).

The Road Marking Specialist shall note that the above-mentioned solid glass beads which are to be applied to the surface of the markings are in addition to the minimum solid glass bead content specified for incorporation within the body of the mix for reflectorised markings.

It shall be permissible to apply a Tack Coat to promote better adhesion of the marking. This may particularly be the case in overlaying existing thermoplastic material with new material. The tack coat shall be laid to the same width as the line being laid in so far as practicable. The application of a tack coat and its type shall be agreed with the Contractor's Designer in advance.

The Road Marking Specialist shall not carry out any work when the weather conditions or the road conditions (e.g., dampness, dust, cold) are such that the quality of the work might be adversely affected. In particular, application of markings shall not be carried out when the road temperature is less than 5°C.

The Road Marking Specialist shall ensure that the horizontal alignment of the applied marking is to the satisfaction of the Employer's Representative in respect of straightness of line and smoothness of curvature.

The Road Marking Specialist shall supply certification that the material and the method of application of markings to the road which the Specialist proposes to use, conforms to the specification as outlined above. For this purpose, the Specialist shall obtain from Transport Infrastructure Ireland or another approved agency, a report containing:

- (1) The certified analysis, from a laboratory with current ISO Certificate (copy of Cert. to be attached) for this specific purpose, of each grade of thermoplastic material the Specialist proposes to use, and
- (2) The results of an examination of the application equipment the Specialist proposes to use. This examination shall be carried out by a company approved to do so by Transport Infrastructure Ireland. (In the event that a Company has up to date ISO Certification for maintenance of road marking machinery and apparatus including control devices this will be accepted as complying with this requirement on submission of such Certification to Transport Infrastructure Ireland for verification.



The submitted report shall relate to certification carried out within the previous six months. Any subsequent change in the source of thermoplastic material or the method of application shall be certified as acceptable by Transport Infrastructure Ireland or another approved agency before use.

22.19 MEASUREMENT/TESTING FREQUENCY

Measurements should be carried as follows:

On short sections (i.e., discreet sections of work of overall length less than 2kms) at least three locations should be tested at random intervals. At each location five luminance and five reflective measurements shall be taken. Furthermore, where skid resistance is being tested, three measurements should be taken at different spots over a twenty-metre length of either broken or continuous line.

On long sections (i.e., sections greater than 2kms) testing frequency may be extended to one location per kilometre. The frequency may be reduced further if in the opinion of the Employer's Representative the work is visually perceived to be up to standard.

If the measured values are not to specification or there is a wide variability in test results the frequency of testing should be increased to three locations per kilometre. The average test results per three locations should be reported. The Specialist shall be required to replace the whole or part of any section which fails to comply at the discretion of the Employer's Representative.

22.20 PERFORMANCE CLASSES

On application and during the period of guarantee, these properties, when measured in situ in an approved manner, shall not be less than the values stated below.

LUMINANCE (to EN 1436: 2018):

Luminance is the property of the marking which describes the brightness of its colour. The method of measurement for the luminance factor β should be in accordance with Annex C of EN 1436:2018.

- White Material B4: β (luminance factor) ≥ 50 (Texture depth $< 2\text{mm}$)
- White Material B3: $\beta \geq 40$ (Texture depth $\geq 2\text{mm}$)
- Yellow Material B2: $\beta \geq 30$

REFLECTIVITY (to EN 1436: 2018):

Reflectivity is a measure of the reflection of light in a given direction of observation. The method of measurement should be in accordance with Annex B of EN 1436: 2018.

- White Material R2: $RL \geq 100$
- Yellow Material R1: $RL \geq 80$

SKID RESISTANCE (to):

The classes of performance for skid resistance of road markings are set out in EN 1436: 2018.

- White Material S2: SRT $\geq$ 50
- Yellow Material S2: SRT $\geq$ 50

DURABILITY:

In any 100m length of road marking continuous or broken line, at least 90 per cent of the marked areas shall contain a uniform coating of marking material through which the underlying surfacing has not penetrated. Discontinuities over the full width of line, due to wear, shall not be accepted in continuous lines. At least 75 per cent of each marked segment of a broken line shall remain intact.

CHROMATICITY:

Chromaticity is the definition of the colour of the line by reference to the Commission Internationale de l'Éclairage (CIE) chromaticity diagram to define the area within which the colour must fall. It is measured in accordance with the method given in Annex C of EN 1436: 2018.

The colour of White material shall fall within the boundaries of the four-sided figure as defined by the 'x' & 'y' coordinates of four corner points on the Chromaticity chart as set out below. The colour of Yellow material shall fall within the boundaries of the figure as defined by the 'x' & 'y' coordinates of the points on the Chromaticity chart as set out below.

The corner points of chromaticity regions on the CIE chromaticity diagram for white and yellow road markings shall be as set out below:

Chromaticity					
Colour		Comer 1	Comer 2	Comer 3	Comer 4
White	x	0.355	0.305	0.285	0.335
	y	0.355	0.305	0.325	0.375
Yellow	x	0.443	0.545	0.465	0.389
	y	0.399	0.455	0.535	0.431

22.21 LINE DIMENSION TOLERANCES

- (1) Line Width: Specified width +10% to -5%
- (2) Line thickness: Minimum 2.5mm for guaranteed lines (maximum thickness shall not exceed 5mm in any case)
- (3) Line Length: (Segments up to 4m long). The average of any 10 consecutive segments shall be between + or - 50mm of the specified length and no one segment within that 10 shall be less than the specified length by more than 75mm. Quantities for payment will make no allowance for any extra lengths. Where lengths fall short of the specified length removal of the markings will be required.

- (4) On the newly constructed roads being marked for the first time, the lateral placing of the markings shall be within tolerances of $\pm 10\text{mm}$ of the design position as set out by the Specialist or as described in the scheme drawings.

Note 1: Notwithstanding the requirements and tolerances in the specifications for line dimensions, the phenomenon of an excess flow or 'fishtailing' of material at the point where lines, particularly extruded lines, commence or terminate is undesirable. (This is more likely to occur in the laying of broken yellow or white lines). Where such phenomenon is identified, particularly where repetitive it shall be deemed not to comply and it shall be open to the Employer's Representative to reject such work. Excess spray and spray drift particularly where repetitive shall be treated similarly.

Note 2: The lines shall be laid in a smooth flowing alignment. Visible interruptions shall not be accepted. Line edges shall be clearly defined.

22.22 CONTINUOUS AND RAISED RIB MARKINGS

At continuous road markings or raised rib markings gaps of 10-25mm shall be provided every 15m to allow drainage of the pavement.

Spacing of Traverse raised ribs shall be 500mm c/c. The raised rib shall be 8mm.

22.23 TEMPORARY ROAD MARKINGS

Temporary road markings type shall be subject to the approval of the Employer's Representative.

All road marking works are to be completed as soon as is practicable after completion of the surface course.

22.24 REMOVAL OF ROAD MARKINGS

The marking shall be removed from the road surface in so far as is practicable utilising modern available equipment. The existing road surface shall not be damaged by the removal operation except insofar as a slight difference in texture will be tolerated between the area of pavement underneath the removed markings and the rest of the pavement.

The Road Marking Specialist shall submit a description, on his own notepaper, of the methods he proposes to use in removing the markings. Acceptable methods of removal include sand blasting, scabbling and water jetting. Burning off shall only be permitted subject to the approval in advance by the Employer's Representative.

22.25 ROAD STUDS

Road stud location, colouration, orientation and spacing will be in accordance with the latest version of the Department of Transport's Traffic Signs Manual.

Reflecting road studs shall be:

- Type 1 – depressible self-cleaning, reflecting of the "cat's-eye" type, complying with BS 873:Part 4. They shall be installed as recommended by the manufacturer.



22.26 FIXING OF GULLIES

Gully pots shall be bedded on and surrounded with concrete, min Grade C16/20, to an appropriate thickness. Grates shall be centred on pots at a maximum distance of 25mm from the kerb.

22.27 NATURAL STONE

Natural stone shall be of durable quality, uniform in texture and free from iron bands, spots, sand holes, flaws, shakes and other imperfections which would adversely affect its strength and appearance. The dimensions of stones shall be adequate for proper coursing and bonding. Add mortar mix.

22.28 DRESSED NATURAL STONE KERBS, CHANNELS, QUADRANTS AND SETTS

New dressed granite and whinstone kerbs, channels, quadrants and setts shall comply with the relevant provisions of IS EN 1342 and IS EN 1343.

Second hand stone kerbs, channels, quadrants and setts shall not be excessively weathered, worn or chipped, and shall be free from all bedding and jointing materials. Faces which are to remain exposed on completion of the Works shall be free from stains.

22.29 PRECAST CONCRETE KERBS, CHANNELS, EDGINGS AND QUADRANTS

Precast concrete kerbs, channels, and edgings shall be hydraulically pressed, and they shall comply with IS 146. Where kerbs or channels are required to be laid to a radius of 12 metres or less, components of the appropriate radius shall be used.

22.30 GATE PIERS – ORDINARY TYPE

Unless otherwise instructed or shown on the detail drawings, piers shall be 450mm square by 1.80 metres high overground level on a footing 900mm square and carried to a firm foundation. Weathered and throated pier caps 100mm thick at their edges and extending 75mm beyond the edges of the piers shall slope at 1 in 6 to a pyramidal apex. The piers and caps shall be constructed in Grade C16/20 concrete and shall be plastered 1:3 cement mortar in two coats the final coat being floated to a smooth finish. Hanging irons shall be built into the piers and accurately spaced to take the 3.00 metre gates.

22.31 CONCRETE KERBS

Where cast in situ concrete kerbs are proposed they shall be either 250mm deep by 150mm thick laid on a 100mm thick x 300mm wide concrete bed and haunch or be designed to sit 50mm on to finished concrete carriageway surface being 175mm thick on top section and 125mm thick on lower section. Concrete throughout shall be Grade C20/25 Concrete with maximum size of aggregate 20mm. Where precast kerbs are used, they shall be 250mm x 125mm complying with IS 146 and shall be laid on a 100mm thick by 300mm wide concrete bed and haunch Grade C16/20 concrete. Alternative kerb types at carriageway edges shall be subject to approval.



22.32 SITE SIGNAGE

A provision is to be made within the contract sum for the supply and fit of the estate name to be located at the entrance to the development.

Provision should be made for the supply and fit of house names and numbers located at the entrance to each dwelling and at the first junction into the site.

22.33 WARNING SIGNS

The Contractor shall wherever necessary erect warning signs of size and colour and with lettering to the approval of the Road Authority indicating that there is a constructional hazard “including a warning, where necessary, of restricted sight distances”. He shall erect appropriate signs for the benefit of construction traffic to alert of dangers and for the benefit of the public road users to alert them of the danger of emerging construction traffic from the site. Such signs shall be arranged with the Employer’s Representative Site Staff and the Employer’s Personnel shall be consulted as to the location of signs, which may only be erected with his permission first obtained. All such signs shall be properly maintained while in use and shall be removed when need for them is no longer apparent.

Adequate warning to drivers approaching an excavation or road obstruction shall be provided with warning boards which meet the requirements of Chapter 8 of the Traffic Signs Manual. Such warning boards shall be maintained in a clean and easily legible condition and shall be moved daily or as required as the work proceeds so as always to be properly positioned for the convenience of road users.

Notwithstanding compliance with statutory public notices in the Press etc. where Roads are closed, the Contractor must provide Diversion Notices complying with the above Guidelines at all such locations as may be necessary so that no user of the road is obliged to retrace his steps upon discovery of the Works and the obstruction to passage.

22.34 DAMAGE TO ROADS AND STREETS

If through the improper use of excavating machinery or through carelessness or for any other avoidable reason the Contractor excavates trenches to greater widths than are specified, or if in the remaining portions of roadways, pavement or footpath, damage is done to surfaces by heavy machinery the Contractor shall be entirely responsible for the complete restoration of the surfaces so damaged and shall himself restore them to the condition in which they were before the Contractor commenced his operations, or shall pay to the owner or Local Authority the certified costs of such repairs.

22.35 INTERFERENCE WITH UNDERGROUND SERVICES

The Contractor shall comply with the latest revision of the “Code of Practice for Avoiding Danger from Underground Services” published by the Health and Safety Authority.

Before the commencement of work in any area where there is likelihood of interference with Underground Services of any kind, the Contractor must first of all consult with all the Service Authorities and obtain from them site location information.

Where locations of existing services are identified following consultation with the Services Authorities the Contractor shall, if necessary, carry out trial excavations or other investigations



so that all available information regarding the service may be obtained before excavating in the vicinity of same. Where an unanticipated service is encountered in excavation the Contractor shall immediately call the attention of the Employer's Representative Site Staff and the appropriate Authority thereto.

A proper record shall be kept showing the precise position of services encountered. Location seeking of the various services can only be carried out under the supervision of the particular Authority concerned with that service.

The Contractor shall make all arrangements for the temporary shoring up and supporting, diversion when permitted by the owner, and keeping in operation all sewers, drains, land drains, gas, water and other pipes, culverts, electricity and telephone cables, etc., as may be affected, disturbed or exposed by his operations. In the event of any damage during or after the execution of the Works, he shall immediately notify the Authority or owner concerned and shall be liable for the full cost of such remedial works as may be determined by that Authority or owner and including consequential damage to the property of third parties which may arise from the execution of the Works.

Where permanent diversion or permanent support is rendered necessary as the unavoidable result of the construction of the Works in accordance with the Contract or where in the opinion of the Employer's Representative Site Staff the position of existing services over 75mm external diameter which cross the permanent work for a distance not less than five times the net width thereof warrants temporary diversion or support the Employer's Representative Site Staff will instruct the Contractor accordingly.

Before commencing any work which may affect the flow in any sewer or storm drain the Contractor shall submit, and obtain the approval of the Employer's Representative to, his detailed proposals for maintaining or temporarily diverting the flow. Standby pumping equipment with day and night attendance shall be provided where the Contractor proposes to pump the flow and in general he shall provide and fix all necessary dams, chutes, tanks and other plant and labour as may be required.

Temporary pumping for diversions or over pumping of existing sewers shall be arranged with electrically operated pumps from ESB mains supply as the continuous 24 hour running of diesel pumps or generators adjacent to residential properties will not be permitted.

The Employer's Representative will not approve any proposal for the temporary diversion of flow, which does not provide capacity equal to or greater than that which it replaces or which unnecessarily affects the sewer conditions upstream. Notwithstanding that such works may be required only for a limited period they shall if so required by the Employer's Representative be constructed to a standard similar to that specified for the permanent works.

Any temporary works constructed for the diversion of flow shall be entirely removed and the connections to the existing structures made good if and when the Employer's Representative shall so order. Where the Employer's Representative considers that the removal of the temporary works would involve risk to the permanent works or other structures or would give rise to undesirable further opening up of ground surfaces he may direct the Contractor that such temporary works are to be cleaned out and filled in as specified.

22.36 OBSTRUCTION OF ROADS

The Contractor shall not occupy or obstruct by his operation more than one half of the width of any road or street.



If it becomes necessary with the approval of the Local Authority first obtained to restrict traffic to a single lane, properly trained and alert flagmen shall be provided to direct traffic. One-way traffic will not be permitted over continuous lengths of road exceeding 100 metres except in very exceptional circumstances or where the density of traffic is light.

22.37 CLOSING OF ROADS AND TEMPORARY BRIDGES

In streets or along roads where traffic may conveniently be diverted the Contractor may make written application for permission to close a road. Before any road can be closed to vehicular traffic the Contractor must have obtained the written consent of the Employer's Representative and the Employer and must ensure that all statutory obligations preliminary to the closing of the road have been complied with. Even if a road is closed to vehicular traffic a footway for pedestrian traffic must be kept clear.

In addition to the obligation imposed upon the Contractor under the provisions of other Clauses to provide temporary footways and bridges in locations where private holdings are divided into two parcels by a pipeline trench, the Contractor will also be obliged to provide a similar convenience for the public while trenches are open in all roads, either Public or Private. Such temporary bridges shall be built solid with 225mm x 75mm planks tightly cramped together with a minimum width of 1600mm or alternatively sheet steel properly supported may be used. Guardrails 900mm over the deck of the temporary bridges shall be provided and toe boards shall be fixed 225mm high on each side of the footway. Entries to footways shall be kept clean and spoil heaps shall be kept back so that accident or injury to pedestrians will be obviated.

23.0 DEMOLITION

23.1 GENERAL

Demolition work shall be carried out in accordance with British Standard Codes of Practice; BS 6187: 2011 (Code of Practice for Demolition and BS 5228 Pt 1, 2 & 4 (Noise and Vibration Control), or any other relevant code of practice.

The necessary demolitions, removals and alterations are shown on the drawings. These shall be carried out carefully with regard to existing surroundings.

The order and method of each operation is to be submitted to the Architect/Engineer for review prior to commencement. This to include proposed methods of propping, shoring, protection of adjoining areas, property, retained structures et cetera.

Notwithstanding any information given in the Contract documents, the onus shall be on the Contractor to visit the site of the works and satisfy himself as to the nature and extent of the work and all other matters that might influence his price or time for completion of the works. Arrangements to visit the site should be made with the Client / Engineer.

23.1.1 Retained Property/Temporary Works

The demolitions shall be carried out without damage to retained property or adjoining areas. If such damage should occur, through negligence in the carrying out of this demolition, the Contractor shall reinstate and make good at his own expense. Any such reinstatement shall be executed with materials and workmanship to match the existing work.

23.1.2 Working Hours

Demolition Work shall be carried out during the hours as set out in the Planning Guidelines / as specified within the Contract. The Contractor shall liaise with the Architect / Engineer with all matters relating to the Planning Conditions.

23.1.3 Supervision

Demolition work is to be carried out under the supervision of a responsible and competent person experienced in demolition work who shall ensure that adequate safety precautions are taken at all times, and that all necessary statutory regulations are fully adhered to.

Before commencement of works, the Contractor is to advise the Client in writing of the name and contact details of the Contractor's Site Manager.

23.1.4 Safety

The Contractor shall perform the demolition works in accordance with Safety, Health and Welfare at Work (Construction) Regulations 2013.

They will also ensure the safety of the works and the public during demolition work and carry out demolition works in such a manner as to cause the minimum inconvenience to the site users, the public and to adjoining owners.

The Contractor will be held responsible for any claim that may arise from disregarding this clause.

23.1.5 Plant and Equipment

All demolition plant equipment is to be:

- Of suitable types and standards for the location and type of work.
- In the charge of competent operators.
- Maintained in good working condition.

Materials arising from the demolitions are to become the property of the Contractor and are to be removed from site as the work proceeds. Credit should be allowed at the end of the demolitions section for any materials upon which the Contractor places a value, and the Employer reserves the right to retain or purchase any or all of the materials at the credit value shown, should they so wish. If any items are not so listed, it will be deemed that the Contractor regards the materials concerned as having no value.

23.1.6 Making Good

All making good after demolition and removal either shown or described on the drawings, or inferable, or necessary shall be carried out, in all trades, to the Engineers satisfaction.

23.1.7 Avoidance of Nuisance

Demolition waste, rubble, etc. is to be well sprinkled with water to prevent dust arising and prices for the carrying out of work shall include for all necessary scaffolding and plant and for the removal off site of all materials not being re-used.

23.1.8 Reinstate and Make Good

All taking down shall be carried out without damage to adjoining property and if such damage shall occur, the Contractor shall reinstate and make good the same at his own expense. Any taking down in excess of what is intended shall be made good together with any consequential work at the Contractor's expense.

23.1.9 Temporary Hoardings

The Contractor shall provide and maintain all necessary temporary fencing, hoardings, fans, planked footways, guard rails, gantries and the like for the protection of the public and for meeting the requirements to the Local Authority. They shall also allow for altering, shifting and adapting from time to time the temporary fencing, hoardings, etc as necessary. It is the Contractor's responsibility to apply for a hoarding licence and pay the relevant fees.

23.1.10 Demolitions and Cutting

Demolition and cutting of reinforced concrete must be carefully executed and is to be carried out by a specialist sub-Contractor. The specialist sub-Contractor shall have the necessary plant, tools and equipment to carry out the accurate cutting and demolition of reinforced and concrete walls and floors and shall have extensive experience in the execution of this type of work. The sub-Contractor shall also carry the required demolition insurance. Cutting is to be carried out so that the cut surfaces, which remain after the cutting operations, are smooth and square to the walls and floor and without spoiling and unevenness of the concrete cut surface.

The Demolition Contractor shall scabble and roughen the cut face of all demolition cut surfaces where materials are to be bonded or applied over the cut surfaces (all in compliance with the current safety regulations and with a minimum of risk for the operators).

The specialist sub-Contractor shall carry out all necessary work for the complete demolition, cutting, and removal from site of waste demolition material. The sub-Contractor shall carry out the drilling of any holes in the work for lifting or lowering or other purpose and shall provide all temporary angled or other propping for the stabilisation of cut pieces prior to their removal by him from existing position.

The specialist sub-Contractor shall liaise with the Main Contractor with regard to all operations of the sub-contract. He shall also liaise with the Main Contractor with regard to the Main Contractor's performance of work and site operation and agree on the integration of his work with the main Contractor's programme.

23.1.11 Methods of Demolition

The Main Contractor shall clearly indicate by Method Statement in writing the manner of demolition i.e., machine, mechanical tools, piece by piece hand method etc., for each area and specifically for adjoining existing buildings and boundaries.

It should be noted that demolition must be closely linked in with the provision of any temporary support required to adjoining buildings and the facade. All methods used shall ensure an orderly and safe transfer of the loads from the existing to the temporary works and to the permanent structure.

23.1.12 Completion

When the Contractor considers that the whole of the Works relating to the demolition of the building has been completed, he shall give written notice to that effect to the Client's Engineer.

The site is to be left neat and tidy to the satisfaction of the Main Client, Engineer and Architect.

23.2 REMOVAL OF ASBESTOS AND OTHER HAZARDOUS MATERIALS

23.2.1 Discovery

The Contractor shall:

- Give notice immediately of suspected asbestos containing materials discovered during demolition work.
- Avoid disturbing such materials
- Submit methods for safe removal.

23.3 PRELIMINARY WORK

23.3.1 Services

The Contractor shall arrange with the appropriate Authority for the location and marking of the position of services affected by the demolition work.



The Contractor is responsible for ensuring that all services, electricity, gas, telecommunications, water, sewerage etc., are made safe prior to demolition.

Any damage to services that are required to be maintained are to be made good at the Contractors expense. Any services that are required on site by the Contractor during the works are to be included in the contract sum.

The Contractor is responsible for the protection of overhead cables. He is to provide suitable measures to ensure all necessary precautions are undertaken and should have them clearly marked to ensure immediate identification.

23.3.2 Plans

The Contractor shall examine all available plans of buildings or structures to be demolished.

23.3.3 Disconnection of Services

Before starting demolition work the Contractor shall arrange with the appropriate Authority for the disconnection of services and removal of fittings and equipment. The Contractor shall pay all charges for disconnection of services.

23.3.4 Schedules of Dilapidations

The Contractor is to include in his price for the works, the carrying out of a schedule of dilapidations on all adjoining properties. This schedule should be in the form of pictures and sketches including all defects noted in the properties. These schedules are to be provided to the Architect / Engineer and will require to be agreed between all parties including adjoining owners prior to commencement of any demolition works. After the works are complete the adjoining properties are to be inspected to ensure that no deterioration has taken place as a result of the demolition works. All costs associated with discussions / meetings with adjoining owners, or their representatives are deemed to be included in the contract sum.

23.4 PRECAUTIONARY MEASURES

23.4.1 Partly Demolished Structures

The Contractor shall prevent access of unauthorised persons to partly demolished structures. Leave safe at close of each day's work.

23.4.2 Dangerous Openings

The Contractor shall identify, illuminate and protect as necessary.

23.4.3 Overloading

The Contractor shall prevent debris from overloading any part of the structure.

23.4.4 Dust

Debris shall be watered where necessary to prevent the rising of dust. The demolition site is to be kept in a safe condition and materials shall not be stored in a manner likely to cause injury or nuisance to people on the site and adjoining owners. The Contractor shall make arrangements



that debris, dirt etc is not allowed accumulate outside the site. All public roads and footpaths are to be kept clean.

The Contractor shall ensure that all public roads and pathways in the vicinity of the demolition works are at all times kept clear of waste and mud falling from vehicles connected with the Works or soiling or staining of the public road as a result of the Works in any way.

23.4.5 Support

The Contractor shall support the existing structure as necessary during cutting of new openings or replacement of structural parts. The Contractor shall not remove supports until the new work is strong enough to support the existing structure.

23.4.6 Protect

The Contractor shall protect the parts of existing building which are to be retained. Cut away and strip out with care to reduce the amount of making good to a minimum.

23.4.7 Shoring Props, Etc.

It shall be for the Contractor to judge whether or not any necessary removal or demolition gives rise to the need for temporary shoring or props. He shall be deemed to exercise expert judgement in this matter. The Engineer may be consulted but the decision to use or not use shoring or props rests with the Contractor who shall be solely liable for the proper design of any shoring or props, shall be liable for any damage resulting from failure to use temporary supports in any situation where common practice and prudent judgement indicate that they required to be used.

23.4.8 Noise

The attention of the Contractor is drawn to the particular requirements of the Contract to minimise the noise created by the works. He is required to take all necessary precautions to reduce noise and to not create noise during the periods stipulated in the Contract.

23.4.9 Monitoring of Adjacent Buildings

It may be a requirement that adjacent buildings have movement monitoring equipment (tell tales) installed before or during demolition. The Contractor shall provide suitable ladders and assistance for installation.

23.4.10 Protection of Property, Public, Hoardings

The Contractor shall provide and erect to the satisfaction of the Engineer all necessary protective screens or scaffolds that may be required, of a sufficiently substantial nature to prevent damage, nuisance or disturbance by debris or dust to adjoining properties, public highways or persons or traffic passing nearby.

During the demolition works no wall or part of the structure shall be left in a dangerous or insecure condition at any time when a representative of the Contractor is not on the site, and adequate barriers and (after darkness) lamps shall be provided to warn users of the public highway of any obstruction or danger.

The Contractor shall bear in mind that demolition sites are of special attraction to children and shall take all reasonable precautions to warn children of the danger of trespassing and to deter

them from so doing. The Contractor must keep all public footpaths adjoining the sites available at all times for use by the public, and the stacking of timber and other materials thereon is expressly forbidden.

The Contractor shall perform the demolition works with respect to the wind direction and shall implement all appropriate and necessary measures to ensure minimal dust nuisance to the surrounding environment.

The demolition of the property is to be carried out in such a manner as to cause as little inconvenience to adjoining property owners and/or the public as possible, and the Contractor will be held responsible for any claim which may arise from disregard of this clause.

23.4.11 Pricing on Site

The Contractor is deemed to have visited the site and ascertained the full extent and nature of the demolitions.

23.5 MATERIALS ARISING

23.5.1 Contractors Property

Components and materials arising from the demolition are deemed to be the property of the Demolition Contractor except where otherwise provided. The Contractor is responsible for its safe removal from site as work proceeds.

24.0 CODE OF PRACTICE FOR WORKING ON PRIVATE LANDS

24.1 COMMENCEMENT OF WORKS

Written Notice of intention to commence work shall be given to the owners along the wayleaves for the works and along any temporary wayleaves acquired for access before entry is made onto private land. The notice shall be as long as possible, but a minimum of one month's notice of commencement shall be given. The work shall be carried out in accordance with a programme of which the owners shall be kept informed.

The Contractor shall inform the landowners of the name, address and telephone number of the person to whom queries may be addressed.

Where possible entry onto the working strip will be made only at points where it intersects public roads. The Contractor will not be authorised to operate on land outside the working strip without prior permission of the owner except where a separate temporary wayleave is acquired for access.

24.2 RECORD OF CONDITIONS

The Contractor or a competent and authorised representative shall in conjunction with the Employer's Representative Site Staff inspect all private lands prior to the commencement of works in such lands. The Contractor or a competent and authorised representative shall prepare a written Report on the conditions and features of the wayleave area based on the inspection. The Contractor shall take photographs to indicate typical surface conditions, unusual features and all fence crossings. The written Report and photographs shall be submitted to the Employer's Representative.

24.3 DURATION OF OCCUPATION

The Contractor shall complete all works within the area of each ownership or occupation within a period not exceeding twelve months from first entry (trial holes excluded) or prior to the Date for Substantial Completion, whichever period is the lesser, except that he may return for maintenance purposes or for seeding and re-seeding in the proper season. Where other periods are stipulated in Sections 1 to 4 inclusive these shall take precedence over this Clause.

24.4 TRIAL HOLES

Trial Holes in advance of the work, where necessary or specified, shall be opened only after consultation with the owners. The method shall be such as to cause the least disturbance to crops. Stones shall not be left on the surface when the holes are reinstated. On no account shall any trial hole be left unattended or unguarded for any period of time.

24.5 TREES/TIMBER

Trees shall be removed only where specified, or where they cause obstruction to the permanent works or severely obstruct the construction of the works. Trees for removal shall be determined by the Representatives of both the Contractor and the Employer's Representative in conjunction with the setting out of the works. The Contractor shall take all necessary steps to ensure that other trees are not damaged during the construction of the works.

If it is specified in Section 1 that the landowners require to retain the timber specified for removal the Contractor shall place the timber at the specified locations. Otherwise, the Contractor shall dispose of the trees off the site.

On completion of the Works, the Contractor shall employ a specialist to supply, plant and maintain (for a period of 12 months) the number of species of trees as set out in the Section 1 or as shown on the Drawings.

The Contractor shall replace at his own cost all trees removed or damaged by him during the course of the construction of the works other than those specified or designated for removal by representatives of the Contractor and the Employer's Representative.

24.6 FENCING

The specification for fencing of wayleaves in urban areas where protection of persons is of main concern is dealt with under Section Three. This particular Clause relates to stock proof fencing.

All temporary fencing shall be erected in position, by the Contractor, before construction work commences. The temporary fencing shall only be removed, by the Contractor, following certification by the Employer's Representative that the reinstatement of land is complete.

Unless otherwise specified in Section 1 or shown on the Drawings, the methods of fencing the Wayleave shall be as follows:

The fencing shall consist of four strands of 75mm (3") barbed wire, together with 75mm square timber posts, or similar fencing material 2 metres long, 600mm of which shall be driven into the ground, and set not more than 3 metres apart, on both sides, where appropriate, of the Working Strip. Straining posts, if necessary, shall be erected where appropriate and at changes of direction of the fence.

Any special requirements in relation to the provision of paddock fencing or sheep wire is set out in Section 1 or shown on the Drawings.

Fences, walls and hedges, where broken by the Contractor within the Wayleave area, shall be replaced with similar materials in each case.

24.7 FARM ROADWAYS AND PASSES

Where acquired wayleaves cross existing farm pathways or roadways, the Contractor shall provide a means of crossing them as specified in Section 1 or as shown on the Drawings. Where an existing access is obstructed, the Contractor shall provide adequate facilities for passage of persons, livestock and machinery across the working strip / wayleave. All permanent pathways, roadways affected shall be restored to a satisfactory state to at least match the state prior to occupation of the wayleave by the Contractor. In all cases, access shall be provided for the owners when reasonably required.

24.8 WATER SUPPLIES

All water courses and water supplies shall be protected in so far as possible against contamination from silts, mineral oils or other materials arising from the work. All proper steps shall be taken to avoid any interference with water supplies. Before occupation of wayleaves or carrying out trial investigations, the Contractor shall acquaint himself with the position, type

and size of all underground services. In the event of a water pipe being severed, the Contractor shall carry out immediate repairs. In the event of a well or other private water supply within the wayleave area being permanently affected or destroyed by the permanent works the Contractor shall construct an alternative supply pending the provision of which, the Contractor shall provide an appropriate temporary supply.

24.9 DRINKING TROUGHS

Where cattle drinking troughs are located within the wayleave / working strip, temporary drinking troughs of similar standard shall be provided at sites specified, or otherwise agreed between the owner and Contractor, outside the wayleave. On completion of the works all troughs shall, unless otherwise agreed between the owner and Contractor, be replaced in their original position. Where cattle are cut off from their usual drinking sources by the fenced wayleave / working strip, alternative facilities shall be provided.

24.10 SEWERS, SEPTIC TANKS AND OTHER SERVICES

Where excavations or the works interfere with sewers, septic tanks, or other services, within the wayleave, these facilities shall be maintained by the Contractor without interruption during the course of the work.

24.11 LAND DRAINS

Particular care shall be taken to ensure that a minimum amount of damage or disturbance is caused to land drains.

Where an open land drain traverses a wayleave and access is required across the land drain the Contractor shall install a temporary pipe / culvert system to facilitate the normal flow of water within the land drain during the works.

All land drains interfered with by the work shall be finally restored to as good a condition as before the commencement of works.

Where any land outside the strip is affected as a result of interference during the duration of the works, with either the natural or artificial drainage, the damage shall be rectified by the Contractor.

24.12 TOPSOIL

All topsoil to an existing depth shall be stripped from the entire wayleave width, shall be kept separate from other existing or imported materials, shall be stacked to one side of the working Strip, shall be kept free from the passage of vehicles and plant and shall be replaced carefully after completion of the works.

Prior to replacement the stockpile of topsoil shall be sprayed with a suitable pesticide to eradicate any weed growth. The spraying shall take place at a suitable timeframe before movement of the topsoil that ensure full eradication of the weed growth.

24.13 BACKFILLING OF PIPELINE TRENCHES

Backfilling of pipeline trenches between the top of pipe surround and the underside of the topsoil layer shall consist of selected excavated material, comply with the requirements of “Acceptable Material” as outlined in Clause 601 of the TII Specification for Roadworks Table 6/1, Class 8, Class 2 unless otherwise specified in Sections 1 to 4. Where there is not sufficient suitable excavated material for backfilling then imported material to be agreed with the Employer’s Representative shall be used.

Where broken rock is returned to the trenches as backfilling, it shall not be placed within 300mm of the finished surface level and shall be a maximum of 40mm nominal diameter.

On sections of the pipeline where rock is removed from the trenches, priority shall be given to the removal off site of the broken rock as surplus excavation.

24.14 REINSTATEMENT OF LAND

The Contractor shall be responsible for restoring all ground within the wayleave / working strip and any other ground accidentally disturbed by his operations, to a condition equivalent to that existing before the commencement of the works. This means that topsoil shall in the first instance be removed from the full wayleave width and replaced at final restoration time again for the full width of the acquired wayleave.

Reinstatement of land shall involve:

- (a) After the sub-soil has been replaced the wayleave shall be ripped with a mechanical ripper to a uniform depth of 30 to 45 cm. (12 to 18 inches). Additional mole ploughing or sub-soiling shall be done in areas where compaction deeper than 45 cm. has occurred. This work is to be carried out under suitable soil and weather conditions. All surface stones and roots over 15 cm. (6”) in any direction shall be picked before any topsoil is put back.
- (b) The topsoil should be left in a loose and friable condition.
- (c) The ground shall be graded so as to present a neat and level appearance.
- (d) The removal of all stones in excess of 50mm (2”) in any direction from the surface.
- (e) The reseedling of the area of grassland as specified. The rate of seeding and selection of seed mix and time and method of sowing including application of fertiliser shall be as specified or as otherwise agreed between the Landowner and the Contractor. Land under tillage shall not be reseeded or fertilised unless otherwise specified in Section 1.
- (f) Driving over the land where topsoil has been put back shall be kept to a minimum, particularly in wet weather. Mechanical equipment, heavier than standard tractors and trailers, shall not be allowed travel back over the topsoil.
- (g) Where a weed problem exists as a result of the Works, chemical sprays shall be used in accordance with the Sustainable Use (of pesticides and herbicides)

Directive.. Where organic farming is practiced the approach to the weed problem shall be agreed between the Contractor and the landowner.

24.15 RE-STATEMENT OF PRIVATE ROADWAYS, DRIVEWAYS, HARDSTANDING AND BOUNDARY WALLS AND FENCES

The Contractor shall be responsible for restoring all private roadways, driveways, hardstanding and any boundary walls and fences affected by the works to a condition equivalent to that existing before the commencement of the works.

24.16 COMPLETION OF WORKS

On completion of the works, the Contractor shall remove all temporary buildings, roadways, surplus spoil, stones or gravel and any debris such as trees, brush woods and any other material that does not naturally belong on the site and is put there resulting from the works by the Contractor.

24.17 SUPPORT OF STRUCTURES

Temporary underpinning supports and other protective measures for buildings, structures and apparatus in or adjacent to the works area shall be of proper design and sound construction and shall be securely placed to the reasonable satisfaction of the owner and Employer's Representative.

24.18 MARKER POSTS

Marker posts, where required, shall be sited by agreement between the owner and the Contractor and as far as practicable shall be sited adjacent to hedges or fences.

24.19 STRAYING STOCK

The Contractor, after consultation with the owner, shall take all necessary precautions to prevent the straying of the owners livestock and will extend his Public Liability Policy to provide an indemnity to the Landowner in respect of claims arising due to the negligence of the Contractor.

24.20 ANIMAL DISEASE

The Contractor shall comply with any regulation which may be necessary in connection with any Department of Agricultural Disease Eradication Scheme.

24.21 INSPECTION AND MAINTENANCE

Except in the case of emergency, notice shall be given to the owner of any subsequent entry for purposes of maintenance or inspection of the works. The owner shall be consulted as to the means of access necessary to carry out such works.

24.22 SPORTING RIGHTS

The Contractor shall take all reasonable and practicable steps to protect fishing and sporting rights from damage or other interference.

24.23 SUPERVISION OF WORKS

The Employer's Representative Site Staff shall observe and oversee the works. The duties of the Employer's Representative Site Staff shall include the following:-

1. Inspect and agree, in conjunction with the Contractor, the condition of all lands affected by the wayleave before any works commence.
2. Supervision of topsoil removal.
3. Supervision of restoration of land drains broken or damaged during the course of the works.
4. Supervision of backfilling of trenches and checking on consolidation of same.
5. Inspection of boundaries before removal and ensuring that they are adequately restored.
6. Inspection of permanent restoration of surfaces topsoil for same and planting of trees, shrubs, etc.
7. Inspection of temporary fencing and ensuring adequacy of same with particular reference to disease control.
8. Inspection of the temporary fencing removal by the Contractor.

24.24 LANDOWNERS AGREEMENT

On completion of the Works the Contractor shall obtain the written agreement of the Landowners that the restoration work has been carried out to their satisfaction.

