

Additional Accommodation Queen of Angels Primary School, Sandyford, Dublin 16

Civil & Structural Specification Document – General

DOCUMENT CONTROL SHEET

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Reviewer	Alan Armstrong	Signed: 
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PROJECT DESCRIPTION

The Board of Management intend to construct a development at Queen of Angels Primary School, Sandyford, Dublin 16 for extension and refurbishment works to the existing school Building.

This development will consist of the following:

The development will consist of extensions to and alterations within the existing school as follows, including:

- Construction of proposed entrance canopy, entrance lobby.
- Construction of three mainstream classrooms with associated toilets and linking corridor circulation.
- Construction of two special education needs classrooms and associated quiet spaces and toilets for independent use.
- Construction of a central activity space with daily living skills area, storage, sensory room, secure lobby, SEN Office, universal access toilet and two staff toilets,
- Works include alterations to existing existing school consisting of alterations to classroom windows.
- Works further include removal of one tree and part existing hedge in order to form SEN pupil & fire brigade access to building.
- Works also include the creation of six additional parking spaces including one disabled parking space and installation of an attenuation with infiltration.
- Associated site development works, including staff carpark realignment with new fencing with gates and a new replacement Ball Court to the east of the school buildings with all associated site development works.

1 GENERAL REQUIREMENTS

1.1 METHOD STATEMENT

At least 2 weeks prior to commencing works to a defined Works Area, the Contractor shall provide a Method Statement and Risk Assessment (MSRA) describing their proposed general and detailed arrangements, and methods for carrying out the works for approval by the Employer/ Employer's Representative. A minimum of 5 working days shall be allowed for review and comment. The MSRA shall include details of how all stages of the works will be executed, in particular where any works can have potential interfaces with staff/ public areas, rock breaking methodology, site infrastructure or involve any temporary outages or changes to traffic or pedestrian management. It shall also highlight the appropriate health and safety requirements and any specialist training the site personnel will require before working on the sites.

The MSRA should also take account of any and all requirements with regard to phasing of the works if set out in these Works Requirements or agreed with the Employer/ Employer's Representative.

1.2 SUPERVISION

The Contractor shall ensure adequate managerial supervision of the sites and shall provide a competent foreman to be continuously employed on the sites while work is in progress and for him, as the Contractor's representative, to receive and carry out any instructions issued to him by the Employer's Representative.

1.3 DOCUMENTS

The Contractor shall keep, at the location of the works, copies of the contract drawings and specification. These are to be available at all times to his foreman and the Employer's Representative.

1.4 PROCEDURE

No variation from the sequence and nature of the works detailed in these Works Requirements will be permitted except with the prior written consent of Employer's Representative.

1.5 STANDARD OF WORK

The Contractor shall carry out the works in a professional and competent manner. The Contractor shall adhere to industry best practice throughout the duration of the project. The Contractor shall take all due care to ensure that no damage occurs to those elements of the site not included in the works, including the existing access road to the site via the L4009, and in the proximity of any works along the

L4009. This shall include but not be limited to: existing car parking areas, paving areas, roadways, footpaths, public areas, soft landscaping, drainage systems, existing ICT, mechanical and electrical infrastructure. The Contractor is reminded that site forms part of a live educational environment and includes pedestrian routes, roadways, parking areas, public areas, common areas and entry/exit points all of which must be maintained fully operational during the course of the works. Any damage caused by the Contractor's negligence or lack of care shall be repaired at the Contractor's own cost and the Contractor will indemnify the Employer against all claims that may result from such damage.

1.6 HEALTH & SAFETY

The Contractor shall carry out all operations associated with the specified works in accordance with all current legislation and, in particular, in accordance with the Safety, Health and Welfare Act 2005 and Safety, Health and Welfare at Work (Construction) Regulations 2013.

The Contractor will also be appointed as Project Supervisor Construction Stage (PSCS) as per the Safety, Health and Welfare at Work (Construction) Regulations 2013 and any amendment to them. The Contractor is expected to fulfil all the duties assigned to him through these regulations.

As PSCS the Contractor will be deemed to have included for all costs/ tasks associated with following the advice in relation to COVID-19 and Construction Works from the HSE, the Health Protection Surveillance Centre, The Department of Health and the Health and Safety Authority.

2 WORKING PRACTICES

2.1 LABOUR, PLANT ETC.

The Contractor shall supply all labour, approved tools, plant and equipment necessary for the efficient execution of the works. He shall comply with all statutory regulations and shall provide such storage sheds, canteens, latrines and shelters as may be required, maintaining same during the contract in a thoroughly sanitary and hygienic manner and clear away on completion to the satisfaction of the Employer's Representative/ Client. All temporary accommodation shall meet the British Standard or other appropriate specifications and Health and Safety requirements current during the period of the Contract.

The Contractor must comply with the Registered Employment Agreement (Construction Industry Wages & Conditions of Employment) and (Construction Industry Pensions Assurance & Sick Pay).

2.2 DELIVERY, STORAGE AND REMOVAL OF MATERIALS

All loading and unloading of materials and plant, including that belonging to sub-contractors, is to take place within the boundaries of the site, except by specific agreement with the Employer's Representative.

Pedestrians, cyclists, staff and other road users are not to be adversely affected by the works.

Where some disruption may occur, e.g. during the delivery/ removal of spoil materials, the Contractor shall implement proper traffic and pedestrian management measures, including the provision of a suitably trained banksman, to direct delivery vehicles and other traffic/ road users in a safe and secure way.

2.3 SITE MAINTENANCE

The Contractor shall provide bins or other appropriate receptacles for all rubbish, waste etc. generated on-site. All food waste etc. shall be discarded properly into a waste receptacle with a closable and secure lid. No rubbish or waste is to be discarded within the sites.

2.4 PROVISION OF MATERIALS

Any work, when inspected, which are found by the Employer's Representative to be unsatisfactory or likely to produce unsound work, will be rejected. Any rejected works shall be removed from site and the Contractor shall take suitable corrective action. All rejected works shall be removed and replaced at the Contractors own expense.

Any delays caused by the rejection of the sample/work shall not, in any way, relieve the Contractor from his responsibility with regard to completion within the contract period.

2.5 CONTROL OF DUST

The Contractor shall conduct his operations so that as far as possible any dust settles within the site and is not carried beyond the immediate working area.

Any stockpiles of material subject to wind whipping shall be damped down and covered to ensure satisfactory dust control.

The Contractor shall provide, maintain and keep available plant and equipment necessary to minimize the formation and accumulation of dust arising from the Works, particularly in dry weather conditions. A water bowser shall be available at all times to keep dust from becoming airborne. The contractor shall bear in mind the sensitive location and surroundings of the site with regard to dust issues and control.

2.6 AVOIDANCE OF NUISANCE

2.6.1 Noise Control

The Contractor shall employ the best practical means to minimise noise produced by his operations, including plant maintenance, and shall comply with the recommendations in BS 5228 (Noise Control on Construction and Open Sites). The Health and Safety General Application Regulations, Chapter 1 of 5: Control of Noise at Work should also be adhered to fully.

All vehicles and mechanical plant used on the works shall be fitted with effective exhaust silencers and shall be maintained in good and efficient working order for the duration of the works in compliance with BS 5228. Machines in intermittent use shall be shut down in the periods between works or throttled down to a minimum. The Contractor shall remove from the works any item of plant which, in the opinion of the Employer's Representative, is ineffectively silenced. All compressors shall be "sound reduced" models fitted with properly lined and sealed acoustic covers which shall be kept closed whenever the machines are in use. All ancillary pneumatic percussive tools shall be fitted with mufflers or silencers of the type recommended by the manufacturers. Pumps and mechanical static plant shall be enclosed by acoustic sheds or screens where directed by the Employer's Representative.

Sound levels shall be monitored by methods set out in Appendix B of BS 5228. All measurements shall be made 1 m outside the facade of each building in question using a sound level meter conforming to IS EN 60651 on SLOW response.

Any plant, such as generators and pumps, which is required to work outside the hours of 09.00 to 17.00, shall be surrounded by an acoustic enclosure to the approval of the Employer's Representative which shall restrict the noise level to not less than 5 dB(A) below levels quoted hereunder.

The Contractor shall organise his operations with regard to the positioning of plant and the location of haul routes, etc., so as to minimise construction noise to adjacent properties.

The Contractor shall ensure that at all properties outside the site boundaries the sound levels arising from activities do not exceed the values shown in Table 4.1. If work is permitted outside of these hours (e.g. Preliminary Health & Safety Plan, Planning Conditions or elsewhere in the contract), limits of 50 (mean noise limit) and 55 (peak) are applicable.

Table 4.1 Maximum sound levels

	Working Period	Mean Noise Limit (1hr) dB(A)	Peak dB(A)
(a)	Monday - Friday 09.00-17.00	70	80

2.7 INCLEMENT WEATHER

The works or any part thereof shall be suspended temporarily by the Employer's Representative when, in his opinion, working conditions are unsuitable due to inclement weather. Work must cease when conditions are such that deep rutting of the soil or any other detriment could result.

2.8 HANDWORK

The Contractor shall allow in his pricing for the hand working on parts and conditions where the use of machinery will not produce results to the satisfaction the Employer's Representative. Handwork is required around existing services, pipes, drains and shrubs not to be removed as part of the works. The Contractor shall provide adequate and proper support to any items that require handwork. Hand excavation is advised to ensure that no services are damaged throughout the duration of the works.

2.9 WATER FOR WORKING

The Contractor shall provide his own water for use during the works. No water or other services are available at the sites.

2.10 POWER SUPPLY

The Contractor shall provide his own power supply for the duration of the works. No electricity or other power sources are available at the sites.

2.11 SETTING OUT

The contractor is responsible for the setting out of works and shall provide the Employer's Representative with their position and level in order that they may be checked and revised if necessary.

3 SITE SPECIFIC INFORMATION

3.1 SITE RESTRICTIONS

The Contractor shall secure the relevant Works Area against unauthorised entry by Staff or the Public. This is to be by agreement with the Employer as soon as access into the relevant Works Area has been obtained (e.g. erection of Herras Fencing to Works Areas externally, providing secure and defined boundaries to Works Areas internally to include measures to prevent noise and dust from affecting live working environments). This fencing shall not permit illegal access into the Works Area for that phase of the works.

The Contractor shall confine his personnel and material, plant etc. to the Works Area.

The Contractor shall take all due care to protect the residents of the school and residents on road and members of the public during the carrying out of works, particularly as the site is adjacent to a public road, access roads, car parking areas and a live residential environment.

Surface water generated by the development shall be kept within the confines of the working area and shall not adversely affect the adjoining routes during construction; operation or post reinstatement phases.

- The construction contractor will be required to implement a construction management plan incorporating the following specific mitigation measures, for release of hydrocarbons, polluting chemicals, sediment/silt and contaminated waters control:
- Provision of exclusion zones and barriers (e.g. silt fences and sand bags) between earthworks, stockpiles and temporary surfaces to prevent sediment washing into the existing drainage systems and hence the downstream receiving water environment;
- Weather conditions will be considered when planning construction activities to minimise risk of run-off from the site;
- Prevailing weather and environmental conditions will be considered prior to the pouring of cementitious materials for the works adjacent to surface water drainage features, or drainage features connected to same. Pumped concrete will be monitored to ensure no accidental discharge. Mixer washings and excess concrete will not be discharged to existing surface water drainage systems. Concrete washout areas will be located remote from any surface water drainage features, to avoid accidental discharge to watercourses;
- Any fuels or chemicals (including hydrocarbons or any polluting chemicals) to be stored in a bunded area to prevent any seepage of into the local surface water network or groundwater.
- All mobile fuel bowzers shall carry a spill kit and operatives must have spill response training.

All fuel containing equipment such as portable generators will be placed on drip trays. All fuels and chemicals required to be stored on-site will be clearly marked;

- Implementation of response measures to potential pollution incidents;
- Emergency procedures and spillage kits to be available and construction staff will be familiar with emergency procedures in the event of accidental fuel spillages
- The following measures to be undertaken during the construction phase of the project to reduce the risk of construction-related pollutants entering the receiving surface water network:
 - Potentially polluting materials, such as oils, cements, fuel etc. to be stored a minimum of 50m from watercourses at a designated location within the subject lands. These materials will be banded in containers that can hold 110% of the volume of their contents; and,
 - The construction compound to be equipped with spill kits to deal with any potential fuel or material spillage events

Emergency Access routes shall be kept clear at all times.

3.2 STORAGE OF EQUIPMENT AND MATERIALS

All equipment and materials shall be stored in areas as agreed. The Contractor shall be responsible for reinstating any such areas at their cost.

3.3 SERVICES AND UTILITIES

All mains, services and public authorities' services affected by the works shall be investigated and verified by the Contractor who shall satisfy himself as to the exact position of such apparatus. The Contractor shall liaise fully with and take all measures required by any statutory undertaker or public authority for the support and full protection of the pipes, ducts, cables and other apparatus during the progress of the works. He shall keep the Employer's Representative or his representative informed of such liaison and measures.

It will be the Contractors responsibility to ensure that Statutory Undertakers, Local Authorities and Authorised Contractors are organised in advance, to be on in time to carry out their works in order to facilitate the Contractors programme. The Contractor is responsible for making arrangements with the Statutory Undertakers, Local Authorities and Authorised Contractors, to ensure that all the work that they require and also that work which they carry out themselves or by Authorised Contractors is allowed for in the programming of the Contractors Works. The Contractor shall arrange to obtain any excavation/opening permits required.

The Contractor shall make good any damage resulting from his operations, and shall indemnify the

Employer against any claim for damage to drains,

The Contractors prices shall be deemed to include for all investigation, relocation, protection, repair and/or other necessary work due to the presence of these services, etc. in or adjacent to the works or affected by the works.

The Contractor shall ensure that there is no disruption or disconnection of live services to the adjacent residential properties/ developments.

The Contractor shall be aware that other services may be within the site and the Contractor shall take appropriate measures at all times to scan, locate and identify the service to avoid the risk of damage.

Where services and utilities are encountered, the Contractor shall implement proper site management measures such as warning signs, bunting, fencing etc. to ensure that no damage is caused to the services or utilities. Any damage resulting from the Contractor's action, or lack thereof, shall be repaired at the Contractor's expense.

All electricity, gas, water or other underground services that may be encountered during excavation works shall be excavated by hand.

3.3.1 Protection of Existing Services

The Contractor shall be entirely responsible for locating the positions of all services, including mains, cables, pipes sewers and drains, and shall allow in his rates for carrying out excavation in roads, and elsewhere where services are encountered, by hand digging so as to ensure that no damage is caused to services.

It is the Contractor's responsibility to identify existing drainage and watermain services. The contractor shall, at his own expense, carry out additional underground utility's surveys (by GPRS) or slit trenches to assist in the safe execution of the works. As outlined in the information provided, a 250mm dia. Existing IW watermain traverses the site – the methodology of works to be carried out adjacent to this pipe must be agreed via a MRA with DFCE a minimum of 2 weeks prior to commencement of the associated works.

The Contractor shall make good, at his own expense any damage whatsoever to existing services to the complete satisfaction of and in accordance with the instructions of the Employer's Representative, and shall keep the Employer indemnified at all times from claims in connection with the damage. All services which are encountered in the course of excavation shall be adequately supported and protected from injury to the satisfaction of the Employer's Representative or person in whom they may be vested. Allowance must be made in the excavation rates for the cost of providing such for the discharge of ground water without the written consent of the Employer's Representative. No drain or pipe of any description shall be disturbed until it has been inspected by the Employer's Representative.

3.4 MAINTENANCE OF PUBLIC ROADS ETC.

3.4.1 Work in Public Roadways

In the execution of the works in public roadways, the adjacent Estates Road, and in gaining access to the Site of the works from roadway the Contractor shall take such precautions and adopt such measures as are necessary to ensure the safety and convenience of the public and the owners and occupiers of affected properties, and to eliminate interference with the use of the roadway and private property. Works shall be executed in accordance with the recommendations in the current edition of the guidelines for *'Traffic Control at Rural Roadwork's'* and the guidelines for *'Signposting Roadwork's in Urban Areas'*. In carrying out works across existing public roadways/ adjacent Estates Road, the Contractor shall always keep one half width of the roadway open to traffic. In the event of single-way traffic becoming necessary the Contractor shall provide a width of at least 3m for the passage of vehicles. This regime must be marshalled by a full time pointsman, with priority given to emergency vehicles to ensure their passage is not delayed. All roadways shall be fully opened to traffic outside of the site working hours. Where excavations are backfilled, a suitable temporary surface finish shall be laid. This shall be in accordance with the *"Guidelines for the Opening, Backfilling and Reinstatement of Trenches in Public Roads"*.

3.4.2 Traffic Control

Any alterations to traffic and pedestrian management regimes between various stages and phases of the work must not affect the adjacent housing estates (e.g. temporarily block traffic or pedestrian routes). Allowance should be made, where necessary, to carry out these alterations outside of normal working hours by prior written agreement with the Employer/ Employer's Representative.

The Contractor shall erect and maintain on all works in roadways and on the approaches to the works, all traffic signs necessary for the warning, direction and control of traffic. The signs shall be illuminated by night and shall be for temporary use during the progress of the work, remaining the property of the Contractor on completion of the contract.

All signs erected for traffic safety and control purposes shall comply with the *"Guidelines of Signposting Road Works in Urban Areas"*, published by the Roads and Traffic Department of Dublin Corporation, and the Guidance for the Control and Management of Traffic at Road Works except where superseded by Chapter 8 of the Traffic Signs Manual.

Where the diversion of any existing road, footway or public right of way is temporarily necessitated by the works, the Contractor shall clearly sign, provide and maintain a like for like alternative, which shall be operational before interference with the existing way. The signage shall include clear approach signage notifying pedestrians and road users of the temporary diversion. This shall take cognizance of any potential infirm or disabled users in this live environment.

3.4.3 Safety Precaution for Road Users

The Contractor shall comply with the recommendations in the current edition of the guidelines for 'Traffic Control at Rural Roadwork's' and the guidelines for 'Signposting Roadwork's in Urban Areas'. It emphasises that the Contractor's responsibility to guard street works extends to all persons whose use of the public roadway is reasonably foreseeable, including the blind or infirm. Guards or barriers must be such that they would be easily detectable by a blind person using a stick. All arrangements for the protection of road users and for the guidance and control of traffic shall be made in consultation with the Gardaí and the local Authority.

3.4.4 Soiling of Roadways

The Contractor shall remove weekly (or more frequently if deemed required by the Employer's Representative) and cart away any mud, debris or spoil deposited on the roadways immediately adjacent to or approaching the works. Before leaving the site, all vehicles are to be hosed down and all mud removed from tyres, and the Contractor will be responsible for ensuring that the surfaces of adjoining roads remain clean at all times during the carrying out of the

3.5 PARKING

The contractor shall be aware that there are no parking facilities in the adjacent properties or roads, particularly the L4009, for the Contractor's and Sub-contractor's staff and such vehicles shall not be permitted to use existing Residents', Staff or Public Parking facilities during the works. Parking will be permitted, where it can practically be provided within the Contractor's Compound.

3.6 OFF-SITE TRESPASS

The Contractor shall ensure that all measures and precautions necessary are met to prevent any trespass upon the works area or to adjoining land or property through the works area and to preclude any rubbish, materials, etc. from being deposited or otherwise transported thereon.

3.7 PROTECTION OF TREES AND SHRUBS

The Contractor shall carefully preserve and protect all trees and shrubs on the sites and on adjoining properties from damage and shall make good at his own expense, any damage thereto when carrying out the works. The Contractor shall ensure that all trees and shrubs temporarily removed to facilitate works as identified in the Works Requirements are transplanted into suitable soil so that they can be reinstated to their original position on completion of the reinstatement works post decommissioning of the temporary landing zone.

3.8 COMPACTION OF FILL

The Contractor's method must take account of the proximity and condition of adjacent structures, services and the like.

Earthmoving machines must not be used as compaction plant.

Compaction shall be carried out as soon as practicable after deposition of the fill materials. Each layer of fill shall be spread and compacted by plant appropriate to that class of fill as specified in **Table 1** below.

The Contractor shall provide protection and place and compact fill against structures, membranes or buried services in a sequence and will ensure stability and avoid damage. The Contractor shall design any temporary support necessary to ensure stability during filling and submit details thereof.

For Type 1 and Type 2 granular material the moisture content during spreading and compaction shall be maintained within a range between 2% below to 1% above the optimum moisture content for compaction determined from BS 1377, Test 14, unless otherwise specified.

3.9 COLD WEATHER WORKING

No frozen materials or materials containing ice shall be used for filling. Fill shall not be placed on a frozen surface.

Any material, which has been affected by frost, shall be removed and after thawing re-compacted as defined in this Specification.

Table 1 – Compaction of Fill

Type of Plant	Category	Material Type				
		Type B		Type A		Hardcore
		D	N	D	N	N for D=250mm
Smooth Wheeled Roller	Mass per meter width of roll: kg					
	Over 2100-2700	125	10	125	10*	u/s
	Over 2700-5400	125	8	125	8*	u/s
	Over 5400	150	8	u/s		u/s
Grid Roller	Mass per meter width of roll: kg					
	Over 2700-5400	u/s		150	10	u/s
	Over 5400-8000	125	12	u/s		u/s
	Over 8000	150	12	u/s		u/s
Pneumatic Tyred Roller	Mass per wheel: kg					
	Over 1000-1500	u/s		150	10	u/s
	Over 1500-2000	u/s		u/s		u/s
	Over 2000-2500	125	12	u/s		u/s
	Over 2500-6000	125	10	u/s		u/s
	Over 6000-12000	150	8	u/s		u/s
	Over 12000	175	6	u/s		u/s
Vibratory Roller	Mass per meter width of vibrating roll: kg					
	Over 270 – 450	75	16	150	16	u/s
	Over 450 – 700	75	12	150	12	u/s
	Over 700 – 1300	125	10	150	6	u/s
	Over 1300–1800	150	8	200	10*	u/s
	Over 1800-2300	150	4	225	12*	12
	Over 2300-2900	175	4	250	10*	11
	Over 2900-3600	200	4	275	8*	10
	Over 3600-4300	225	4	300	8*	8
	Over 4300-5000	250	4	300	6*	7
Vibrating Plate Compactor	Mass per m ² of base plate: kg					
	Over 880-1100	u/s		75	6	u/s
	Over 1100-1200	75	10	100	6	u/s
	Over 1200-1400	75	6	150	6	u/s
	Over 1400-1800	125	6	150	4	u/s
	Over 1800-2100	150	5	200	4	u/s
	Over 2100	200	5	250	4	
Vibro-tamper	Mass: kg					
	Over 50 – 65	100	3	150	3	u/s
	Over 65 – 75	125	3	200	3	12
	Over 75 – 100	150	3	225	3	10
	Over 100	200	3	225	3	10
Power Rammer	Mass: kg					
	100 – 500	150	6	u/s		u/s
	Over 500	275	12	u/s		14

4 GENERAL SPECIFICATION

4.1 STANDARDS & CODES OF PRACTICE

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 Community.

Where items to an Irish Standards Specification (IS) or British Standards Specification (BS), or any other Standard Specification of a Member State of the European Community are called for, this requirement shall be read as including items to a relevant national standard of any Member State of the European Community, which provides an equivalent guarantee of safety and suitability.

Where items certified by the National Standards Authority of Ireland as complying with an Irish Standard are called for, this requirement shall be read as either certified by the National Standards Authority of Ireland as complying with the Irish Standard, or shall be certified as complying with a relevant national standard of another Member State of the European Community which provides an equivalent guarantee of safety and suitability.

Design loads shall comply with appropriate Irish Standard where they exist, unless otherwise stated. Where an Irish or British Standard or Code of Practice quoted in this document has been amended or superseded, the current edition or superseding document shall apply.

The following is a non-exhaustive list of the Irish, British and European Standards and Codes of Practice that are relevant and must be complied with.

- BS EN 1990 Eurocode: Basis of Structural Design
- BS EN 1991 Eurocode 1: Actions on Structures
- BS EN 1992 Eurocode 2: Concrete
- BS EN 1993 Eurocode 3: Steel
- BS EN 1994 Eurocode 4: Composite
- BS EN 1995 Eurocode 5: Timber
- BS EN 1996 Eurocode 6: Masonry
- BS EN 1997 Eurocode 7: Geotechnical Design
- BS EN 1999 Eurocode 9: Aluminium
- B.S. 648 Schedule of weights of building materials
- B.S. 6399 Loading for buildings
- B.S. 6399 Part 1 Code of Practice for Dead and Imposed Loads
- B.S. 6399 Part 2 Code of Practice for Wind Loads

- B.S. 6399 Part 3 Code of Practice for Imposed Roof Loads
- B.S. 8103 Structural design of low-rise buildings
- B.S. 8104 Code of Practice for assessing Exposure of walls to wind-driven rain
- C.P. 3 Code of basic data for the design of buildings
- C.P. 3 Part 2 Wind loads
- C.P. 111 Structural recommendations for load bearing walls

4.2 SI UNITS

The International System of Units (SI) shall be used for all designs, specifications and drawings.

4.3 GOOD PRACTICE

Where, and to the extent that, materials, products and workmanship are not fully specified, they shall be:

- The best quality and suitable for the purpose of the works stated in, or reasonably to be inferred from, the Contract Documents.
- In accordance with good Employer's Representative practice.

4.4 QUALITY ASSURANCE SYSTEM

At the outset of the contract, the Contractor shall propose to the Employer's Representative and implement during the contract an inspection system for providing assurance that the works are carried out in accordance with the Specification, whether on site or by off-site manufacturers, suppliers, fabricators and others. He shall provide details of the personnel involved, both on and off-site, and the name of any third party and/or testing agency which the Contractor proposes to employ.

The Contractor shall be responsible for carrying out, or arranging to be carried out, all tests required by the Specification or called for by the Employer's Representative and shall arrange for copies of the test results to be supplied direct to the Employer's Representative immediately when available. The Contractor shall nominate a member of his staff with the necessary authority to be responsible for all inspection matters to the satisfaction of the Employer's Representative.

The Contractor shall agree with the Employer's Representative, prior to commencement of the works, those elements of the work for which specific tests shall be carried out and for which inspection and test records shall be maintained. These elements are likely to include in particular those sections of the works which would be covered up during the course of construction of the works.

The Contractor shall establish and maintain clear and current inspection and test procedures, agreed with the Employer's Representative prior to commencement of the works, for each inspection and test operation. If the Employer's Representative requests notice of any work being done under the contract, the Contractor shall provide agreed notice to enable the Employer's Representative to witness whatever inspections or tests are performed by the Contractor. The Contractor shall maintain records of all inspections and tests performed to substantiate conformity with the Specification including those carried out by Sub-Contractors and/or third-party testing agencies and manufacturer's or supplier's certificates of tests.

All records shall be retained on site and made available to the Employer's Representative on request. These records shall include, inter alia, identification of the element, item, batch or lot, the nature and number of the observations and tests, the number and type of deficiencies found and details of any corrective action taken. Any records which indicate that the work or materials inspected or tested does not comply with the Specification shall be submitted to the Employer's Representative without delay in order that the Contractor's proposals for rectification may be assessed.

Where possible, materials shall be certified as complying with the relevant Irish Standard Specification and shall bear the Irish Standard Mark or shall be certified to a national standard of another Member State of the European Community which provides an equivalent guarantee of safety and suitability - certification to be by the National Standards Authority of Ireland. Manufacturers' or suppliers' certificates of compliance with the Standard shall be provided when requested by the Employer's Representative.

Where appropriate, all materials delivered to the site should bear the manufacturers name, brand name, standard mark or any other data that may be required to verify the exact nature of the material and relate it to the requirements of the Specification.

4.5 TRADE NAMES

In every case where on the Drawings, in the Specification or in the Bill of Quantities, materials appliances or fittings of special design, manufacture or description, patented or otherwise, are described or the names of the manufacturers or agents are given, any departure from the specified articles or material will only be permitted on the written authorisation of the Employer's Representative and if no such authorisation is obtained, the Contractor must supply the articles or materials originally specified.

When the words "or other equal and approved" are included after the use of a trade name the Employer's Representative may accept the alternative product provided that the contractor shall demonstrate to the full satisfaction of the Employer's Representative that it is in appearance, workmanship, quality, performance durability and warranty at least equivalent to the product originally specified and approved by the Employer's Representative. If requested the Contractor shall provide test certificates and any other necessary information to enable full comparison with the product originally specified to be made.

Important Note:

In these specifications trade names and/or suppliers are sometimes used for the purpose of brevity and clarity of technical, aesthetic and functional intent. Such references are for the conveniences of the contractor in clearly indicating the standard of technical, aesthetic and functional requirements sought by the specifier. The intention is not to favour one product over another or to eliminate other products/suppliers.

Other materials/suppliers may be put forward for consideration as equivalent materials to those stated in the specification.

Approval for substitution of equivalent materials/suppliers will be given where the alternative material/supplier are demonstrable equal in full accord with the original specification.

Equivalence of an offered substitution will be judged on the basis of objective, clear and verifiable independent proof of similar compliance with equal standards to those specified.

Where appropriate verification is provided through a detailed technical dossier, drawings, data sheets and/or a test report from a recognised body, a material/product substitution will be permitted by the Employer's Representative who is the client representative. Any increased costs arising whatsoever from such a substitution in terms of redesign, rescheduling, health and safety issues etc. shall be borne by the Contractor.

Alternative suppliers/installers will need to prove their ability to perform their sub-element part of the main contract through the submission of proof of their technical and/or professional capacity (education, experience, equipment etc.); including their ability to manage in an environmentally sound manner such as EMAS or other certified environmental management systems or details of such measures taken in previous contracts. The contracting authority, through its Employer's Representative who is the client representative, will determine on a case by case basis, from a technical, aesthetic and functional perspective, what constitutes an equivalent standard/product. Verification will take place only after the award of contract, as part of the contract management regime. Sufficient time is to be allowed to check.

4.6 ENTRY ONTO THE SITE

The Contractor shall notify the Employer's Representative in writing fourteen days in advance of his intention to start work within each Works Area.

The Contractor shall keep records of the dates of his entry onto and departure from all property and lands of each owner and occupier, together with the dates of the erection and removal of all enclosures, and shall furnish copies of these records when required by the Employer's Representative. He shall keep, and furnish, copies of similar records in respect of roads and footpaths.

It should be noted that the project is to be carried within a live site and provisions must be allowed for to ensure that access for staff, students and visitors is maintained during the life of the project. Access must also be maintained for waste management, firefighting services and other emergency services. Please refer to Preliminary Health & Safety Plan for further details.

4.7 SURVEY OF ROADS & PROPERTIES

The Contractor shall arrange for a comprehensive photographic dilapidations survey to be carried out on the following (*as a minimum*):

- All site boundaries
- All roads where construction traffic or deliveries route through the existing school campus. This includes adjacent footpaths and service/ utility chambers thereon.
- The section of the existing school building within 15m of the structural interface between the new extension and the existing building.
- The Junior School.
- The single storey Boyd Barrett building to the front of the site.

Before any work affecting such properties or structures is commenced, the Contractor shall confirm in writing to the Employer's Representative that the relevant survey is a true and accurate record of their condition, and provide a copy of same to them for Approval.

4.8 SITE FENCING

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.

4.9 LEVELS AND REFERENCE POINTS

The Contractor shall supply to the Employer's Representative details of the value and location of the temporary bench marks and reference points which he proposes to use.

The Contractor shall satisfy himself that the existing ground levels as indicated in the contract are correct. Should the Contractor wish to dispute any levels, he shall submit to the Employer's Representative a schedule of the position of the levels considered to be in error and a set of revised levels. The existing ground relevant to the disputed levels shall not be disturbed before the Employer's Representative's decision as to the correct levels is given.

4.10 LEVELLING AND SETTING OUT

The Contractor shall set out the works and shall provide all equipment, instruments, material and labour for this purpose. The procedures for survey and setting out shall be agreed with the Employer's Representative who shall be informed 24 hours in advance of any setting out work and shall subsequently be informed in writing of the details of the work set out. Adequate time shall be allowed for checking of setting out by the Employer's Representative following this notice and for rectification of any errors found to arise. Temporary bench marks and other setting out reference points shall be provided at all structures, major excavations and on the routes of pipelines or tunnels. These shall be located to be secure and clear of the works, and shall consist of steel pins in a concrete surround in Grade C25 concrete. Steel pins shall be installed in concrete surround over the centreline of all tunnels and used as reference levels against which any ground settlement can be measured.

4.11 CHECK ALL DIMENSIONS AND LEVELS

The Contractor shall check all dimensions and levels, both on drawings and site, particularly the correlation between components and the work in place. Materials and components shall not be ordered or work carried out until any discrepancies have been resolved with the Employer's Representative.

4.12 STABILITY

The Contractor shall accept full responsibility for the stability and structural integrity of the works during the contract and he shall support as necessary and prevent overloading.

4.13 INCLEMENT WEATHER

The Contractor shall use all reasonable and approved building aids and methods to prevent or minimise delays during inclement weather. The Contractor shall adequately protect the works from damage by inclement weather.

4.14 COMPLETION OF THE WORK

The Contractor shall leave the whole of the works in a clean and tidy condition, free from all rubbish and superfluous material of any kind. He shall clear up and cart away all surplus materials and rubbish to an approved tip and shall remove all temporary markings, coverings and protective wrappings unless otherwise instructed.

On completion of building work, the building shall be left in a neat and tidy condition, both internally and externally. All glass, windows and tiling shall be thoroughly cleaned and all spots, splashes and stains shall be removed.

Minor faults in newly painted work shall be touched up and badly marked areas shall be repainted back to suitable breaks or junctions. All moving parts of new work including doors, windows, drawers, ironmongery, appliances and controls which have moving parts shall be adjusted, eased and lubricated to ensure easy and efficient operation.

The whole of the works and the site shall be left in good order and in sound, clean condition and to the satisfaction of the Employer's Representative.

All soft landscaping affected by the works shall be re-seeded and fully reinstated to their pre-works condition.

4.15 INTERFERENCE WITH LAND INTERESTS

The Contractor shall confine his constructional operations within the site, or such other areas of land as defined by the proposed Site Layout drawing.

Subject to any unavoidable disturbance which may be necessitated by the execution of the contract, the Contractor shall not interfere with any sporting, fishing or other rights which may be enjoyed on or near the site.

Before exercising any right negotiated by him in connection with way leaves or accommodation outside the site, the Contractor shall notify the Employer's Representative in writing of such arrangements.

4.16 INTERFERENCE WITH ACCESS TO PROPERTIES AND SERVICES

Before interfering with access to any property, the Contractor shall provide alternative arrangements. The Contractor shall notify the Employer's Representative and the relevant occupiers in writing 14 days in advance of any such interference and shall confirm to the Employer's Representative that alternative arrangements have been agreed.

4.17 PROCEDURE FOR COMPLAINTS AND CLAIMS FOR DAMAGE

Details of all claims, or warnings of intended claims which the Contractor may receive in respect of matters against which he is required by the contract to indemnify the Employer, shall be notified without delay to the Employer's Representative, who shall likewise pass to the Contractor any such claims or warnings which may be submitted directly to the Employer's Representative or Employer.

A similar exchange of information shall also be made in relation to all complaints which may be received.

The Contractor shall notify the Employer's Representative in writing immediately following any damage or injury arising out of the execution of the works.

4.18 CORRESPONDENCE AND MEETINGS WITH PERSONS AFFECTED BY THE WORKS

The Contractor shall send to the Employer's Representative, on the same day on which it is received or despatched by the Contractor, copies of all correspondence with Statutory Authorities, Gardaí, service companies and any other bodies referred to in the Specification.

Adequate notice shall also be given to the Employer's Representative of any meetings arranged with any of these bodies or persons to discuss matters affecting the contract.

4.19 PROTECTION AGAINST DAMAGE

The Contractor shall take all necessary precautions to avoid causing any unwarranted damage to roads, lands, properties, trees and other features and, during the currency of the contract, shall deal promptly with any complaints by owners or occupiers.

Where any portion of the works is close to, across, or under any existing apparatus of the Local Authority, utility company or other parties, the Contractor shall temporarily support and work round, under or adjacent to all apparatus in a manner designed to avoid damage, leakage or danger and to ensure uninterrupted operation.

Should any leakages or damage be discovered, the Contractor shall at once notify the Employer's Representative and the Statutory Authorities or owner concerned and the Contractor shall afford every facility for the repair or replacement of the apparatus affected.

4.20 EXISTING SERVICES

4.20.1 Location of and Maintenance of Existing Services

The Contractor must clearly understand that existing sewers, culverts, watermain, gas mains, cables, water services and house drains cannot be located accurately beforehand either as to position on plan or depth below ground level. For pipe laying work, the Contractor shall be required to locate and identify all such services prior to trenching. He shall include for the following: -

- Liaison with Statutory Authorities and other utilities including Eircom, the ESB, ICT Providers, Bord Gais and the Sanitary Services Department of the Local Authority.
- He shall have on site and use electromagnetic pipe locating equipment to confirm the position of services.
- Where necessary, he shall include for advance trial holing on the line of the main with all necessary hand excavation to locate the services.

- Have regard to (for information purposes only) to the Underground Utility Survey deliverables included with the tender documentation.

He must allow in his rates for proceeding with the work in such a manner that the works shall be constructed without interference with these existing services unless the Contractor is specifically ordered to interfere with them under the terms of this contract or by direction of the Employer's Representative. A minimum of two weeks' notice is required to be given to each Authority in advance of excavation works at each location. Where services are shown on the contract drawings, these are based on the available record data and are provided without warranty as to their accuracy.

Low voltage overhead ESB lines running parallel to trenching operations will require notification to machine operatives of their existence and precautions to ensure that contact is avoided. The ESB shall be notified of times and dates when pipe laying work is programmed directly beneath the low voltage overhead crossings. Following setting out of the exact pipeline route, the ESB shall be notified to ascertain the requirements in relation to the protection of existing low voltage overhead lines running adjacent and parallel to the proposed trench.

No extra payments will be allowable for any difficulties due to site conditions associated with underground services not being in positions contemplated by the Contractor. The Contractor shall make full allowance in his rates for restrictions on his work methods, programme implications, difficulties and delays due to adjacent services, including all necessary support measures required to be taken by the relevant authority. He shall allow for deviations from straight lines and gradients such as may be expected for these various services.

4.20.2 Alterations to Existing Structures or Services

The Contractor shall make all necessary arrangements for and pay all costs in connection with the removal, alteration or demolition of existing works or services for the purpose of carrying out the contract, whether special items are provided in the Schedule of Quantities for this purpose or not.

4.20.3 Incorporation of Existing Works and Services

Where the works involve connection to existing services (watermains or services, sewers or drains) and to existing structures (roads, walls, etc.), the onus shall be on the Contractor to acquaint himself fully with positions, conditions and materials of these. He shall include for all difficulties of maintaining existing services, flow control and all re-mobilisation and other costs due to having to return to make such connections to suit the commissioning programme of the new works and the programme requirements of the utility in question. All operations which involve tie-ins to existing services and structures will require the submission of a Method Statement/ Risk Assessment and works schedule not less than 2 weeks in advance of the works for review by DFCE and the Client.

4.21 AVOIDANCE OF NUISANCE

4.21.1 Site to be Tidy (Dirt Control, etc.)

The Contractor shall be responsible for keeping the whole of the site, i.e., the site or sites on private property or along public roads, passageways or public open spaces, in a clean and tidy condition. The Resident Employer's Representative shall be empowered to require him to tidy the site and to store materials in a manner in which they can be readily checked.

The Contractor shall take every precaution to prevent dirt, mud or other material being dropped or spread by traffic associated with the work on roads being part of the works which are made available for public use by the Contractor, whether such traffic is the Contractors own vehicles, the Sub-Contractors or his suppliers or vehicles hired by any of the above.

The Contractor shall clean roadways of any such dirt, mud or other materials which may be spilt or spread by traffic travelling to or from the site in connection with the works, whether such traffic belongs to the Contractor, his Sub-Contractors or his suppliers. The Contractor shall employ a road suction sweeper to clean the relevant section of the existing adjacent Estate Roads use to access the site. Such cleaning operations shall be carried out notwithstanding road cleaning work being carried out by the Employer or other Contractors to the Employer. If the Contractor fails to keep roads and other public areas clean to the satisfaction of the Employer's Representative, the Employer shall be entitled to do the work and deduct the cost from any sums due to the Contractor.

The Contractor shall take particular care to avoid damage to roads, footpaths, grass margins and other surfaces outside of the authorised site and shall be liable for the cost of repairing, to the satisfaction of the Employer's Representative and the owner, all such damage caused by his operations. He shall take precautions to prevent spillage of diesel fuel or other solvents. He shall also prohibit the use of tracked plant on road surfaces outside of the site unless suitably approved protective measures are taken to safeguard the integrity of the road surfaces. Any damage so caused shall be made good by the Contractor at his own expense.

A wheel wash is to be installed with associated gulley and silt trap and is to be used by all construction vehicles existing the site.

4.21.2 Nuisance from Dust and Vibration

The Contractor shall provide and maintain and keep available plant and equipment necessary to minimise the formation and accumulation of dust arising from the works, in dry weather conditions. The Contractor shall take all steps necessary to minimise vibration caused by plant and machinery used on the site. No machine shall be permitted which uses a system of dropping a heavy weight, whether power assisted or by gravity, for the purpose of breaking up paving or foundations. Vibrations shall be monitored by vibrometer where instructed by the Employer's Representative. Vibrations associated with mechanical

plant shall typically not exceed 2.5 mm/s as peak particle velocity in any perpendicular direction at the property boundary (assuming the vibration frequency is between 10 and 60Hz).

4.21.3 Health and the Environment

The Contractor shall take all necessary precautions to avoid injury to public health, animal health and the surrounding environment. Care shall be taken to prevent the discharge of deleterious material to watercourses and streams. The Contractor shall rigorously conform to the provisions of Local Government (Water Pollution) Act, 1977 & 1990 and subsequent amendments. He shall take particular care in disposing of water from excavations, washing, flushing or testing to ensure that no damage is caused to existing watercourses by erosion, siltation or contamination and shall be liable for making good any such damage to the satisfaction of the Employer's Representative.

The Contractor shall have regard to the condition of mature trees which do not have to be felled as part of the works. He shall protect these in an approved manner from damage by moving plant. In the event of accidental damage to tree branches, these shall be sawn back in an approved manner and sealed with Arbrex or equivalent compound. Where a specialist examination and report by an approved tree surgeon is called for in the contract or required by the Employer's Representative prior to carrying out works in the vicinity of mature trees, this shall be arranged in advance of commencement of work and any recommendations resulting from this inspection shall be strictly adhered to by the Contractor.

4.21.4 Public Relations

The Contractor shall give 14 days' notice to the Gardaí, Local Authorities, members of the public and residents of impending events likely to cause disturbance, such as the planned disconnection of services, movements of heavy loads liable to cause traffic congestion, or any other planned abnormal occurrence likely to cause disturbance to persons in the vicinity of the works.

The Contractor shall be required to adhere to the provisions of the Temporary Closing of Roads Regulations 1994 in relation to any necessary road closure. This requires written notice of intention to close a road to the Local Authority at least 2 months in advance, who must then publish notices in the local press. Any member of the public is entitled to object to the closure of a public road.

4.22 TRAFFIC REQUIREMENTS

Before any work in or affecting the use of any public road is commenced, the Contractor's proposed method of working shall be agreed with, and confirmed in writing to, the Employer's Representative and the Local Authority and Gardaí.

Throughout the execution and maintenance of the works, the Contractor shall co-operate with the Local Authority and Gardaí concerning works in, or access to, the public road. The Contractor shall inform the

Employer's Representative of any requirements of, or arrangements made with, the Local Authority and Gardaí.

Where the diversion of any existing carriageway, footway or public right of way is temporarily necessitated by the works, the Contractor shall provide and maintain an alternative, which shall be operational before interference with the existing way.

Where ramps are required, they shall be provided and maintained to a standard suitable in all respects for the class or classes of traffic or pedestrians requiring using them.

A Traffic & Pedestrian Management Plan shall be submitted to the Employer's Representative for review in advance of commencement, containing at a minimum:

- Proposed routing of deliveries at off peak times to be agreed with the Client and protocols for the avoidance of reversing manoeuvres of delivery vehicles onto public thoroughfares and overflow of delivery traffic onto same.
- Proposed traffic and pedestrian management layouts, signage and safety procedures to enable the execution of the project. These are to include wayfinding signage for delivery vehicles along established delivery routes and advance warning signage for motorists on roads approaching and leaving the site.
- Procedures and layouts to maintain unobstructed routes for emergency vehicles/ ambulances at all times, as agreed with the client.

4.23 TRAFFIC SAFETY AND CONTROL

All signs erected for traffic safety and control purposes shall comply with the *"Guidelines of Signposting Road Works in Urban Areas"*, published by the Roads and Traffic Department of DCC, and the *Guidance for the Control and Management of Traffic at Road Works* except where superseded by Chapter 8 of the Traffic Signs Manual.

Where construction work is carried on, crossing, parallel or adjacent to an existing trafficked roadway, the Contractor shall erect and maintain 3 no. reflectorised metal signs 600 mm x 600 mm along the verge on both sides of the road crossing. These signs shall state "Major Road Works Ahead", "Heavy Machinery Crossing", and "Slow". These signs shall, in all cases, be preceded by the relevant statutory diamond shaped sign. The Contractor shall take note of any specific traffic control requirements of the Specification and these shall be strictly adhered to.

All lamps which are used to delineate roadworks or temporary obstruction shall show a yellow light. All portable traffic signal units shall be of a type approved by the Employer's Representative. The optical

performance of all portable traffic control signals shall comply with the requirements for high density traffic control signals as specified in BS 505. Traffic signals shall require prior approval of the Employer's Representative, Local Authority Traffic Department and the Gardai.

4.23.1 Publicity

The Contractor shall not allow visitors to the works, photography of the works or make or issue to the press or any other media for the dissemination of information, any statement relating to the works or any other matter arising out of the contract, without first obtaining the approval of the Employer's Representative in writing.

4.24 PROGRESS PHOTOGRAPHS

The Contractor shall arrange, as described in the Contract Documents, to have record photographs of the works taken by a professional photographer approved by the Employer's Representative. Such photographs shall be taken as the Employer's Representative shall direct, the number, frequency and quantity of prints and/or negatives of each to be as defined in the Contract Documents.

4.25 BILLPOSTING AND ADVERTISING

The Contractor shall not undertake or allow billposting or advertising of any kind upon the works without the written consent of the Employer's Representative.

4.26 SITE SAFETY

The Contractor shall, in accordance with the Conditions of Contract, ensure that all relevant Acts of the Oireachtas dealing with construction safety are complied with. He shall provide a copy of his company's Safety Statement within two weeks of commencement of the contract to include a Safety Policy and Safe Working System. He shall ensure that this statement is understood and implemented on site by his staff and by all Sub-Contractors on the site. He shall nominate a Safety Officer who shall be responsible for maintaining day to day contact with Statutory Bodies, Local Authorities, the Gardai and the Employer's Representative on all matters concerning interference with services, traffic control and safety on site. The Safety Officer shall have attended an approved course of instructions on accident prevention and have experience of the type of work in the contract. The Contractor shall ascertain and have particular regard to the safety requirements of the ESB with regard to work in the vicinity of live overhead and underground power lines. These guidelines shall be strictly enforced by the Contractor whose sole responsibility it shall be to ensure compliance.

The onus shall be on the Contractor to ensure that good safety practices are established and enforced on the site, including the wearing of approved headgear, footwear, protective eyewear, etc. He shall ensure

that all constructional plant is in good working order and that all operatives responsible for plant operation are fully trained and skilled in its use.

The Contractor shall supply, regularly maintain and have available on the site all necessary safety, breathing and rescue apparatus, first aid equipment, etc. An adequate ventilation system shall be provided for work in tunnels, culverts and other confined areas. He shall be required to monitor regularly for dangerous gases and take all other measures in accordance with BS 6164: 1990.

4.27 LIAISON OFFICER

The Contractor shall designate one of his qualified Employer's Representative Staff as Liaison Officer to deal with landowners, utilities, the Gardaí and other authorities affected by the works. This person shall be responsible for all advance liaisons with such parties as required in the Contract Documents.

4.28 EXPLOSIVES AND DANGEROUS SUBSTANCES

No explosive or other dangerous substance shall be brought onto the site or used for any purpose.

4.29 ELECTRICITY DISTRIBUTION ON THE SITE

All electrical installations forming part of the Temporary Works shall comply with the relevant provisions of the "Regulations for Electrical Installations" (IEE Wiring Regulations - 16th Edition), published by the Institution of Electrical Engineer's Representatives, with the ESB Regulations and with the ETCI Regulations.

4.30 TESTING AND COMMISSIONING

This Specification should be read in conjunction with the following Irish Water Documents:

- Irish Water Publication – Wastewater Infrastructure Standard Details
- Irish Water Publication – Water Infrastructure Standard Details
- Irish Water Publication – Code of Practice for Wastewater Infrastructure
- Irish Water Publication – Code of Practice for Water Infrastructure

Where any conflict exists between this document and the contents of the documents above, then the Irish Water documents shall take precedence.

4.30.1 Cleansing of Pipelines.

On completion of construction, internal surfaces of pipelines shall be cleaned thoroughly in such a way as to remove all oil, grit and other deleterious matter.

4.30.2 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.

Testing against closed valves shall not be permitted without the prior written consent of the Employer's Representative.

Should the Contractor be compelled to test against a valve, the valve shall have been tested at the manufacturer's works to the full maximum test pressure before delivery on site.

4.30.3 Testing Method Programme and Notification

The proposed programme and method of testing and swabbing shall be submitted to the Employer's Representative before testing the pipeline.

The Contractor shall notify the Employer's Representative at least three clear working days beforehand of his intention to test a section of pipeline.

4.30.4 Testing Non-Pressure Pipelines

Non-pressure pipelines laid in open cut shall be tested after they are jointed and before any concreting of 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 in addition to a closed-circuit television (CCTV) 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.

4.30.5 Water Test for Non-Pressure Pipelines.

The test pressure for non-pressure pipelines up to and including 750 mm nominal bore shall be not less than 1.2 m head of water above the pipe soffit or ground water level, whichever is the higher at the highest point, and not greater than 6 m 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 2 hours shall be allowed for absorption, after which water shall be added from a measuring vessel at intervals of 5 minutes and the quantity required to maintain the original water level noted. Unless otherwise specified, the length of pipeline shall be accepted if the quantity of water added over a 30-minute period is less than 0.5 litres per lineal metre per metre of nominal bore.

4.30.6 Air Test for Non-Pressure Pipelines

Non-pressure pipelines to be air tested shall have air pumped in by suitable means until a pressure of 100 mm head of water is indicated in a U-tube connected to the system. The pipeline shall be accepted if the air pressure remains above 75 mm head of water after a period of 5 minutes without further pumping, following a period for stabilisation. Failure to pass the test shall not preclude acceptance of the pipeline if a successful water test, can subsequently be successfully carried out.

4.30.7 CCTV Inspection of Pipelines

Where internal inspection of pipelines by CCTV 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.

4.30.8 Infiltration

Non-pressure pipelines (including tunnels) and manholes shall be tested for infiltration and 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 lineal metre per metre of nominal bore.

Notwithstanding the satisfactory completion of the above test, if there is any discernible flow of water entering the pipelines 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.

4.30.9 Testing of Pressure Pipelines

Gauges used for testing pressure pipelines shall either be of the conventional circular type, not less than 200 mm diameter, calibrated in metres head water, or shall have a digital indicator capable of reading increments of 0.1 m 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.

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 operating pressure for the period described in the contract, 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 lowest part of the section and the pressure shall be maintained at this level, by pumping if necessary, for a period of one hour. The pump shall then be disconnected and no further water shall be permitted to enter the pipeline for a further period of 1 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.

The permissible loss shall not exceed 2 litres per metre nominal bore per kilometre length per metre head (calculated as the average head applied to the section) per 24 hours.

In addition to the tests on separate sections, the whole pipeline shall be tested on completion to the same pressure and by the same procedures as that outlined for individual sections.

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.

The length of main to be tested shall not be less than 400m nor exceed 1,500m.

To test lengths outside these limits shall require special permission of the Employer's Representative which must be requested before the test is set up.

The site test pressure shall be 50% more than the maximum certified working pressure for the main under test.

4.30.10 Commissioning of Watermains

This Specification should be read in conjunction with the following Irish Water Documents:

- Irish Water Publication – Water Infrastructure Standard Details
- Irish Water Publication – Code of Practice for Water Infrastructure

Where any conflict exists between this document and the contents of the documents above, then the Irish Water documents shall take precedence.

4.30.10.1 Swabbing of Watermains

On completion of the hydraulic test on watermains, a foam swab shall be passed through the main for final cleansing, sufficient times to achieve clear wash water.

4.30.10.2 Sterilisation of Watermains

Before any section of pipeline is put into commission, the mains shall be thoroughly scoured out with clean water, the water to be provided at the Contractor's expense if it is not available from the completed scheme.

After scouring of the mains, they shall be filled with chlorinated water with a chlorine content of 20 mg/l. This water shall be left standing in the pipeline for at least 24 hours.

The chlorinated water shall then be drawn off the mains and the mains flushed again with normal potable water from the supply. The chlorinated water should receive appropriate treatment to dilute the chlorine to a level of 0.5 mg/l before discharge to a sewer or watercourse.

When the mains have been thoroughly flushed, they shall be put into commission by the Contractor.

4.30.11 Cleansing of Structures

On completion of the construction and before any disinfection, 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.

4.30.12 Disinfection of Structures for Potable Water

Immediately before acceptance of any structure for potable water, the interior shall be disinfected using water chlorinated to give a residual of not less than 20 mg/l of free chlorine. The structure shall be

emptied, flushed with mains water and then filled with water having a chlorine residual of not more than 0.5 mg/l free chlorine to normal top water level.

After 24 hours, the Employer's Representative shall arrange for a sample to be taken for bacteriological analysis. The structure shall be deemed to be disinfected if there are no coliforms in the sample. If there are coliforms in the sample, the Employer's Representative shall arrange for one further sample to be taken and the structure shall be deemed to be disinfected if there are no coliforms in that sample.

4.30.13 Provision of Water for Testing

The quantity of water required for carrying out tests will be large. It should not be assumed that the Client will be in a position to supply water to the Contractor for test purposes.

The Contractor must obtain an adequate supply of suitable water for testing. He must also satisfy himself regarding the adequacy of streams or other outlets to accommodate the quantity of water to be discharged from a test section after testing and, when cleaning, having regard to the pollution of watercourses and without giving rise to complaints by landowners or other interested parties.

5 MATERIALS SPECIFICATION

5.1 GENERAL ITEMS

5.1.1 Standards and Submission of Materials

Where materials are required to comply with European, Irish or other National Standards, specifications or their equivalents, the Contractor shall submit to the Employer's Representative test certificates, furnished by the supplier or manufacturer of the materials, indicating compliance with the relevant specification.

As soon as possible after the contract has been awarded, the Contractor shall submit to the Employer's Representative for his approval a list of his proposed suppliers and sources of materials required for the execution of the works.

Where a choice in manufacturer or source of supply is allowed for any particular product or material, the whole quantity required to complete the work must be of the same type, manufacture and/or source.

Products shall be new unless otherwise specified.

Where approval of products or materials is specified, the Contractor shall submit samples or other evidence of suitability.

Samples shall be taken in accordance with the appropriate European, Irish or other National Standard where applicable.

Orders shall not be confirmed or materials used until approval has been obtained.

Approved samples shall be retained on site for comparison with products and materials used in the works and the samples shall be removed when no longer required.

The materials subsequently supplied shall conform to the quality of samples which have been approved by the Employer's Representative.

Where samples of finished work are specified, the Contractor shall obtain approval of stated characteristics before proceeding with the works. For facing bricks, plastering, floor tiles, painting and other in situ finishes, a sample panel of at least 1 m² shall be made.

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.

5.2 WATER

Water for use in concrete shall comply with BS 3148: “Test for Water for Making Concrete”, and the Appendix thereto. It shall be clean, free from turbidity and suspended matter and, if not from the mains potable water supply, shall be certified by a reputable chemist as suitable for its intended purposes.

5.3 CONCRETE AND MORTARS

5.3.1 Aggregates for Concrete

Aggregates for concrete shall be obtained from an approved source and shall conform to the requirements of IS 5, “Aggregates for Concrete” or BS 882, “Aggregates from Natural Sources for Concrete”.

The Contractor shall submit to the Employer’s Representative for his approval full details of his proposed aggregate source including the following:-

- Location and supplier’s production facilities and method of production.
- Petrology and possible variability.
- Proposed aggregates, processed sizes and results of at least three sieve analyses.
- Certification from the supplier that the output from the source of production consistently conforms to the requirements of the appropriate specifications of IS 5 or BS 882.
- Details of typical physical and chemical properties of aggregates from the source, as listed in Appendix A and C of BS 882.
- Samples of each size of aggregate taken in accordance with IS 5 or BS 812, “Testing Aggregates”.

The Contractor shall produce, with the first consignment of each size of aggregate, a sieve analysis carried out on a sample of the consignment. If any such or other sample does not conform to the specification, the aggregate it represents shall be promptly removed from the site and the Contractor shall carry out such modifications as may be necessary to secure compliance with the specification.

Any changes in the particulars of the aggregates which occur during the course of the contract must be notified to the Employer’s Representative without delay.

When concrete is being mixed on site, aggregates shall be stored in separate stock-piles, so arranged as to prevent intermingling of the various aggregates. Stockpiles shall be suitably protected to prevent contamination of aggregates from the ground, rubbish, or by leaves, dust or other wind-blown materials. When concreting in cold weather, aggregates must be free of frost and ice before being used.

Sampling and testing of aggregates to prove they comply with the relevant standards shall be carried out as directed by the Employer's Representative by an approved laboratory. Laboratory fees for samples which pass the tests shall be recoverable, with the Contractor liable for fees associated with samples which fail.

5.3.2 Sands

Sands for mortar and grout shall comply with BS 1200 and be graded in accordance with Table 1 of that standard.

Sands for floor screeds shall comply with the relevant provisions of BS 882.

Sands for external renderings and internal plastering with lime and Portland cement shall comply with the relevant provisions of BS 1199.

All sands required to comply with BS 882, BS 1199 or BS 1200 shall be washed.

5.3.3 Cement

The Contractor shall obtain with the first delivery to the site a manufacturer's certificate in accordance with Clause 9 of IS 1.

Alternative types of cement may only be used with the prior approval of the Employer's Representative. Rapid hardening cement shall not be used for structures retaining aqueous liquids.

If required, the Contractor shall sample any consignment of cement delivered on site or proposed to be used to the satisfaction of the Employer's Representative.

5.3.4 Admixtures for Concrete or Grout

Accelerating, retarding and water-reducing admixtures for concrete or grout shall comply with the relevant provisions in BS 5075: Part 1. Air-entraining admixtures shall comply with the relevant provisions of BS 5075: Part 2. Super-plasticising admixtures shall comply with the relevant provisions of BS 5075: Part 3.

Calcium chloride shall not be used in concrete which is to be reinforced, contains embedded metal, or

has been designed to retain an aqueous liquid. Admixtures containing chlorides shall also not be used.

Admixtures shall not be used without the prior written approval of the Employer's Representative.

5.3.5 Lime for Mortar

Hydrated lime for mortar shall comply with IS 8.

5.3.6 Cement Grout

Cement grout shall be mixed in the relevant proportions indicated in the following table using the minimum quantity of water to ensure the necessary fluidity and to render it capable of penetrating the work:-

Class	Nominal Mix by Mass	
	Cement	Sand
G1	1	-
G2	1	3
G3	1	10

Cement grout shall be used within one hour of mixing, except where containing a retardant admixture.

5.3.7 Mortar

Mortar shall be mixed only as and when required in the relevant proportions indicated in the following table, until its colour and consistency are uniform. The constituent materials shall be accurately gauged, allowance being made for bulking of sand:-

Nominal Mix by Volume				
Class	Cement: Lime Sand	Cement: Sand with Plasticiser	Class	Masonry Cement: Sand
M1	1:0 to ¼:3	1:2½ to 3	M5	1:2 to 2½
M2	1:½:4 to 4½	1:3 to 4	M6	1:2½ to 3½
M3	1:1:5 to 6	1:5 to 6	M7	1:4 to 5
M4	1:2:8 to 9	1:7 to 8	M8	1:5½ to 6½

Ready-mixed lime sand for mortar and ready-to-use retarded mortar shall comply with the relevant provisions of IS 406.

All mortar shall be conveyed fresh to the works as required for use. Mortar which has begun to set or which has been site-mixed for a period of more than one hour, in the case of classes M1, M2 and M5 and M6, and two hours, in the case of Classes M3, M4, M7 and M8, shall not be used. Plasticising and set retarding mortar admixtures shall comply with BS 4887: Parts 1 and 2 respectively and shall be supplied with instructions for use.

5.4 STEEL REINFORCEMENT

5.4.1 Standards

Steel reinforcement shall comply with the relevant provisions of the appropriate British Standard, as set out below: -

Type	BS
Carbon Steel Bars	8666
Steel Fabric	4483

Type 2 (ribbed) high yield steel reinforcement bars shall be used.

Steel fabric reinforcement shall be welded at the intersections and, unless otherwise described in the contract, shall be delivered to the site in flat sheets.

5.4.2 Tying Wire

Tying wire for steel reinforcement shall be 1.6 mm diameter fully annealed mild steel wire, complying with BS 1052.

5.4.3 Cover Blocks and Spacers for Reinforcement

Cover blocks and spacers shall be designed to maintain the correct clear cover of concrete over steel reinforcement, shall be as small as possible consistent with their purpose, and of a shape acceptable to the Employer's Representative.

Concrete cover blocks shall be manufactured with a 10 mm maximum aggregate size and otherwise produced to the same specification as the surrounding concrete.

Spacers shall be of rust-proof material and shall not produce staining or otherwise be detrimental to the concrete or steel.

5.5 MANHOLES

5.5.1 Precast Concrete Manholes

Precast concrete manhole of circular cross-section shall comply with the relevant provisions of IS 420. Units which bed onto bases shall be manufactured so that imposed vertical loads are transmitted directly via the full wall thickness of the unit. For joints between units and the underside of slabs, joint profiles shall be capable of withstanding applied loadings from such slabs and spigot-ended sections shall only be used where the soffit of the slab is recessed to receive them.

5.5.2 Precast Concrete Cover Frame Seating Rings

Precast concrete cover frame seating rings shall comply with the relevant provisions of IS 420.

5.5.3 Manhole Covers and Frames

Manhole covers and frames shall be fully sealed and comply with the relevant provisions of IS/EN 124. The name of the manufacturer shall be cast on to each cover together with a reference to the appropriate standard to which the cover conforms, e.g., IS/EN 124 - Grade A. The approved type shall be double triangular Grade A cover, three point suspension, non-rock with circular opening to be 600 mm clear diameter.

All covers and frames shall be coated by dipping using a hot applied coal-tar based material complying with BS 4164 or a cold applied black bitumen material complying with BS 3416.

The design of covers shall be such that they cannot be displaced by normal traffic. The covers must fit tightly and evenly in the frames and shall incorporate a non-rock seating arrangement. All loose, badly seating or rocking covers shall be rejected. Where a locking mechanism is incorporated in the cover, this shall not be capable of being detached from the cover.

5.6 METAL WORK MATERIALS

5.6.1 Nuts, Screws, Washers and Bolts

Mild and high strength nuts, screws, washers and bolts shall comply with the relevant provisions of the appropriate British Standard, as set out below: -

Type	BS
Black Hexagon Bolts, Screws and Nuts	4190
Metal Washers for General Purposes	4320
High Strength Friction Grip Bolts, Nuts and Washers	4395: Parts 1 - 3

Wood screws shall comply with the relevant provisions of IS 97.

Bolting pipes and fittings shall comply with the relevant provisions of BS 4504: Sections 3.1 and 3.2, except that spheroid graphite iron bolts for use with ductile iron pipes and fittings shall be manufactured from metal complying with the provisions of BS 2789 for Grade 500/7.

Bolt lengths shall be sufficient to ensure that nuts are full-threaded when tightened in their final position.

Stainless steel nuts, screws, washers and bolts shall be manufactured from Grade 316S31 steel complying with IS/EN 10088-1 to 3

Where bolting is incompatible with the material being fixed, suitable isolating washers and sleeves shall be used.

5.6.2 Fixing for Metalwork

Mild steel bolts and nuts shall be hot dip galvanised in accordance with BS 729 and stainless-steel bolts and nuts shall be manufactured from Grade 316S31 steel complying with IS/EN 10088-1 to 3.

Stainless steel proprietary fixings shall be manufactured from Grade 316S31 steel complying with IS/EN 10088-1 to 3: Part 2. Mild and high tensile steel proprietary fixings shall be protected in accordance with the relevant provisions of the appropriate British Standard, as set out below: -

Type of Protection	Type of Fixing	
	Cast-In, Having No Machined Thread	Cast-In/Expanding, Basic Major Diameter of Machined Thread

		Not Exceeding 19 mm	Exceeding 19 mm
Hot Dip Galvanised	BS 729	-	-
Electroplated Cadmium	BS 1706, Cd 4	BS 3382: Part 1	BS 1706: Cd 4
Electroplated Zinc	BS 1706, Zn 10	BS 3382: Part 2	BS 1706: Zn 10

Where described in the contract, axial and shear loading tests on structural fixings in concrete or masonry shall be carried out in accordance with the provisions of BS 5080: Parts 1 and 2 respectively. The safe working load shall be as described in the contract.

Where fixings are incompatible with the material being fixed, suitable isolating washers and sleeves shall be used.

5.7 BUILDING MATERIALS

5.7.1 Synthetic Resin Adhesives

Synthetic resin adhesives for plywood and wood shall be phenolic and amino plastic and comply with the relevant provisions of IS/EN 301 and IS/EN 302 respectively.

5.7.2 Bricks and Blocks

Clay bricks, concrete blocks, concrete bricks and calcium silicate bricks shall comply with the relevant provisions of IS 91, IS 20, IS 189 and IS 190 respectively.

Bricks to be used for manholes and chambers shall be solid type.

The shapes and dimensions of special bricks shall comply with the relevant provisions of BS 4729.

Air bricks and gratings for wall ventilation shall comply with the relevant provisions of BS 493 and shall match any surrounding bricks.

5.8 ROAD MATERIALS

5.8.1 Precast Concrete Kerbs, Channels, Edgings and Quadrants

Precast concrete kerbs, channels and edgings shall be hydraulically pressed and they, and precast concrete quadrants, shall comply with IS 146. Where kerbs or channels are required to be laid to a radius of 12 m or less, components of the appropriate radius shall be used.

5.8.2 General Filling Materials

Hardcore shall consist of clean, hard, durable material, either broken stone, bricks or concrete, graded from 200 mm to 50 mm, and be free from extraneous matter.

Selected fill, whether selected from locally excavated material or imported, shall consist of uniform readily compactable material, free from vegetable matter, building rubbish and frozen material, or materials susceptible to spontaneous combustion, and excluding clay of liquid limit greater than 80 and/or plastic limit greater than 55 and materials of excessively high moisture content. Clay lumps and stones retained on 75 mm and 37.5 mm sieves respectively shall be excluded from the fill material.

5.8.3 Granular Sub-Base Material

Granular sub-base material shall be natural sands, gravels, crushed rock, in accordance with the requirement of Clause 803 (Type A) and Clause 804 (Type B) of the "Specification for Road Works" as published by the National Roads Authority. The material shall be well graded and lie within the following grading limits: -

BS 812: Part 103 Sieve Test	Percentage by Mass Passing	
	Type B	Type A
75 mm	100	100
37.5 mm	85 - 100	85 - 100
10 mm	40 - 70	40 - 70
5 mm	25 - 45	25 - 65
600 µm	10 - 22	8 - 30
75 µm	0 - 8	0 - 10

Where granular sub-base material is to be used within 450 mm of the surface of any road, the Contractor shall supply to the Employer's Representative a certificate confirming that the material has a heave not greater than 13 mm when subjected to the frost test as specified in BS 812: Part 124.

Natural sands and gravels shall only be permitted in Type A material.

The particle size shall be determined by the washing and sieving method of BS 812: Part 103 and IS/EN 933: Part 1. The material passing a 425 µm BS sieve, when tested in accordance with BS 1377: Part 2, shall be non-plastic for Type B and have a Plasticity Index of less than 6 for Type A.

The material shall have a "10% fines" value of 130 kN or more when tested in accordance with IS 5: Part 3.9.

5.8.4 Wet-Mix Macadam

Wet-mix macadam shall consist of crushed rock or crushed slag, graded in accordance with the following table: -

BS 410 Test Sieve	Percentage by Mass Passing
50 mm	100
37.5 mm	95 - 100
20 mm	60 - 80
10 mm	40 - 60
5 mm	25 - 40
2.36 mm	15 - 30
600 µm	10 - 22
75 µm	0 - 8

The particle size shall be determined by the washing and sieving method of BS 812: Part 103.

Aggregate quality and cleanliness shall comply with the relevant requirements of Clause 2.2.4. The Flakiness Index shall be less than 35 when determined in accordance with BS 812: Part 105, Section 105.1.

The moisture content of the wet-mix macadam shall be the optimum $\pm 0.5\%$ as determined in accordance with BS 5835: Part 1.

5.8.5 Coated Macadam

Coated macadam for roads and other paved surfaces shall comply with relevant provisions of BS 4987: Part 1 and the “Specification for Road Works” as published by the National Roads Authority.

5.8.6 Rolled Asphalt

Hot rolled asphalt shall comply with the relevant provisions of BS 594: Part 1 and the “Specification for Road Works” as published by the National Roads Authority.

5.8.7 Bitumen Road Emulsions

Bitumen road emulsions shall comply with the relevant provisions of BS 434: Part 1 and the “Specification for Road Works” as published by the National Roads Authority.

5.8.8 Dowel Bars

Dowel bars for expansion joints in concrete shall consist of mild steel complying with the provisions of BS 8666, Grade 500.

5.9 JOINTS

5.9.1 Joint Filler Board

Filler board for joints in concrete (other than softwood) shall comply with the tests in Clause 1015.1 of the Department of Transport’s “Specification for Highway Works”. Knot-free softwood, preserved in accordance with BS 5589 may be used for joints in concrete carriageways.

Holes in preformed joint filler to accommodate dowel bars shall be accurately bored or punched out to produce a sliding fit on the dowel bars.

The material comprising the joint filler shall be of such quality that it can be satisfactorily installed in position at the joint.

Adhesives used to retain preformed joint fillers in place during construction shall have no harmful effects on concrete and, except for those used in connection with softwood fillers, shall be obtained from the same manufacturer as the joint filler.

Preformed filler for joints in structures to retain aqueous liquids shall have a maximum water absorption of 0.3% by volume and a non-recovered compression set of 20% of the original thickness, both when tested in accordance with ASTM D3595.

5.9.2 Joint Sealing Compounds and Sealants

Joint sealing compounds shall comply with the requirements of WIs No. 4-60-01 and shall be impermeable ductile materials of a type suitable for the conditions of exposure in which they are to be placed and capable of providing a durable, flexible and watertight seal by adhesion to the concrete throughout the range of joint movement.

Hot poured joint sealants shall comply with BS 2499, Ordinary Type A1 sealant.

Cold poured polymer-based joint sealants shall comply with BS 5212: Part 1, Normal Type N sealant.

Two-part polysulphide-based sealants shall comply with the relevant provisions of BS 4254. Pouring grade shall be applied to horizontal upward-facing joints and gun grade to joints of any other aspect or inclination. Other two-part polymer-based sealants of gun or trowel grade shall comply with the physical and test requirements of BS 4254.

Silicone based building sealants shall comply with the relevant provisions of BS 5889.

Primers for use with joint sealants shall be compatible with and obtained from the same manufacturers as the adjacent sealant. Primer shall have no harmful effects on concrete.

Sealants and primers which will be in contact with water to be used for potable supply shall not impart to water taste, colour, or any effect known to be harmful to health, and shall be resistant to bacterial growth.

Sealants and primers which will be in contact with sewerage or sewerage sludge shall be resistant to biodegradation.

6 TRENCH EXCAVATION

- Irish Water Publication – Wastewater Infrastructure Standard Details
- Irish Water Publication – Water Infrastructure Standard Details
- Irish Water Publication – Code of Practice for Wastewater Infrastructure
- Irish Water Publication – Code of Practice for Water Infrastructure

6.1.1 Purpose of the Excavation

In excavating and refilling trenches for pipelines, it is essential to bear in mind that: -

- (a) The pipeline is to be laid to smooth gradients so that there are no sharp changes of grade.
- (b) Horizontal alignment must be in straight lines or smooth easy curves, where these are approved by the Employer's Representative for watermains only.
- (c) It is necessary to provide a firm uniform bed under the pipe without any hard or soft spots.
- (d) It is essential to backfill the pipe carefully.
- (e) It is necessary to have a trench wide enough to provide adequate working space for men to carry out the jointing efficiently.
- (f) It is necessary to cause minimum inconvenience to the public and to landowners.
- (g) It is necessary to restore all surfaces carefully and neatly.
- (h) Excavation at anchorage points shall be carefully carried out by hand.

6.1.2 Method of Excavation

Excavation of the trench may be done by backacter, bucket-trencher or any other suitable machine. Road surface damaged by machine tracks or legs shall be restored at the Contractor's expense. Whatever equipment is used, the trench should first be dug to approximate grade only and then finished off by hand. See section 5.5 for recommendations on services and utilities, also note Volume D documentation. Should the Contractor consider it necessary to have side batters on the trench in adverse ground conditions, he must allow for cutting the width of the trench to the minimum width sufficient to allow proper tamping of the backfill for a depth of trench at least up to the crown of the pipe. Any battering back of the trench walls should be done above this level and may only be carried out with the prior approval of the Employer's Representative. The Contractor shall be responsible for the cost of all additional excavation, backfilling, spoil removal and reinstatement arising from such battering of trench side slopes.

6.1.3 Trench Alignment

The trenches for the pipelines shall be laid out accurately to the grades shown on the longitudinal sections and carefully aligned horizontally.

The trenches shall then be excavated to smooth grades as shown on the drawings. Smooth curves may be used to avoid bends on watermains, provided that the allowable tolerance for deflection of the pipe joint, as recommended by the manufacturer, is not exceeded.

6.1.4 Trenching in Roads

Where trenching takes place along roads, the length of road surface where the pipe trench is supposed to be cut is clearly defined on the longitudinal sections of the pipelines. The onus shall be on the Contractor to visit the site and satisfy himself that he can confine his trenching operations to the lengths of road shown and the actual width of road available having regard to the traffic control requirements of the Contract Documents.

6.1.5 Transport of Spoil

It may be that, due to narrow road widths and traffic requirements where the contract allows backfilling with selected excavated material, the Contractor will have to transport some or all of the trench spoil (apart from the surplus spoil) while the laying and testing of the pipes is being carried out. Subsequently, he may have to transport the spoil back to its original position for the refilling of the trench.

6.1.6 Bottoming Up of Trenches and Pipe Bedding

The bottom of all trenches shall be cleaned up by hand. Appropriate side battering or trench support techniques should be used to permit manual access in to the trench, in accordance with HSA document – *A Guide to Safety in Excavations*. The finished surface of the trench shall be below the invert levels of the pipes shown on the longitudinal sections by the amounts defined on the DFCE drainage and watermain details drawings.

Pipe bedding shall be in accordance with TGD H

To prevent the intrusion of fine ground soils, such as clays, silts or fine sands into the bedding, especially under wet conditions, one part of coarse sand may be added and thoroughly mixed with two parts of Type A bedding as defined in section 1 TGD H. Alternatively, a free draining all-in mixture of similar grading can be used.

6.1.7 Hand Holes for Joints

It will be necessary to provide hand-holes where joints occur and the Contractor is required to have a wooden laying square for this purpose. The long leg of the square will be equal to the length of the pipe and the short vertical leg will be suitable to fit into the socket of the pipe previously laid. In this way, immediate location of the next socket is indicated and, therefore, the position of the hand-hole.

6.1.8 Backfilling

Special backfill material, carefully compacted, is required to 300 mm over the crown of the pipe for each pipe material as follows: -

- uPVC and High Density Polythene Pipe
 - Fine grained material (clean pit run sand or gravel less than 10 mm size) as specified above. GRP Pipe
- Granular material Type as defined in TGD H.
 - Ductile Iron, Steel and pcc Pipe

(a) Where granular surround is specified (typically under roads) – granular material Type A as defined in TGD H

(b) Otherwise - selected backfill Type “B” whether selected from locally excavated material or imported. This is defined as uniform, readily compactable 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 75 mm sieve and stones retained on a 25 mm sieve.

In the case of all pipe materials, unless otherwise specified, the remainder of the trench shall be backfilled as follows: -

1. On Tarmac and Surface Dressed Roads

The backfill shall continue to within 50 mm of the road surface with properly compacted Clause 803 material as defined in the Department of the Environment Specification for Road Works. The top 50 mm shall be dealt with as indicated in paragraphs of this Specification dealing with surface restoration. Water bound macadam roads and laneways shall be backfilled as per as indicated in the relevant clauses of this Specification.

2. On Tarmac Footpaths

The remainder of the trench, to within 150 mm of the top, shall be filled in 300 mm layers of standard backfill carefully compacted by a mechanical rammer. The top 150 mm shall be dealt with as indicated in the relevant clauses of this Specification.

3. On Concrete Footpaths

The remainder of the trench, to within 150 mm of the top, shall be filled in 300 mm layers of standard backfill carefully compacted by a mechanical rammer. The top 150 mm shall be dealt with as indicated in the relevant clauses of this Specification.

4. Elsewhere

The remainder of the trench, to within 300 mm of the top, shall be filled in 300 mm layers of standard backfill carefully compacted by a mechanical rammer. Backfilling of subsoil shall not take place when the soil is in a waterlogged condition. The top 300 mm shall be dealt with as indicated in the relevant clauses of this Specification.

6.1.9 Essential Plant

Before the Contractor can open any pipe trenches on site, he shall have on site the following plant: -

- (a) The necessary excavating machines.
- (b) The necessary trench sheeting equipment and materials.
- (c) The necessary material for sight rails, boning rods, lasers, etc.
- (d) The necessary mechanical and hand ramming equipment for ramming of the backfill.
- (e) Sufficient transport in the form of dumpers, lorries, etc., to remove spoil or temporarily transport it as required.

7 SUBSTRUCTURE & SUPERSTRUCTURE

7.1 LOADING

7.1.1 Dead Loads

The load due to the self-weight of materials used in the building structure shall be calculated from BS EN 1991: Part 1-1 or else shall be actual known weights of materials and plant.

7.1.2 Wind Loads

The wind loads on the building shall be calculated in accordance with BS EN 1991: Part 1-4 General Actions – Wind Actions.

7.1.3 Imposed Loads

The imposed loads on floors and roofs shall be calculated in accordance with BS EN 1991 Parts 1-1 & 1-3. Imposed loads have been assumed in the design of this structure which varies depending on the use/occupancy of the building/room.

8 EXCAVATION AND EARTHWORKS

8.1 GENERAL CLAUSES

8.1.1 Standard Codes and Practice

The following is a non-exhaustive list of the Irish and British Standards and Codes of Practice that must be complied with and the latest edition shall apply.

- BS EN 1997 Eurocode 7: Geotechnical Design
- B.S. 4360 Specification for weldable structural steels
- B.S. 6110: Part 2 Substructure and foundations
- B.S. 8004 Code of Practice for Foundations
- B.S. 8102 Foundations and substructures for non-industrial buildings of not more than four storey's
- BS 8102 Protection of buildings against water from the ground
- C.P. 2004 Foundations
- BS 7385 Evaluation and measurement for vibration in buildings.

8.1.2 Trial Holes

Frequently during the contract, it will be necessary for the Contractor to make small trial holes including hand excavation in advance of his trenching or excavation in order to accurately ascertain the position of underground services or structures or to ascertain the quality of the excavation.

The Contractor shall make due allowance in his excavation rates for the provision of the necessary compressors, excavating machinery and manual labour to carry these out, together with all difficulties and delays.

The cost of such trial pitting or trial excavations shall be included in the general rate for excavation.

8.1.3 Shoring of Excavations

The Contractor shall include in his excavation rate for the provision of all the necessary support, including sheeting, walings, trench boxes and struts as may be necessary to properly secure and support all openings, whether mass excavation or trench excavations. He shall comply with all statutory safety requirements in carrying out excavations.

The onus shall be on the Contractor to ensure that excavations are adequately supported at all times but the Contractor must provide such support as the Employer's Representative shall direct him to do should the Employer's Representative choose to give such instructions.

The Contractor should note that it may be necessary to take out extra excavation for working space in order to put in supports and he should carefully note that such extra excavation will not be paid for and he must include for carrying this out in his general excavation rates for the permanent work.

8.1.4 Splaying of Excavations

The Contractor may decide to splay the excavations in order to avoid timbering or trench boxes. Trench excavations shall not be battered without the prior approval of the Employer's Representative. Where battering of trench excavations is proposed, it should be noted that this may result in the subsequent subsidence of road or footpath surfaces. In no case will the Contractor be paid for this splayed excavation.

The Contractor shall have regard to the Site Investigation information on roadways showing surface dressing on minimum foundation depths. He shall, therefore, include for possible overbreak of surfacing and trench edges in his rates.

8.1.5 Working Space Excavation

Any excavation for working space for either formwork, timbering or trenches or wider working space, which would enable men to work at the external faces of structures for either the temporary work or the permanent work, shall be carried out by the Contractor.

Where over-excavation is below the level of footings, floor slabs, paths, aprons or roads, the voids formed shall be filled in Clause 804 granular material as defined in the "Specification for Road Works" of the National Roads Authority. The cost of this filling material shall be borne by the Contractor in his general rates.

Where over-break occurs under proposed structures, this shall be backfilled in Grade C20 concrete with 40 mm aggregate.

8.1.6 Water in Excavation

The Contractor shall construct the permanent works in accordance with the contract, dealing, as he sees fit, with any groundwater, rainwater or open water.

He shall include the cost of maintaining his excavation in a working condition in his general rates for excavations, or he may make provision in Method Related Charges, if any, in accordance with CESMM, 3rd Edition.

In disposing of water from excavations, he shall ensure compliance with TGD H.

8.1.7 Hand Excavation

In very confined spaces or for particular operations such as trimming the bottom of excavations to receive concrete or keeping the surfaces of the excavations in condition, the Contractor may have to use hand labour. Hand excavation will also be required in excavations in heavily serviced areas for service location.

An experienced, competent Contractor examining the site will realise that in confined spaces hand labour will be necessary. He must make allowance for this in pricing his excavation as separate items may not be included in the Pricing Document for this work.

8.2 DEFINITIONS

8.2.1 Topsoil

Topsoil shall be taken to mean the vegetable soil containing humus for a depth of 300 mm from the surface of the ground or other depth as shown on the drawings and defined in the Contract Documents. The Contractor shall include in the item for excavation of topsoil for storing on site when it is required for reuse subsequently.

8.2.2 Normal Excavation

In the case of all contracts, normal excavation shall mean excavation in all materials other than solid rock. Soft rock or shattered rock which can be removed by a backacter with a 0.5 m³ bucket shall be deemed to be normal excavation.

Boulders with a volume of 0.10 m³ in trenches or 0.20 m³ in mass excavation shall be regarded as normal excavation.

Old masonry culverts or drains and old masonry wall structures below the ground which can be removed by 0.5 m³ backacter shall likewise be deemed to be normal excavation.

8.3 STRUCTURAL EXCAVATIONS

8.3.1 Formation Level

The excavation shall be finished accurately by hand to receive the structure to be placed upon it. In all cases where structural concrete is to be placed on the excavation, a blinding layer at least 75 mm thick shall first be placed on the formation surface. The lines and contours of the finished blinding layer shall

be accurate in the case of sloping floors. This is of particular importance so that the minimum structural thickness of reinforced concrete shall be possible in all areas.

8.3.2 Inspection of Finished Excavation

No work shall be commenced on any blinding layer or any foundation until the Employer's Representative or his representative has seen and approved the formation surface. The Contractor shall notify the Employer's Representative or his representative when the excavation is ready for inspection.

8.3.3 Underpinning

Underpinning (if deemed required) to be provided in accordance with DFCE drawings. Underpinning to be in 1m hit and miss sections. Sequencing to strictly be provided to DFCE for approval in advance of works. Sequencing shall be as follows:

- Each 1m section to be numbered in sequence 1,2,3,4,5,6, 1,2,3,4 etc...
- All no.1's shall be completed on one day
- All no.2's shall be completed on subsequent days
- Repeats no's 3-6 inclusive as per the step above on subsequent days.
- This careful sequencing will ensure that only discrete sections of wall are without ground support and any one time to help avoid temporary collapse.
- The wall to be supported shall be laterally supported during the works, with the Temporary Works design and detail for same carried out by the Contractor's Indemnified Chartered Structural Engineer and submitted (along with TWDC) to DFCE for approval prior to the works.

8.4 BREAKING THROUGH AND REINSTATEMENT IN ROADS.

8.4.1 Breaking Surfaces

In the case of paved surfaces of any type, whether tarmac or concrete roads or any other type of paved surface, the Contractor shall carefully mark both sides of the trench on the road surface.

The Contractor shall then cut through the paved surface with a road saw along both sides of the trench opening so that a clean straight edge is shown on both sides of the trench.

The width of pavement penetrated in this way should be sufficient to allow the pipeline to be constructed properly and efficiently.

If the paved surface should be damaged outside this width, due to the Contractor's failure to support the sides of the trench or due to his machinery, then the Contractor shall be liable to pay for the additional restoration arising from such damage.

8.4.2 Temporary Reinstatement of Tarmac Roads

The trench backfilling in urban areas shall be completed on a daily basis in roads and streets to 40 mm below finished road level in Clause 804 Type B granular material as defined in 'Specification for Road Works' of the National Roads Authority. To facilitate re-opening of sections of road as soon as possible after backfilling, the top 40 mm shall be sealed in 40 mm thickness of cold-mix bituminous macadam complying with the NRA "Specification for Road Works" as an interim measure. This shall be done on a daily basis.

This temporary surface shall be maintained in trafficable condition to the satisfaction of the Employer's Representative pending provision of a bitumen macadam surface.

The Contractor shall subsequently carry out temporary reinstatement of the tarmac road surfaces in zones on a weekly basis or as directed by the Employer's Representative. This shall consist of the following: -

1. Excavation of temporary surfacing and backfill to a depth of 60 mm and disposal of excavated material.
2. Cutting back the edges of the original tarmac construction to straight lines to a regular consistent pattern where any damage or failure has occurred to tarmac surfaces outside the original trench width.
3. Temporary surfacing to existing road level in a minimum of 60 mm of close graded bitumen macadam wearing course to Clause 912 of the "Specification for Road Works" of the National Roads Authority formed to match the existing road profile. The edges of the existing road surfacing shall be treated in advance by a brush applied coating of 100 pen bitumen. Similarly, the joints in the road surface shall be finished in a pour-on coat of similar material to a uniform thickness of approximately 2 mm with a width of 70 mm.

8.4.3 Maintenance of Temporary Restoration

For a period of 12 calendar months after the completion of temporary restoration to the Employer's Representative's satisfaction or, alternatively, until permanent restoration is undertaken, whichever is the shorter, the Contractor shall maintain the temporary restoration.

During this period, he shall make good any damage by traffic or due to faulty workmanship in carrying out the consolidation of the backfill.

Any such damage shall be made good by the Contractor with 6 mm premixed tarmac thoroughly rolled in and matched to the surrounding road surface.

The Contractor shall repair such damage to temporary restoration immediately after such damage becomes apparent. Warning signs shall be erected and the area cordoned off until the repair is completed. Should he fail to do so, the Employer's Representative shall be empowered to hand over the work to the Local Authority concerned and charge the Contractor with the cost of repair of the damage by way of a deduction from the contract amount payable to him.

8.4.4 Reinstatement of Concrete Footpaths and Kerbs

Standard backfilling in concrete footpaths shall be completed to within 150 mm of the top. The temporary restoration shall consist of filling and compacting a 150 mm layer of Clause 803 material. Permanent restoration shall consist of excavating out the Clause 803 material and replacing it with 150 mm of Grade C25/30 concrete. Expansion joints shall be formed at 7 m centres and at the junction with the existing concrete path and the new concrete sections.

A timber float finish shall be required to the top surface of the concrete reinstatement supplemented by steel trowel edging to match the existing finish, where required. Where pipelines are laid along existing footpaths, they shall be permanently restored across their full width unless otherwise specified.

Where kerbs are broken through, reinstatement shall consist of erection of precast concrete kerbing to the road edge bedded and backed in Grade C16/20 concrete and finished to straight lines and smooth curves.

The workmanship and materials used in reinstatement of kerbs and footings shall be in accordance with Series 1100 of the 'Specification for Road Works' of the National Roads Authority. Where that Specification refers to a Mix ST4 concrete, this shall be read as a Grade C20 concrete.

8.5 GEOTEXTILES

Geotextiles are required to separate capping from sub-grades. Such geotextiles shall comply with Clause 609 of the NRA Specification for Roadwork's, and be laid and lapped in accordance with the approved manufacturer's requirements. During construction, the Designer's Site Representative will ground conditions Geotextiles may also be required for Filter Drains and for use as basal reinforcement within the embankments on soft ground.

1. When separation geotextiles are instructed by the Designer or Designer's Site Representative, the Contractor shall submit a Method Statement and Risk Assessment for approval at least one week prior to starting earthwork operations, detailing his proposals for securing the geotextile in place and filling over it. The proposed method should in no way alter the original characteristics of the material or create any localised stresses in the material through piercing of the material with nails or pegs.

2. The geotextile shall be inert to all chemicals naturally found in soils and shall have no solvents at ambient temperature. It shall not be susceptible to hydrolysis, shall be resistant to aqueous solutions of salts, acids and alkalis, and shall be non-biodegradable. It shall have a design life of at least 120 years.
3. Full test certificates for the proposed geotextile covering all requirements of clause 609 shall be submitted to the Designer at least two weeks prior to installation. On-going control testing shall be undertaken as per Appendix 1/5.
4. The geotextile shall be manufactured in accordance with the Quality Assurance requirements ISO 9002. If required by the Designer, the Contractor shall provide evidence that the manufacturer's Quality Assurance System has been certified to conform to ISO 9002 by an external authenticating authority approved by the Department of Trade and Industry.
5. Adjacent sheets of the geotextile shall be overlapped according to the Manufacturer's design requirements.
6. The Contractor shall ensure that the layer of material on which the geotextile is to be placed shall not have protrusions or sharp projections which are likely to damage the geotextile during installation or whilst in service.

General Notes

The necessary precautions, in accordance with the manufacturer's design requirements, shall be undertaken at all stages of placing the geotextiles and shall include the following:

- (a) End-dump on previously placed material, do not dump directly onto the geotextile.
- (b) Accomplish densification of the first lift by tracking in place with dozers. Once the embankment is at least 600 mm above sub grade level, a smooth drum vibratory roller or other suitable compaction plant may be used.
- (c) Turning of construction plant is not permitted.
- (d) The weight of construction vehicles shall be limited to prevent rutting of the initial lift in excess of 75 mm.
- (e) Atmospheric exposure of the geotextile to the elements following placement shall be limited to 2 days.

- (f) Before the geotextile is covered, the Designer shall inspect the condition to ensure that holes, rips, tears or other defects are not present.

- (g) Where a starter layer is to be placed over the geotextile, a 100 mm protective course of pea gravel (rounded) shall be placed on the geotextile to prevent any coarse rock material from penetrating or damaging the geotextile.

9 DRAINAGE

This Specification should be read in conjunction with the following Irish Water Documents:

- Irish Water Publication – Wastewater Infrastructure Standard Details
- Irish Water Publication – Water Infrastructure Standard Details
- Irish Water Publication – Code of Practice for Wastewater Infrastructure
- Irish Water Publication – Code of Practice for Water Infrastructure

Where any conflict exists between this document and the contents of the documents above, then the Irish Water documents shall take precedence.

9.1 PIPELAYING GENERALLY

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 final surface 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 bed or cradle is used.

Where pipes are required to be bedded directly on the trench bottom, the final surface 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.

No protective cap, disc or other appliance on the end of a pipe or fitting shall be removed permanently until the pipe or fitting which it protects is about to be jointed. Pipes and fittings, including any lining or sheeting, shall be examined for damage and the joint surfaces and components shall be cleaned immediately before laying.

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.

Where pipeline marker tape is specified, it shall be laid between 100 mm and 300 mm above the pipe. Where a tracer system is specified, it shall be continuous and adequately secured to valves and fittings.

9.2 PIPE BEDDING

Bedding for pipes shall be constructed by spreading and compacting bedding material, as TGD H, 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.

9.3 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 TGD H.

Concrete provided as a protection to pipes shall be Grade C20, 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 TGD H

Rapid hardening cement shall not be used in concrete for the protection of plastics pipe.

Plastics pipe shall be wrapped with a layer of plastic sheeting complying with TGD H before being surrounded by concrete.

9.4 COMPLETION OF PIPE SURROUND

After completion of the relevant operations, fill 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 300 mm above the crown of the pipes.

Subsequent filling shall then be carried out as specified in TGD H.

9.5 THRUST BLOCKS

Except where welded steel pipelines or self-anchoring joints are used, thrusts 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 plastics pipe.

Plastics pipes shall be wrapped with a layer of plastic sheeting complying with TGD H before being surrounded by concrete.

9.6 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 at any joint as laid shall not exceed three quarters of the maximum deflection recommended by the manufacturer.

9.7 WELDED JOINTS IN PLASTIC PIPES

Fusion welded joints in high density and medium density polyethylene pipes shall be made only between pipes having the same physical characteristics. Joints between pipes from different manufacturers shall only be made with the specific approval of the Employer's Representative.

Site fusion jointing shall be made in accordance with the manufacturer's instructions.

When solvent welded PVC-U pipes are jointed outside the trench, they shall not be lowered into place until the period recommended by the manufacturer for complete setting of the joints has elapsed.

A pipe section containing a completed weld shall achieve the same strength characteristics as the parent pipe.

9.8 JOINTING UPVC PIPES

The handling, installation and jointing of uPVC pipes shall be in accordance with the provisions of "Recommendations for Handling and Installation of Unplasticised PVC Pipe" (Ref. SR3) or "Recommendations for Handling and Installation of uPVC Buried Drains and Sewers" (Ref. SR7) as appropriate. Both documents are published by the National Standards Authority of Ireland.

9.9 FLANGED JOINTS

Flanges shall be properly aligned before any bolts are tightened.

Jointing compounds shall not be used when making flanged joints, except that, to facilitate the making of vertical joints, gaskets may be secured temporarily to one flange face by a minimum quantity of clear rubber solution. Bolt threads shall be treated with graphite paste and the nuts tightened evenly in diametrically opposite pairs.

9.10 OGEE JOINTS

Ogee joints shall be so made that the required jointing material fills the joint cavity. Any surplus jointing material extruded inside the barrel shall be trimmed off and, where practicable, pointed on completion.

9.11 WELDED JOINTS IN STEEL PIPES

The process of welding steel pipelines shall be in accordance with BS 4515.

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 25 mm 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.

The Contractor shall submit details of the proposed welding and welding repair procedures, before production welding begins, and test welds using these procedures shall be made by the Contractor under simulated site conditions.

Welders shall only make welds for which they are approved.

Joints shall be tested using non-destructive techniques, unless it is necessary to use destructive testing to achieve adequate interpretation.

9.12 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 M1 cement mortar shall be pressed into the joint to fill the socket and shall be levelled at 45° from the outside edge of the socket.

9.13 RUN LEAD JOINTS

Run lead joints shall be made by forcing home strands of white sterilised jute piping yarn, to the back of the socket cavity leaving a space of 75 mm (60 mm for pipes of 300 mm 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 with molten lead poured in one running. After cooling, the lead shall be set up and neatly finished with the face of the lead 2 mm back from the socket face. In the case of pipes over 750 mm diameter, the socket and spigot shall be heated before the joint is run.

9.14 PROTECTION OF FERROUS PIPES, JOINTS AND FITTINGS

Ferrous pipes, joints and fittings shall be cleaned and all loose rust removed before protection is applied. External protection for bolted joints and fittings shall comprise: -

P1	The application of mastic pastes in sufficient quantity to cover all protruding edges, bolt heads and sharp edges or flanges, to give a smooth external profile. The joint or fitting shall be wrapped with two separate applications of protective tape wound spirally with a minimum half width overlap. The taping 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 self-adhesive rubber-based cold-applied tape wrap combined with a thick PVC backing. Where bolt heads, flanges and other projections arise, a moulding putty shall be used to give a smooth external profile. The joint or fitting shall be wrapped with two separate applications of protective tape wrap wound spirally with minimum of half width overlap. The tape shall extend along 150 mm of the barrel of the pipe on each side of the joint or fitting.
or	
P3	The application of heat shrink sleeves.

External protection for ductile iron pipes shall comprise: -

P1	The covering of the pipes with lay flat polythene sleeving securely held in place with adhesive tape at pipe joints and intermediate positions.
or	
P2	The factory application of plastic sleeving. The protection of joints and repairs to any damage shall be in accordance with relevant statutory documents
or	

P3	The factory application of plastic tape. The protection of joints and repairs to any damage shall be in accordance with Relevant statutory Documents.
or	
P4	Painting the external surface as described in the contract.

Completion of internal and external protection of steel pipes shall be provided where pipes have a bituminous, epoxy or any other type of proprietary 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.

9.15 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 minimal 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.

Where ductile 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.

9.16 PRECAST CONCRETE MANHOLES

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

Joints shall be made so that the required jointing material 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.

Where manholes are to have a concrete surround, the concrete shall be Grade C16/20 and the height of each concrete pour shall not exceed 2 m. Each construction joint shall break joint with that of the chamber or shaft sections by at least 150 mm.

9.17 BRICK AND IN-SITU CONCRETE MANHOLES AND CHAMBERS

Manholes and chambers constructed in brickwork or in-situ concrete shall comply with the relevant provisions of Sections 9 and 6 respectively.

9.18 FLOORS OF MANHOLES

The floors of manholes shall be formed of C25/30 concrete. Wherever possible, the manholes shall be cast up to the top of channel level when casting the floor. Pipes shall be bedded when this portion of the work is being done.

9.19 WALLS OF MANHOLES

Walls of manholes shall be of Grade C25/30 concrete. The internal surface finish shall be “Type B” as defined in Section 6.

The Contractor should note that in no circumstances will the external surface of the wall be formed by the excavation. “Fair finish” formwork must be provided for the external wall surface as well as the internal wall.

9.20 MANHOLE ROOFS

The roof slabs shall be formed of Grade C30 concrete and reinforced as shown on the drawings. An opening, minimum 0.6 m x 0.6 m, shall be formed to take the manhole cover and frame.

9.21 INVERTS AND BENCHING

Manhole inverts and benchings shall be formed of the materials described in the contract and, where there is no change of diameter, the invert shall follow the same gradient as the outgoing sewer.

The inverts of manholes shall be finished in two coats of 1:2 cement mortar, each 12 mm thick, the second coat finished perfectly smooth with a steel trowel. The benching at the edge of the channel must be brought up vertically to a height equivalent to the maximum sewer size entering or leaving the manhole.

It shall be then neatly rounded off and trowelled back at a slope of 1:6. Branches and junctions coming into the manhole shall have the same crown level as the pipe leaving the manhole. Channels of 300 mm diameter or under may be formed by fixing precast concrete channels in the manhole inverts.

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 C16/20 concrete with a screeded finish or rough finish, as required, and the concrete topping shall be applied as soon as practicable thereafter.

Where the finished surface is to be in-situ concrete, the concrete shall be Grade C16/20 with a steel trowel or fair worked finish as required.

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

9.22 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 shall be in the range 0.5 m to 0.75 m for pipes up to 450 mm nominal bore and shall not exceed 1 m for pipes up to 750 mm nominal bore.

A pipeline may, where practicable, be laid through a manhole and the crown cut out to the half diameter, provided flexible joints are situated on each side, no further than 600 mm from the inner face of the manhole wall.

9.23 CUTTING PIPES SQUARE

Where sewers enter manholes, the pipes shall be cut square with the internal facing of the manhole wall. No jagged edges or rough faces shall be left on the pipe. Pipes are to be placed before the walls are cast and are to be built into the wall as it rises. Connections of pipes to manholes should not be done by boxing out and subsequently building in the pipe.

9.24 WATERTIGHTNESS OF MANHOLES AND CHAMBERS

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

9.25 SETTING MANHOLE COVERS AND FRAMES

Manhole frames shall be set to the required level on Class B Engineering brickwork or on precast concrete cover frame seating rings, as described in the contract. The frames shall be set to level, bedded and haunched over the base and sides of the frame in Class M1 mortar.

9.26 CONNECTIONS TO EXISTING SEWERS

Pipe saddles for concrete or clay sewers shall be bedded in Class M1 mortar and a mortar fillet formed to give a cover of at least 50 mm to the base of the saddle. Pipe saddles for asbestos-cement sewer pipes shall be formed from asbestos-cement and fixed with an epoxy resin adhesive.

Pipe saddles for PVC-U pipes shall be purpose made from PVC-U and shall either be of a mechanical clip-on type or shall be fixed with an appropriate solvent cement.

Where an appropriate saddle or junction unit is unobtainable, a connection to an existing sewer may be made with a pipe cut to give an oblique junction, so that the discharge is in the direction of flow in the main sewer. The connecting pipes shall be of such a length that the socket of the cut pipe rests on the outside barrel of the sewer with no projection inside the main sewer. The pipe joint shall then be pointed in Class M1 mortar externally and internally, where practicable. Alternatively, purpose made junctions may be used by cutting out sections of pipe, fitting a junction and securing with repair couplings.

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

9.27 STORM WATER DUCTING

Unplasticised polyvinylchloride (PVC-U) pipes and fittings, in accordance with the requirements of IS 424 shall be used. The trench shall be constructed in accordance with those shown within drainage drawings & details. Care should be taken that the process of compaction does not displace the pipe from its correct line and level. Granular material should be either 14mm to 5mm graded aggregate, or 10mm single sized aggregate, complying with the requirements of IS 5: Part 1: 1990, Table 7 and should have a Compaction Factor value not greater than 0.2 when measured in accordance with BS 8301: 1985, Appendix D.

The trench shall then be backfilled with selected fill free from stones larger than 37.5mm, lumps of clay over 75mm, timber, frozen material and vegetable matter. The Selected backfill (above the granular level) should be placed in layers not exceeding 200mm, each layer then being well compacted. Backfilling will be carried out and conform to requirements of bedding and backfilling as specified in Technical Guidance Document H – Drainage and Waste Water Disposal.

9.28 MANHOLE COVERS AND FRAMES

Manhole covers and frames shall comply with the relevant provisions of IS/EN 124. The name of the manufacturer shall be cast on to each cover together with a reference to the appropriate standard to which the cover conforms, e.g., IS/EN 124 - Grade A. The approved type shall be double triangular Grade A cover, three point suspension, non-rock with circular opening to be 600 mm clear diameter.

All covers and frames shall be coated by dipping using a hot applied coal-tar based material complying with BS 4164 or a cold applied black bitumen material complying with BS 3416.

The design of covers shall be such that they cannot be displaced by normal traffic. The covers must fit tightly and evenly in the frames and shall incorporate a non-rock seating arrangement. All loose, badly seating or rocking covers shall be rejected. Where a locking mechanism is incorporated in the cover, this shall not be capable of being detached from the cover.

9.29 MANHOLE STEP IRONS TO RUNGS

Step irons for manholes and other chambers shall comply with the relevant provisions of BS 13101: Parts 1, 2 and 3.

Manhole rungs shall be 20 mm diameter stainless steel rungs manufactured of Type 316 S12 stainless steel. Rungs shall be 250 mm wide and coated in non-slip uPVC coating.

9.30 GULLIES AND GULLY COVER SLABS

Precast concrete gullies and gully cover slabs shall comply with the relevant provisions of BS 5911: Part 2. Vitrified clay gullies shall comply with the relevant provisions of IS/EN 295: Part 1.

9.31 GULLY COVERS, GRATINGS AND FRAMES

Gully covers, gratings and frames shall comply with the relevant provisions of IS/EN 124.

10 CONCRETE AND REINFORCED CONCRETE

10.1 STANDARD CODES AND PRACTICE

All design and construction of concrete elements shall comply with appropriate Irish Standard where they exist, unless otherwise stated.

Where an Irish or British Standard or Code of Practice quoted in this document has been amended or superseded, the current edition or superseding document shall apply.

The following is a non-exhaustive list of the Irish and British Standards and Codes of Practice that are to be complied with.

- BS EN 1992 Part 1-1 Eurocode 2: Design of Concrete Structures
- BS EN 206-1 Concrete – Part 1: Specification, performance, production and conformity.
- BS8500-1:2006 Concrete – Complementary British Standard to BS EN 206-1 Parts 1 and 2.
- I.S. 326 Structural use of concrete
- I.S. 1. Portland cement (ordinary and rapid hardening)
- B.S. 882 – 1201 Aggregates from natural sources for concrete (Including granolithic)
- B.S. 1198 - 1200 Building sands from natural sources
- B.S. 1181 Methods of testing concrete (Parts 1 to 6)
- B.S. 1926 Ready mixed concrete
- B.S. 4027 Sulphate resisting Portland cement
- B.S. 4449 Specification for carbon steel bars for reinforcement of concrete
- B.S. 8666 Bending dimensions and scheduling of bars for the reinforcement of concrete
- B.S. 4482 Hard drawn mild steel wire for the reinforcement of concrete
- B.S. 4483 Steel fabric for the reinforcement of concrete
- B.S. 4550 Methods for testing cement
- B.S. 5328 Methods for specifying concrete
- B.S. 5337 The structural use of concrete for retaining aqueous liquids.
- B.S. 5531 Safety in erecting structural frames

- B.S 8110 Structural use of concrete
- BS 8102 Protection of structures against water from the ground
- B.S. 8204 Screeds, bases and in-situ flooring

NCRMA Technical Papers No 13 – Composite Slabs and Beams using steel Decking: Best Practice for Design concrete tolerance

Concrete tolerances shall be within the limits specified in the relevant sections of BS 5606, appropriate to the surface finishes

10.2 REINFORCING STEEL

10.2.1 General

Reinforcement to ordinary reinforced concrete or to prestressed concrete shall be to the relevant codes. Bending of the steel reinforcement shall be in accordance with BS 8666 and to the shapes and dimensions shown on the drawings or bending schedules.

Reinforcement shall not be straightened or re-bent without the Employer's Representative's approval. Where it is allowed, care shall be taken not to damage the surrounding concrete and to ensure that the bend radius is not less than the minimum specified in BS 8666.

No hot bending shall be allowed.

10.2.2 Manufacturer's Certificates

The Contractor shall furnish the Employer's Representative with copies of the manufacturer's certificate of tests for the steel reinforcement to be supplied. The Employer's Representative may, however, order independent tests to be made and any steel which does not comply in all respects with the appropriate foregoing specifications will be rejected.

10.2.3 Measurement and Rates for Steel Reinforcement

The prices inserted in the Pricing Document for steel reinforcement and payments shall be based on the net calculated weight of reinforcement excluding tying wire used in the work in accordance with drawings or as may be directed by the Employer's Representative and no allowance will be made for rolling margins.

Mild steel reinforcing bars, used as stools to support upper layers of reinforcement, will be measurable and payment will be allowed at Pricing Document rates.

10.2.4 Cleaning of Reinforcement

Steel reinforcement, before being placed in position, shall be thoroughly cleaned of mill and rust scale and of any coating that might destroy or reduce the bond. Reinforcement appreciably reduced in section shall be rejected. When there is delay in depositing concrete, reinforcement shall be re-inspected and, when necessary, cleaned.

10.2.5 Fixing of Reinforcement

The reinforcement shall be fixed rigidly and accurately in the forms in accordance with the details shown on the drawings so that the specified cover to the bars is everywhere maintained. Approved spacers and chairs may be used.

Intersecting bars may be bound together with No. 16 gauge soft iron wire with the ends of the wire turned into the main body of the concrete.

Sections of reinforcement may be fabricated, lifted into position and lapped with appropriate lapping bars to the satisfaction of the Employer's Representative.

The concrete cover shall be not less than the required cover minus 5 mm and, where reinforcement is located in relation to only one face of a member, not more than the required cover plus: -

- 5 mm for bars up to and including 12 mm size.
- 10 mm for bars over 12 mm size up to and including 25 mm size.
- 15 mm for bars over 25 mm size.

10.2.6 Welding of Reinforcement

Reinforcement shall not be welded on site except where described or permitted under the contract. All welding procedures shall be subject to the Employer's Representative's prior approval.

10.2.7 Protection of Reinforcement

During the placing of concrete for reinforced concrete work, a competent steel fixer shall be in constant attendance to adjust and correct the position of the reinforcement, if necessary.

10.3 CONCRETE AND CONCRETE MANUFACTURE

10.3.1 Objectives of Concrete Manufacture

Concrete has to have certain properties to ensure its adequacy for the intended works. These properties can be summarised as follows: -

- A minimum compressive strength - structural strength.
- A minimum cement content, maximum water/cement ratio - adequate durability.
- Maximum cement content - to avoid “temperature cycle” cracking.
- Maximum cement content - to avoid shrinkage cracking under low humidity exposure.

10.3.2 General

The concrete supplied on this contract shall be specified and produced in accordance with BS 8500-1:1 & BS 8500-2:2 and shall be the designed mix type unless otherwise specified. Testing and sampling of concrete is to be carried out in accordance with Annex B of BS EN 206-1:2000.

The main strength and durability criteria for design mixes will be indicated on the notes of all GA and reinforced concrete reinforcement drawings.

Final details of all design mixes must be issued to the Employer's Representative a minimum of 14 days before order for written approval of same before use.

10.3.3 Minimum Cement Content

The minimum cement content of the various grades of concrete are set out in the reinforced concrete reinforcement drawings.

10.3.4 Workability

The consistency of the concrete shall be such that it can be placed without segregation and, when fully compacted, surrounds all reinforcement, tendons and ducts and completely fills the formwork.

The workability of concrete shall be within the limits of the specified value as appropriate as outlined in BS 8500 2:2. Unless otherwise stated, the specified value of slump shall be taken as 75 mm.

The standard slump test shall be carried out in accordance with BS EN 12350-2 and as required by the Employer's Representative.

10.3.5 Concrete Strength

The concrete shall be specified by the characteristic strength and compliance determined in accordance with Annex B of BS EN 206-1:2000.

10.3.6 Ready Mixed Concrete

Where concrete is to be obtained from a ready-mix supplier, the Contractor shall obtain the Employer's Representative's approval of the source and shall satisfy the Employer's Representative that the supplying plant is approved by a third party certification body.

The Contractor shall also inform the Employer's Representative what alternative suppliers are available to him if the approval of the source referred to above has to be withdrawn by the Employer's Representative during the currency of the contract.

The Contractor shall also supply details to the Employer's Representative of the length of haul and the time that the concrete will be in the ready-mix lorry.

A delivery ticket shall be required for each load of ready-mixed concrete which shall contain all the information prescribed under BS 5283: Part 3.

All delivery tickets shall be kept at the site and shall be made available for inspection by the Employer's Representative.

Ready-mix concrete shall not be delivered to site during the absence of the Resident Employer's Representative and the Contractor shall agree with the Resident Employer's Representative times of delivery. At least three test cubes shall be taken from any quantity of ready-mix concrete delivered in any 24-hour period.

The delivery of concrete and number of trucks shall be to the Employer's Representative's satisfaction. Concrete must be placed in forms within a maximum of two hours from the time of initial mixing.

10.3.7 Mixing of Concrete

The average mixing time of concrete in a power-driven mixer is three minutes. Dry batches may require a slightly longer mixing time.

The mixer must be level and the drum shall revolve at the speed recommended by the maker.

A mixer of any type which has been out of use for more than 30 minutes shall be thoroughly cleaned out before any fresh concrete is mixed.

The mixer blades shall be maintained in good condition and to the satisfaction of the Employer's Representative.

10.3.8 Admixtures to Concrete

Admixtures, such as plasticisers, hardeners or aerating agents, may not be added to the concrete mixes without the prior consent of the Employer's Representative. Admixtures, if permitted, shall be used in accordance with the manufacturer's instructions and shall be to BS 5075 "Concrete Admixtures" and in accordance with the recommendation of BS 5328.

10.3.9 Transport and Placing of Concrete

Concrete shall be transported in a manner which will avoid the segregation of the constituent materials. The concrete shall be placed in the forms before it stiffens to an extent that it cannot be fully compacted and worked around the reinforcement and into the corners of forms. If concrete is dropped into position, the drop shall be free from obstruction, i.e., reinforcement or formwork, and shall be such that loss of mortar or segregation of the mix does not occur. The concrete may be placed by skip or by chute. In each case, they shall be kept constantly free from coatings of hard concrete or other obstructions.

The maximum height of drop shall be as approved by the Employer's Representative.

Placing concrete by concrete pump or by placer may be permitted, but only with the prior approval of the Employer's Representative. Concreting of any unit or section of the work shall be carried out in one continuous operation and no interruption of the concreting will be allowed without the approval of the Employer's Representative. The placing of concrete should be so phased that ample time is left on each day for proper finishing.

10.3.10 Vibrating Concrete

All structural concrete shall be properly compacted with internal poker vibrators or, in the case of ground floor slabs, by vibrating tamping beams. In the case of ground floor slabs greater than 150 mm thick, they shall be compacted with a poker vibrator and finished with a vibrating beam. If the Contractor proposes to use external or clamp-on vibrators or other methods of compacting the concrete, he shall obtain the Employer's Representative's written permission before doing so.

When using an internal or poker type vibrator, the vibrator shall not come in contact with the reinforcement or with the formwork. The maximum depth of a layer of concrete compacted with vibrator shall not exceed 600 mm depth and desirably should be in the order of 300 - 450 mm. When layers of

concrete are being compacted, the vibrator should be lowered at least 1,000 mm into the layer beneath. The vibrator shall be moved frequently covering the area to be compacted a number of times, if necessary. Vibration is complete when air bubbles cease to come to the surface. When the poker is being withdrawn from the concrete, it should be withdrawn slowly such that the hole in the compacted concrete fills up behind it.

The concrete shall be compacted so that segregation of the mix and the formation of a weak layer of laitance at the top of the pour do not occur.

When vibrating freshly placed concrete on top of a green layer of concreting from which reinforcing bars extend, the vibrator shall not come in contact with this reinforcement as damage to the concrete bond can occur.

10.3.11 Concreting at Low Temperature

Concreting shall be discontinued when a descending air temperature in the shade falls below 3°C, and it shall not be resumed until an ascending air temperature in the shade reaches 1°C. Every care shall be taken to protect fresh concrete from the effects of frost by means of coverings or heating.

Concreting at lower temperatures may be permitted with the approval of the Employer's Representative, provided that the temperature of the concrete when placed in the form is never less than 5°C. In this situation, the Contractor shall provide full details of his proposals for placing, protecting and curing the concrete.

10.3.12 Protection of Fresh Concrete

Freshly deposited concrete, manufactured from ordinary Portland cement, shall be protected from the sun, wind and rain until it has cured properly.

10.3.13 Curing Concrete

Curing shall begin as soon as the concrete has been placed. Curing may be affected by covering the concrete member in wet hessian or plastic sheeting or with proprietary membrane curing compounds.

The Contractor shall check with the Employer's Representative, before using proprietary membrane curing compounds that no further coatings, i.e. screeds, have to be applied or bonded to the surface. The Contractor should also note that curing compounds are not suitable for use on indoor concrete work.

The curing of columns, beams and walls is assisted by the formwork and, after the formwork has been struck, the concrete shall be protected for the completion of the curing period. The curing period shall be to BS 8110: Part 1, or for such longer period as the Employer's Representative may decide. Wet hessian

or plastic sheeting may be used and the covering shall be held securely in place, and kept wet if hessian, and closed around the edges to avoid draughts.

10.3.14 Curing of Floors and Thin Concrete Layers

No slab shall be left unprotected for more than 30 minutes after finishing. If the concrete has not attained its initial set at the end of this period, it shall be protected from sun and wind by low tents of fabric supported clear of the surface and sealed at the edges to prevent draughts. If damp hessian or plastic sheeting is used to cure the slab, the edges shall be weighed down to prevent draughts blowing across the surface. Alternatively, a layer of damp sand 25 mm thick can be applied. Hessian and sand shall be kept damp and all coverings shall be kept in place for the whole of the specified curing period.

Curing by flooding with water will only be permitted with the approval of the Employer's Representative.

When the temperature is below 6°C, the curing covering shall be kept damp for a further period of seven days.

Water curing or covering the concrete surface with a damp absorbent material shall not be used when air temperatures approach 0°C.

The Contractor's attention is drawn to the fact that the curing of thin concrete layers is very important and he shall take all necessary steps to ensure that adequate materials are on site to cure the concrete properly within the specified times.

The normal curing periods for Portland cement concrete are given in Table 6.5 of BS 8110: Part 1. Curing methods shall be in accordance with Clause 6.6.3 of the same publication.

10.3.15 Defective Concrete

Concrete injured by frost or otherwise defective shall be cut out and disposed off site and the work reconstructed.

10.4 JOINTS AND KICKERS

10.4.1 Longitudinal Transverse Shrinkage and Isolation Joints

These joints shall be formed in the positions and to the details shown on the drawings.

10.4.2 Alternate Bay Construction

All ground floor slabs shall be laid in alternate bays or for small areas to the approval of the Engineer. In alternate bay construction, the slab shall be placed in the direction of the longitudinal joints.

The placing of concrete ground floor slabs in a chequer board pattern shall not be permitted.

The concreting of a bay shall not be interrupted, i.e., the Contractor shall place his concrete from transverse joint to transverse joint, unless with the prior approval of the Engineer.

Alternative proposals for pouring large floor areas may be submitted by the Contractor for approval.

10.4.3 Construction Joints

The location of construction joints, if not shown on the drawings, shall be agreed with the Engineer before concreting commences.

They shall be formed at right angles to the axis of the member concerned by the insertion of rigid stopping off forms. The upper surface of lifts of concrete in walls and columns shall be horizontal.

These forms shall be so made that they shall produce on the face of the joint a suitably grooved or indented surface to act as a bond for subsequent concrete.

Before concreting is resumed, the face of the joint already formed shall be scabbled, scrubbed clean and saturated with water.

For structures retaining aqueous liquids, construction joints shall conform to Clause 5 of BS 8007.

10.4.4 Watertight Joints

The Contractor shall form watertight joints in the locations shown on the drawings and in the positions indicated by the Engineer. Where these joints are formed, the surface of the concrete shall be stopped, whether horizontal or vertical, so that it is perfectly normal to the face of the formwork. Joints shall be provided to the details shown on contract drawings (and Particular Specification) or to the Engineer's instructions.

Care shall be taken in placing the next layer of concrete to keep the sealing strip in position so that the strip remains at the centre of the concrete section at all times or its correct location as appropriate.

The Contractor may provide alternative proposals for watertight joints for approval.

Jointing compounds or strips shall be fixed, placed and used in accordance with the manufacturer's instructions.

10.4.5 Kickers

At the base of reinforced concrete walls or columns, upstands or kickers, a minimum of 75 mm high, shall be formed at the same time as and monolithically with the supporting concrete.

Every care must be taken to ensure that these upstands are of the same strength as the concrete in the rest of the wall or column and are correctly lined and levelled. The surface finish of the upstands shall correspond to the finish of the remainder of the wall or column.

10.5 TESTING STEEL

Samples from each consignment of steel may be selected by the Engineer or his Representative and sent to an approved laboratory for testing. Laboratory fees for samples which pass the test shall be recoverable. If any steel fails to pass the test, the whole consignment shall be rejected.

10.6 TESTING WORKS CUBES

The Contractor shall allow for adequate machined steel moulds and tamping rods for the manufacture of 100 mm concrete cube. These cubes shall, at a minimum, be taken in accordance with the recommendations of BS EN 206-1:2000 or as often as the Engineer may require from different batches of concrete (subject to a minimum of 4 per batch). The methods of making and curing test cubes shall be in accordance with BS 1881.

10.7 WEIGHT OF WET CONCRETE

The Contractor shall provide a balance, tamping bar and measure in accordance with BS 1881 to determine the weight of wet concrete. He shall provide all other facilities to enable the Resident Engineer to check the weight of wet concrete.

10.8 CONCRETE CONTROL EQUIPMENT

The Contractor shall provide the following equipment for use in the testing and control of concrete mixes. The equipment shall be in accordance with BS 1881, where applicable: -

- 4 no. 150 mm cast iron cube moulds (minimum).
- Suitable apparatus for estimating water content of sand and fine aggregates.
- Set of British Standard graded sieves.
- Maximum and minimum thermometer.
- A suitable weighting scales.
- A 0.014 m³ bucket.

- A suitable compacting factor apparatus.
- A slump cone and tamping bars.
- A steel trowel.

10.9 GROUT QUALITY CONTROL TESTING

Where tests are required for different properties of grout, they shall be carried out on samples from the same batch.

The density and workability of every batch shall be determined. The density shall not differ from the value described in the contract by more than 5%. The workability shall not differ by more than 125 mm from the “Concrete Flow Through Test” or 5 seconds for the “Marsh Cone Test” with 10 mm orifice from the values described in the contract.

Sampling shall be at the rate of 3 cubes taken from every 5 m³ of grout or 50 m of grouted annulus, whichever is smaller. When tested in accordance with the relevant provisions of BS 4551, cubes shall have a compressive strength as given in the following table: -

Grout Function	Minimum Compressive Strength of 28 Days (N/mm ²)
Annulus Filling	
Type I Lining	12
Type II Lining	3
Exterior Void Filling	2

Cube moulds shall be 70 mm (nominal) or 100 mm and all joints shall be sealed to prevent leakage.

Moulds shall be overfilled and air bubbles removed by lightly tapping the mould. After leaving for 30 - 60 minutes, the excess grout shall be struck off and the moulds covered with plastic sheeting or damp hessian. Moulds shall be stored at 20°C ± 1°C until tested.

11 PAVEMENT DESIGN

11.1 FLEXIBLE PAVEMENT CONSTRUCTION

11.1.1 Roads, Carparking and Hard Landscaping Areas

Pavement build-up as per the drawings.

	<i>Carriageway Location: Roads, Carparking and Hard Landscaping Areas</i>	General Requirement
1	Grid for checking surface levels of pavement courses, if different from the requirements of C1 702.4: Long dim:	N/A
2	Surface regularity (C1 702.7 and C1 702.8): Category of Road	A
3	Additional Requirements for coarse aggregates (C1 901.5):	N/A
4	Freezing and thawing (soundness) category if different from the requirements of C1 901.6:	N/A
5	Sealant to be applied to the whole of any freestanding edge on the outside of the finished pavement on the low side of the camber (C1 903.30):	No
6	Any tests additional to those required by IS EN 13108-20, IS EN 13108-21 or the relevant SRW (C1 925.3):	N/A
7	PSV of Coated Chippings if different from the requirements of C1 915.2:	N/A
8	Whether sub-base material may be spread in more than one layer (C1 802.4):	Yes

11.2 BOND COATS, TACK COATS AND OTHER BITUMINOUS SPRAYS

A K1-40 bitumen emulsion tack coat to clause 920 of the specification applied in accordance with manufacturer's recommendations and clause 920 of the specification, shall be provided between all bituminous layers.

11.3 ROAD PAVEMENTS NRA ROAD CONSTRUCTION DETAILS

Clause No.	Road Construction Detail Drg. No.
701	RCD/700/1, 2, 3, 4, 5 & 6.

12 MASONRY

12.1 STANDARD CODES AND PRACTICE

The work shall be carried out in accordance with the requirements of the current edition of the following Irish and British Standards together with the instructions of this Specification and any further instructions deemed necessary by the Employer's Representative: -

- BS EN 1996 Eurocode 6: Masonry
- I.S. 1 Portland cement (ordinary and rapid hardening)
- I.S. 187 Calcium silicate (sandstone and flintlime) bricks
- I. S. 325 - Part 1: 1986 "Structural use of un-reinforced masonry".
- B.S. 6398 Materials for damp-proof courses
- I.S. 8 Building limes
- B.S. 1014 Pigment for cement, magnesium oxychloride and concrete
- B.S. 1199 -1200 Specification for building sand from natural resources
- B.S. 1243 Specification for metal ties for cavity wall construction
- B.S. 2028 - 1964 Precast concrete blocks
- B.S. 3921 Specification for clay bricks
- B.S. 5618 Code of practice for thermal insulation of cavity walls
- B.S. 5628 - Part 1 Structural use of unreinforced masonry
- B.S. 5628 - Part 3: 1985 "Materials and components, design and workmanship".
- C.P. 111 Structural recommendations for load bearing walls
- C.P. 121 - Part 1 Brick and block masonry
- C.P. 122 Walls and partitions of blocks and slab
- P.D. 6472 Guide to specifying the quality of building mortars
- D.D. 22 Recommendation for the co-ordination of dimensions in building. Tolerances and fits for building. The calculation of work sizes and joint clearances for building components.
- D.D. 34 Clay bricks with modular dimensions

12.2 MATERIALS AND PROPERTIES

12.2.1 Blocks

The minimum standards of concrete blocks are set out following.

12.2.2 Concrete Blocks – Solids and Hollow for General Use

Concrete blocks shall be of approved manufacture to I.S. 20. This will be all load bearing block and shall comply with normal category of manufacturing control in accordance with clause 27.2.1 I.S. 325: Part 1. Sample blocks shall be tested at a laboratory to be approved by the Employer's Representative. Blocks shall be left at least 28 days after casting before being used. All blocks shall be well-compacted and true and square in shape.

12.2.3 Mortar

The mixing and use of mortars shall be in accordance with the recommendations given in B.S. 5628: Part3.

- | | | |
|-----|-----------|---|
| (a) | Cement | The cement used in the mortar shall be NPC in accordance with I. S. 1. The use of high alumina cement is not permitted. |
| (b) | Lime | Lime used in mortars shall be non-hydraulic limes to conform to the requirements of I.S. 8. |
| (c) | Sand | The sand shall be free from deleterious substances and shall comply with the requirement for quality and grading of sand for mortar given in B.S. 1200. |
| (d) | Water | Water shall be free from impurities that are harmful to the mortar. The Contractor shall obtain approval from the Employer's Representative of the source of water supply if the supply is not obtained from a public mains supply. |
| (e) | Admixture | Admixtures may be used subject to the Employer's Representative's approval. |

12.2.4 Preparation of Mortar

- (a) Mix Proportions

Type (ii) as per table 1; IS 325

(b) Batching of Mortars

The materials for the mortar shall be measured accurately to conform to the above specified mix proportions either by weight batching or by the use of gauge boxes. The proportions of sand are based upon the use of dry sand. The Contractor shall adjust the proportions of sand for bulking due to moisture content. If admixtures are used, the proportions shall be further adjusted in accordance with the manufacturer's written instructions.

(c) Mixing of Mortars

The Mortar shall be mixed by machine, which shall be clean before starting to mix.

Mortars containing cement shall be used within one hour of the mixing of the cement and water and any mortar not then used shall be discarded and not retempered.

(d) Ready Mixed Mortar.

Ready mixed sand-lime mortar shall comply with the requirements B.S. 4721 or equivalent.

12.2.5 Testing of Mortar

Testing of mortars shall be carried out in accordance with Appendix A of I.S. 325: Part 1. Preliminary tests shall be carried out at least six weeks before the masonry building is started. Six specimens of one of the following types:

- (a) 75mm cube
- (b) 100mm cube
- (c) 100mm x 25mm x 25mm prism.

These shall be tested in accordance with B.S. 4551 for each mortar designation proposed for use on site.

Six specimens of the type used for preliminary testing, shall be prepared on site and tested for every 150m² of wall, using any one designation of mortar, or for every storey of the building, whichever is the more frequent.

The mortar will be deemed to pass if the average of the values for compressive strength at 28 days obtained from three cubes exceeds the appropriate value given in Table 1 of I. S. 325: Part 1.

12.2.6 Reinforcement and Wall Ties

Bed joint reinforcement where shown shall be of the tramline or truss type, approved by the Employer's Representative and made from 18/8 Stainless Steel. The rod diameter shall be between 3mm and 5mm.

Cavity wall ties shall be vertical twist ties made from austenitic stainless-steel strip complying with the requirements of B.S. 1449: Part 2 and B.S. 970: part 4, minimum 18/8 composition and excluding free machining specifications, with split end anchorage or their equivalent subject to the Employer's Representative's approval and shall conform to the requirements of I.S. 268.

12.2.7 Bonding Ties

Metal strips for bonding blockwork to concrete shall be austenitic stainless steel (material specification as for cavity wall ties) dovetail slot and anchor ties or their equivalent subject to the Employer's Representative's approval. Any remedial fixing of ties to concrete shall be drill fixed to the Employer's Representative's approval and shot fixings must be used.

Metal strips for bonding blockwork to structural steelwork shall be austenitic stainless steel (material specification as far cavity wall ties) vertical twist ties with other end turned down.

The turned down end shall be pre-drilled to suit a shot fixing. The type of shot fixing shall be approved by the Employer's Representative. The ties shall be 2.5 m x 20 mm min. size. Metal strips for bonding block to block shall be flat austenitic stainless steel (material specification as for cavity wall ties) 2.5mm x 20 mm x 200 mm min. long with split and anchorage. Where hollow block walls are bonded to either concrete or steel work then solid blockwork shall be used locally at the location of all bonding ties.

Ties used for bonding stone cladding built in a random pattern in courses normally 675mm or 900mm in height (or as per Employer's Representative's requirements) to blockwork, shall be vertical twist ties made from austenitic stainless steel strip complying with the requirements of B.S. 1449: Part 2 and B.S. 970: part 4, minimum 18/8 composition and excluding free machining specifications, with split end anchorage or their equivalent subject to the Employer's Representative's approval and shall conform to the requirements of I.S. 268. These bonding ties shall be embedded 50mm minimum into blockwork bed joints and shall not be bent to suit coursing of stone cladding. Where coursing of the stone cladding does not correspond to the blockwork coursing a proprietary wall tie system complying with the above requirements shall be mechanically fixed to the blockwork to the Employer's Representatives approval. The spacing of ties for bonding stone cladding to blockwork shall be 450mm centres vertically and 900mm centres horizontally. Ties shall be placed in a staggered manner.

12.2.8 Damp Proof Course

Damp proof course shall be used in accordance with the latest edition B.S. 5628: Part 3.

D.P.C's shall be laid on a smooth bed of fresh mortar. Materials for damp proof courses shall be in accordance with I.S. 57. In laterally loaded walls (e.g. subject to wind loading) the D.P.C. to be used at the base of the wall shall consist of a material which can transmit shear and which has been proven by testing to B.S.I. DD 86: Part 1 to permit the joint to transmit tension. The characteristic flexural tension developed between the D.P.C. and mortar is to be not less than 0.5N/mm^2 .

12.2.9 Handling and Storage of Materials

(a) Cement

Cement shall be stored in such a manner as to ensure that it is not affected by damp and shall be used in the order of delivery.

(b) Lime

Lime shall be stored under weatherproof conditions on a raised floor or in suitable silos.

(c) Sand

Sand shall be stored separately according to type so that they will not be contaminated. They shall be stored on a hard self-draining area.

(d) Metals

Reinforcement and ties shall be protected from becoming contaminated and reinforcement shall be free from loose mill scale and rust.

(e) Blocks

Blocks shall be carefully unloaded so as to avoid damage to the units. All blocks shall be stacked on prepared level areas to ensure that the stack is stable and blocks used for fair-faced work shall be protected to prevent the exposed faces from becoming stained or marked.

It is essential that blocks are protected from the rain and sun by covering with a suitable protective membrane.

12.2.10 Testing

Blocks shall be tested by an approved testing authority. Copies of all reports shall be made available to the Employer's Representative for inspection.

12.2.11 Precast Prestressed Composite Concrete Lintels

Precast prestressed concrete lintels shall be manufactured and installed in accordance with I.S. 240.

The lintel manufacturer shall forward to the Employer's Representatives the relevant span/load tables for the lintels and also details and results of regular testing carried out in the works to comply with I.S. 240 and to verify the span/load tables. The use of heavy duty precast lintels shall be in accordance with the locations shown on the drawings.

12.2.12 Steel Lintels and Custom Arch Formers

All steel lintels supporting masonry over openings in external cavity walls shall be austenitic stainless-steel minimum 18/8 composition type 304 (18% chromium content, 8% nickel content) designed and supplied by specialist suppliers. Generally, over arched door and window openings proprietary custom steel arch formers shall be used to support blockwork and where stone cladding is built over arch openings a natural stone arch shall be formed to Employer's Representative's requirements and Employer's Representatives approval. Where stone cladding is to be built over flat window heads, steel lintels to specialist manufacturers design shall be used to support the stone cladding.

12.3 GENERAL WORKMANSHIP

12.3.1 Dimensions

All walling shall be set out and built to the correct dimensions, thickness and heights shown on the drawings.

12.3.2 Uniformity

All perpends, quoins, joints, etc. shall be kept strictly true and square, and other angles shall be plumbed and whole properly bonded or tied together and the bed joints levelled as the work proceeds. Walling shall be built in level lifts.

12.3.3 Bond

The blockwork shall be built to the bond indicated on the Employer's Representative's drawings. Where no bond is indicated, the units shall be as proposed by the Employer's Representative and approved by DFCE. Where possible the coursing shall be arranged to allow a full block to be positioned directly beneath a lintel bearing.

12.3.4 Cutting

Blocks used for facing shall be cut with a masonry saw. Where it is necessary to cut the blocks wet they shall be allowed to dry before being built into the wall.

12.3.5 Chases, Ducts, Openings etc

The positions and size of the chasings shall be approved by the Employer's Representative or as indicated on the drawings and shall be carried out neatly using a chasing tool.

The Contractor shall form ducts, opening etc., in the walling as the work proceeds. Notwithstanding the above, chases and recesses shall comply fully with Eurocode 6 for masonry.

12.3.6 Colour Vision

The Contractor shall distribute evenly throughout any facing blocks of varying shades of the same colour. The Contractor shall mix deliveries that vary in colour to avoid contrast between adjoining lifts.

12.3.7 Weather

No block laying shall be carried out when the temperature is at or below 3 degrees C unless precautions are taken to ensure a minimum temperature above freezing point until the mortar has hardened. Should any walling be damaged by frost, it shall be pulled down and made good at the Contractor's expense.

Each lift shall be kept dry including the top surfaces until the commencement of the next lift or other superimposed work. Internal blockwork walling shall be protected from rain until such time as the building has been weathered.

12.3.8 Laying

Each block shall be laid and adjusted to its final position while the mortar is still plastic. The maximum height of wall built in any one day shall not exceed 1.5m.

12.3.9 Mortar Joints

All blocks shall be laid on a full mortar bed. Vertical joints shall be filled. All joints are to be normally 10mm thick.

12.3.10 Control Joints

Control joints to new build masonry outer leaves shall be located as follows:

- Blockwork – 6m C/C max.
- Brickwork – 9m C/C max.

Dry butt joints are to be provided to locations to be approved by the Employer's Representative. Ties to be provided at 225mm C/C vertically within 225mm either side of the joint. Joint to be carried through the plaster, requiring the use of a proprietary movement beads, where applicable. Joints need not be continued below the ground floor D.P.C. level. The vertical joints between panels or between a panel and another feature shall be straight and shall be produced by terminating alternative courses in full and half

units bedded in the normal. The location of movement joints is to be strictly agreed with the Employer's Representative and Employer's Representative.

12.3.11 Wind Posts

Proprietary Wind posts tied to floor slab below and roof structure over in accordance with manufacturers guidelines.

The spacing and fixings of these will be designed by the proprietary supplier and will need to comply fully with the applicable requirements of Eurocode 0, Eurocode 1, Eurocode 3, Eurocode 6. They shall be at a maximum of 3m C/C and provide for an Environmental Category of C3 in respect of corrosion resistance.

12.3.12 Masonry Tie-in to Existing Masonry Walls

Proprietary masonry tie system to tie all proposed masonry walls to existing masonry walls. Fixings at 450mm c/c vertically to manufactures guidelines.

Proprietary masonry tie support system designed by supplier and approved by DFCE. To comply fully with the applicable requirements of Eurocode 1, Eurocode 3, Eurocode 6. To provide for an Environmental Category of C3 in respect of corrosion resistance.

12.3.13 Double Leaf (Cavity) Walls

Wall ties

The walls shall be built with cavities of the width shown on the Employer's Representative's drawings and tied together with ties embedded in the mortar as least 50mm. Unless otherwise detailed the ties shall be staggered in alternative courses and spaced in accordance with Table 6 of I.S. 325.

Least leaf	Cavity	SPACING OF TIES		No. of ties
Thickness	Width	Horizontally	Vertically	sq. m
Less than 90	50-75	450	450	4.9
90 or more	50-75	900	450	2.5
90 or more	56-110	750	450	3
90 or more	110-150	450	450	4.9

The spacing may be varied provided that the number of ties per unit area is maintained.

Additional ties shall be provided in every course within 225mm of openings and on each side of control joints. Ties shall be laid falling to the external leaf.

Cavities

The cavity and ties shall be kept clear and clean of mortar droppings or other materials during construction and any extruding mortar shall be struck off flush. No cavity shall be sealed off until inspected and approved by the Employer's Representative.

Weepholes (cavity walls)

Weepholes 10mm wide by 75mm high, spaced at centres not exceeding 900mm and extending through the vertical mortar joints of the outer leaf, shall be provided at ground level and at positions where the cavity is bridged or at alternative locations indicated on the drawings.

Partition Walls

Partition walls should not be built on suspended slabs until after any required props have been removed.

12.3.14 Reinforcement

Bed joint reinforcement shall have an effective side cover of mortar of not less than 20mm and shall be continuous except at control joints, or where otherwise indicated. Bed joint reinforcement shall be positioned as shown on the Employer's Representative's details. Sufficient mortar shall be used in the joints in which the reinforcement is bedded to ensure that the whole surface of the steel is in contact with the mortar to provide adequate bond and protection against corrosion. Bed joint reinforcement shall be provided in two layers not more than 225mm above and below openings in walls and shall extend 600mm past the edge of the opening.

12.3.15 Protection

(a) Stability

The Contractor shall ensure the stability of walling during erection and shall also take precautions to ensure stability of walls during backfilling and concreting operations.

(b) Finished Work

The tops of constructed walls shall be protected from rain and in addition fair-faced work shall be protected against staining from construction activities.

12.3.16 Making Good

At the completion of the work all temporary holes in mortar joints of fair-faced work shall be filled with mortar and suitability tooled. Any damaged walling shall be repaired with approved materials or replaced to the satisfaction of the Employer's Representative.

12.3.17 Tolerances

The permissible deviation for walls shall be as follows: -

- (a) Level: $\pm 10\text{mm}$ for dimensions to any nominally horizontal surface measured from the nearest reference level.
- (b) Position on Plan: $\pm 10\text{mm}$ for dimensions to any nominally vertical surface at the lower edge measured horizontally from the nearest reference line.
- (c) Plumbness: $\pm 5\text{mm}$ in any 1 metre, no more than 20mm for plumbness.
- (d) Straightness: $\pm 10\text{mm}$, measured horizontally.
- (e) Joint thickness:
 - (i) Horizontal joints - joint thickness $\pm 3\text{mm}$
 - (ii) Vertical joints - joint thickness $\pm 3\text{mm}$

12.3.18 Masonry Support Angles

All steel angles supporting external masonry shall be austenitic stainless-steel minimum 18/8 composition type 304 (18% chromium content, 8% nickel content) to the dimensions and thickness shown on the drawings.

Alternative masonry supporting systems are subject to the approval of an DFCE Employer's Representative.

12.3.19 Sample Panels

Within 1 month from commencement on site the contractor shall erect a min. 2m^2 panel of finish brickwork for review and approval by the Employer's Representative and Employer's Representative.

13 STRUCTURAL STEELWORK

13.1 GENERAL

Refer to the National Structural Steelwork Specification (NSSS), BCSA & SCI Publication No. 203/02. (Paragraph references below are per the BCSA document Sections 1-11).

All structural steel to be CE Marked, shot-blasted and primed.

Steel located on inner leaf and/ or any steel in contact with a galvanised member is required to be galvanised.

Fabrication drawings to be produced by Supplier, with the following protocol for approval:

- Allow a minimum of 5 days for DFCE to review and comment on initial draft of fabrication drawings.
- Allow a minimum of 3 days for DFCE to review and comment on subsequent drafts of fabrication drawings.
- Connection details to be proposed by steel fabricator initially to enable design check by DFCE.

All structural steel, handrails, upstands and balustrades to external steps to be galvanised.

Contractor is referred to suite of DFCE Structural Drawings included in this package for further information

13.2 STANDARD CODES AND PRACTICE

Design, Fabrication and erection of all structural steel shall comply with the appropriate Irish Standard where they exist, unless otherwise stated. Where an Irish or British Standard or code of Practice quoted in this document has been amended or superseded, the current edition or superseding document shall apply.

The following is a non-exhaustive list of the Irish and British Standards and Codes of Practice that are to be complied with:

- The National Structural Steelwork Specification (NSSS) for Building Construction (5th Edition).
- BS EN 1993 Eurocode 3: Steel
- BS EN 1994 Eurocode 4: Composite
- B.S. 4: Structural Steel Sections

- B.S. 4: Part 1 Specification for hot-rolled sections
- B.S. 449: Specification for the use of structural steel in building
B.S. 639: Specification for covered electrodes for the manual metal-arc welding carbon and carbon magnesium steels.
- B.S. 709: Methods of destructive testing fusion welded joints and weld metal in steel
- B.S. 729: Hot dip galvanized coatings on iron and steel articles
- B.S. 1449: Steel plate, sheet and strip
- B.S. 1449: Part 1: Specification for carbon magnesium plate, sheet and strip.
- B.S. 1494: Fixing accessories for building purposes
- B.S. 1494: Part 1 Fixing for sheet, roof and wall coverings
- B.S. 2600: Methods for radiographic examination for fusion welded but t joints in steel
- B.S. 2600: Part 1 2mm up to and including 50mm thick
- B.S. 2600: Part 2 Over 50mm up to and including 200mm thick
- B.S. 2901: Filler rods and wires for gas-shielded arc welding
- B.S. 2901: Part 1 Ferritic steels
- B.S. 10162: Cold rolled steel sections
- B.S. 3692: ISO metric precision hexagon bolts, screws and nuts
- B.S. 4165: Specification for electrode wires and fluxes for the submerged arc welding of carbon steel and medium tensile steel.
- B.S. 4190: ISO metric black hexagon bolts, screws and nuts
- B.S. 4232: Specification of surface finish of blast cleaned steel for painting.
- B.S. 4320: Metal washers for general engineering purposes.
- Metric series
- B.S. 4360: Specification for weldable structural steel
- B.S. 4395: High strength friction grip bolts and associated nuts and washers for structural steel. Metric series
- B.S. 4395: Part 1 General grade
- B.S. 4395: Part 2 Higher grade bolts and nuts and general grade washers
- B.S. 4604: The use of high strength friction grip bolts in structural steelwork. Metric series

- B.S. 4604: Part 1 General grade
- B.S. 4604: Part 2 Higher grade (parallel shank)
- B.S. 4848: Hot rolled structural steel sections
- B.S. 4848: Part 2 Specification for hot-finished hollow sections
- B.S. 4848: Part 4 Equal and unequal angles
- B.S. 5135: Specification for process are welding of carbon and carbon magnesium steels
- B.S. 5950: Structural use of steelwork in buildings
- B.S. 5950: Parts 1 – 9 inclusive

13.3 PROPOSED WORKS

- (i) For description of the Structure, refer to the Structural drawings.

13.4 DESIGN

The Steelwork Contractor will not be required to carry out detailed design. The information to be provided by the Steelwork Contractor shall generally be in accordance with Section 3 of the BCSA NSSS Document (5th Edition) and the “Design” checklist in Section 1as follows:

- I. Refer to structural drawings for locations and arrangement of steelwork.
- II. Refer to structural drawings.
- III. Connections shall be designed in accordance with BS 5950 (Blue Book).
- IV. Generally moment, shear and axially loaded connections shall be designed as full-strength connections or as shown on the Structural Steelwork General Arrangement Drawings.
- V. Not applicable.
- VI. The Structural Steelwork Contractor will be responsible for the design and provision of temporary vertical bracing of the structural steel frame until such a time that sufficient masonry wall panels have been constructed to brace the frame.
- VII. The Steelwork Contractor shall submit a schedule of drawings, calculations and any relevant information for acceptance.
- VIII. Not applicable.
- IX. Not applicable.

- X. Generally unless noted otherwise 'Hot rolled structural steel sections' (UB's, UC's, Channels, etc.) shall be grade S275 to BS EN 10025. Hollow sections shall be hot finished grade S275 to BS EN 10210-1 as per Table 2.1 of BCSA Document (5th Edition).
- XI. The position of stiffeners, gusset plates etc., shall be as shown on the structural drawings. Notching, cutting, boring etc., of structural members shall not be permitted unless agreed with the Engineer.
- XII. Bolts, Nuts and Washers manufactured to British Standards shall generally be Grade 8.8 Black Bolts in accordance with Table 2.3 of BCSA Document (5th Edition). No specific surface treatment of bolts, nuts and washers is required. Holding Down Bolt Assemblies shall be Grade 8.8 in accordance with Table 2.5 of BCSA Document (5th Edition). No specific surface treatment of bolts, nuts and washers is required.
- XIII. The Steelwork Contractor is responsible for making up the Holding Down Bolt assemblies and preparation of a foundation layout drawing showing the setting out details for the Holding Down Bolts.
- XIV. High strength non-shrink grout shall be used under all column base plates and for grouting in bolts to a maximum thickness of 25mm or as per grout manufacturer's instructions.
- XV. Details of all types of connection shall be shown on Steelwork Contractors fabrication drawings and shall be agreed with the Engineer.
- XVI. Cut-outs or holes for fittings required by others shall not be permitted unless previously agreed with the Engineer.
- XVII. Cambers and presets where required to be as indicated on Structural Steelwork General Arrangement Drawings.

13.5 WORKMANSHIP

Workmanship shall generally be in accordance with Sections 4 to 9 of the BCSA Document (5th Edition) and the "Workmanship" checklist in Section 1 as follows:

- I. Hard stamping or other permanent forms of identification may not be used on exposed steel surfaces as indicated on Structural Steelwork General Arrangement Drawings and in accordance with Section 4.1.3 of the BCSA Document (5th Edition).
- II. There are no special welding procedures required in the fabrication of the proposed structural steel. The Steelwork Contractor shall comply with the Standard Welding Procedure Requirements set out in Section 5.3 of the BCSA Document (5th Edition).
- III. Any special requirements regarding fabrication or erection attachments for steel members should be provided by the Steelwork Contractor to ensure the safe erection of the Structural Steel. Generally attachments should be provided for lifting inclined steel members into place.

There may be a requirement to weld some attachments to the steel frame in order to secure safety netting along the underside of the roof rafters to allow follow on trades to carry out their work safely and in the event that this procedure is adopted the Steelwork Contractor shall comply with the requirements of Sections 3.4.2 and 5.4.5 of the BCSA Document (5th Edition).

- IV. Generally production test plates shall not be required for normal grade materials supplied with test certificates from manufacturers.
- V. Inspection of welds shall be in accordance with the requirements of Sections 3.4.2 and 5.4.5 of the BCSA Document (5th Edition). Site welds shall not generally be permitted but if required Non-Destructive Testing shall be carried out on all site welds.
- VI. The criteria for acceptance of welds shall be as set out in Section 5.5.7 of the BCSA Document (5th Edition).

13.6 ERECTION

Workmanship shall generally be in accordance with Sections 8 and 9 of the BCSA Document (5th Edition) and the “Erection” checklist in Section 1as follows:

- I. Refer to the Structural Steelwork General Arrangement Drawings for datum level and setting out lines/gridlines.
- II. Width and level of prepared working areas, for access of site traffic and cranes and areas available for storage shall be in accordance with the requirements of Sections 8.2 of the BCSA Document (5th Edition).
- III. The Steelwork Contractor shall be made aware of the availability of site services by the Main Contractor and any prearranged procedures for cooperation with other contractors in accordance with the requirements of Sections 8.3.1 and 8.5 of the BCSA Document (5th Edition).
- IV. The Steelwork Contractor shall satisfy all parties that the dimensions or weights of components delivered to site can be transported and erected safely. The site conditions should allow for access of HGV'S, cranes etc to deliver goods to site and erection of same which should be confirmed by the Main Contractor.
- V. Not applicable.
- VI. The location of underground services within the site shall be confirmed by the Main Contractor. The Steelwork Contractor should visit the site to ensure that any overhead lines will not interfere

with the safe erection of steel frame. Access to the building structure shall be confirmed by the Main Contractor.

- VII. The proposed sequence of erection is to be confirmed by Structural Steelwork Contractor (on fabrication drawings or written method statement).
- VIII. The requirements of Section 8.4.1 of the BCSA Document (5th Edition) shall be complied with.
- IX. The Structural Steelwork Contractor shall liaise with the Main Contractor so as to agree when other trades such as blocklaying, roofing, etc can commence.
- X. A Safe Site Handover Certificate and other information necessary shall be provided in accordance with Sections 8.3.1 of the BCSA Document (5th Edition).

13.7 PROTECTIVE TREATMENT

Protective Treatments shall generally be in accordance with Section 10 of the BCSA Document (5th Edition) and the “Protective Treatment” checklist in Section 1as follows:

- I. The surface preparation of steelwork to receive protective treatment shall be in accordance with Section 10.2 of the BCSA Document (5th Edition). Generally steel surfaces shall be blast-cleaned to preparation grade Sa 2^{1/2}.
- II. Sprayed metal coatings – not applicable.
- III. Exposed structural steel elements should be Hot Dip Galvanising in accordance with Section 10.4 of the BCSA Document (5th Edition).
- IV. The paint treatment of steel work shall be as follows and in accordance with Section 10.5 of the BCSA Document (5th Edition).

Internal Steelwork: High build zinc phosphate modified alkyd, 75 microns

External Steelwork: 2 pack zinc rich epoxy, 25 microns plus 2 coats of 2 pack epoxy micaceous iron oxide, 85 microns.

- V. The Steel Contractor shall be responsible for specification of procedure and materials/equipment used for cleaning and touching up damaged paintwork on site.

- VI. Where fire protection is required, apply intumescent coatings by brush to achieve a minimum of 60 mins. Fire resistance or to a protection period specified by the Employer's Representative. Full technical details of the proposed product must be submitted to the Engineer prior to commencement of the work.

13.8 INSPECTIONS AND TESTS

Please refer to the "Inspections and Tests" checklist in Section 1 of the BCSA Document (5th Edition) as follows:

- I. Additional tests and/or inspections may be specified by the Engineer in addition to any testing carried out by the Contractor. Tests and inspections will be witnessed by an approved Inspection Authority. A minimum of 5 additional NDTs will be requested by the Engineer during construction.

The Engineer will inspect: -

- (a) Foundation holding bolts prior to and following casting-in.
- (b) Steelwork frames following alignment and levelling but prior to grouting.
- (c) Site bolted connections.

- II. The Engineer will give advance notice for inspections of 24 hours.

13.9 PROGRAMME

Please refer to the "Programme" checklist in Section 1 of the BCSA Document (5th Edition) as follows:

- I. See (III)
- II. The Engineer will require a period of seven working days to approve Fabrication Drawings.
- III. The Steelwork Contractor shall liaise with the Main Contractor with respect to programme.
- IV. See (III)

14 TIMBER

14.1 STANDARD CODES AND PRACTICE

The work shall be carried out in accordance with the requirements of the current edition of the following Irish and British Standards together with the instructions of this Specification and any further instructions deemed necessary by the Employer's Representative: -

- BS EN 1995 Eurocode 5: Timber
- I.S. 193: Timber trussed rafters for roofs.
- B.S. 565: Glossary of terms relating to timber and woodwork.
- B.S. 1202: Nails
- B.S. 1203: Specification for synthetic resin adhesives (phenolic and amino-plastic) for plywood
- B.S. 1204: Specification for synthetic resin adhesives (phenolic and amino-plastic) for wood
- B.S. 1204: Part 1 Gap filling adhesives
- B.S. 1204: Part 2 Close contact adhesives
- B.S. 1282: Guide to the choice, use and application of wood preservatives
- B.S. 1449: Steel plate, sheet and strip
- B.S. 1449: Part 1 (B) Carbon steel sheet and coil, rolled by continuous process
- B.S. 2989: Specification for continuously hot-dip zinc coated and iron zinc alloy coated steel flat products: tolerances on dimensions and shape
- B.S. 4169: Specification for manufacture of glued-laminated timber structural members
- B.S. 4471: Specification for sizes of sawn and processed softwood.
- B.S. 4512: Methods of tests for clear plywood
- B.S. 4978: Specification for softwood grades for structural use
- B.S. 5268: Structural use of timber. Timber shall be European red or whitewood or other approved softwood. (Stress graded S.S. in accordance with B.S. 4978).

Metal plate connecting devices such as gang nails shall have a valid Agreement Certificate and shall be to the relevant British Standard where applicable.

- I. S. 444: 1998 “The Use Of Structural Timber In Buildings”.
- B.S. 5268: Part 2: 2002 “Structural Use of Timber Code of Practice for Permissible Stress Design, Materials and Workmanship”.
- I.S. 193:1986 “Timber Trussed Rafters for Roofs”

14.2 STRENGTH AND CLASSIFICATION

The strength of timber shall be classified in accordance with I.S./EN 338. Timber shall be graded in accordance with I.S. 127 or I.S./EN 519. The minimum strength class and grade of timber used shall be “GS - C16” (General structure, visually graded, strength class C16) unless noted otherwise on drawings.

14.3 MOISTURE CONTENT

The moisture content of timber in service shall not normally be greater than 20%. The moisture content of the timber at the time of construction shall not normally exceed 20% with no value exceeding 24%.

14.4 CONSTRUCTION

Floor, ceiling and flat roof joists shall be provided with bridging at maximum 1350mm centres. Notching and drilling of structural timber sections shall be in accordance with Section 9.2 of I.S. 444 and shall be agreed with the Employer’s Representative.

14.5 PROTECTIVE TREATMENT

Any protective treatments to be applied to timber elements of the structure shall be in accordance with the Employer’s Representative’s Specification. All structural timber shall be pressure treated.

14.6 HANDLING AND STORAGE

All timber shall be handled and stored/stacked on site in such a manner as to prevent damage due to weathering, warping etc. Generally all timber should be covered with a suitable waterproofing membrane until such time that it is erected on site. Any permanent roof covering shall be placed as soon as is practically possible after erection of structural timber elements.

15 DEMOLITION AND TEMPORARY WORKS

15.1 INTRODUCTION

All demolition works, including proposed best practice methodologies for Noise, Dust and Vibration control, will be subject to a Method Statement and Risk Assessment submitted for review to the Employer's Representative and the Client no less than 10 working days in advance of the works.

15.2 CONTRACT DOCUMENTS

This Specification shall be read in conjunction with all other Contract documents.

15.3 BOUNDARIES

The boundaries of the site shall be as specified on the site plan accompanying this specification.

15.4 CODES OF PRACTICE AND REGULATIONS

The Contractor shall comply with all relevant British Standards, Acts, Bye-Laws, Regulations, Instruments and Codes of Practice relating to demolition and the consequential works, particularly BS 6187 'Code of practice for demolition'. BS 5228 'Code of practice for noise control on construction and demolition sites'.

15.5 LOCAL AUTHORITIES

The Contractor shall ascertain the requirements of the Local Authority and comply with them, particularly as regards working hours, control of noise, vibration, dirt, debris and access to/exit from the site (if stipulated). Any relaxation the Contractor seeks to these requirements from the Local Authority shall also be to the Employer's Representative's approval

15.6 ACCESS

The Contractor shall ascertain the means of access to the site necessary for the execution of the Works and allow for all restrictions and costs that may be incurred through the requirements of any Statutory undertaking or Gardaí regulations. The contractor shall provide, maintain and alter from time to time as may be required all necessary temporary roadways, crossings, gantries etc, for access to the site, and for the works, and shall clear away when no longer required and make good all works disturbed and pay all charges. The removal of asbestos as thermal insulation to pipes, ducts, etc. shall be to BS 5970, Section 6, Clause 30.2

15.7 ACCESS TO ADJOINING BUILDINGS AND PROPERTY

The Contractor shall so arrange and carry out the Works as to cause no interference or interruption to the use of the adjoining buildings or services nor of the roads, footpaths and other means of access to these buildings and services.

15.8 MAINTENANCE OF ADJOINING BUILDINGS, ROADS, FOOTPATHS, ETC

The Contractor shall be responsible, and include in his proposal for the upholding of the adjoining buildings and roads, footpaths etc, together with the mains and services there under from immediately he takes possession of the site until completion of the Contract. The Contractor shall hold the Employer indemnified against all and every claim which may be brought against him for loss and/or damage of any description which may be caused to the adjoining buildings and adjacent roads and footpaths with the mains and services there under by reason of the carrying out of the works or by reason of insufficiency of shoring and strutting.

15.9 TRAFFIC SAFETY AND MANAGEMENT

The Contractor shall provide, erect and maintain such traffic signs, road markings, lamps, barriers and traffic control signals and such other measures as may be necessary for the execution of the Works.

Before the commencement of any work which affects the use of the public highway the Contractor shall, after consultation with the Gardai and Highway or other Authority concerned, submit a programme and method statement showing the proposed scheme of traffic management.

15.10 TEMPORARY WORKS INCLUDING ACCESS SCAFFOLDING

The Contractor shall design and be responsible for all temporary works at all times and at all stages including subsequent dismantling where relevant, other than as may be specifically shown on the contract Drawings.

Temporary works shall be designed by the Contractor's Indemnified Chartered Structural Engineers in accordance with relevant British Standards and Codes of Practice, particularly BS 5973 'Codes of practice and in accordance with the requirements of the Local By-Laws. The design shall include foundations or other appropriate support. Any inspection or opening-up required to enable the design of the temporary works to be carried out shall be the Contractor's responsibility. Temporary Works designs shall be submitted (along with a TWDC) for review by DFCE prior to construction of element.

The provision of scaffolding on any public footway shall be by pre-approval with the Local Authority & the Gardai.

15.11 DISCONNECTION OF SERVICES

The Contractor shall satisfy himself that utility, electrical, gas, water and all other services are properly disconnected prior to the work commencing. The Contractor shall be held responsible for any injury or damage to persons and property caused by the failure on his part to give effect thereto.

The Contractor shall allow all authorities and companies every facility for removing any fixtures, fittings or services which may belong to them, and which are affected by these works. The Contractor shall be responsible for maintaining close liaison with the Local Authority and the Public Utility Authorities so as to avoid any disruption of the existing services.

15.12 ADVERTISING

No fences or hoarding may be used for advertising purposes and the Contractor must keep the fences or hoarding clear from advertisements unless otherwise instructed by the Employer's Representative.

15.13 NUISANCE FROM DUST AND VIBRATION

The Contractor shall provide and maintain and keep available plant and equipment necessary to minimise the formation and accumulation of dust arising from the works, in dry weather conditions. The Contractor must apply measures appropriate for the control of dust at source, such as water spraying and apply best practice techniques in accordance with BRE Digest 465 – *Control of dust from construction and demolition activities* and BS 6187. This is especially critical due to the close proximity of the site to the Airfield and parked aircraft stands. All contractor proposals for source control of dust are to be subject to a full Method Statement and Risk Assessment for review by DFCE and the Client.

In general the following principles will be employed to maintain the air quality and reduce dust dispersion to the atmosphere.

1. The demolition of the building will be undertaken by the physical removal of the structure by mechanical means in a controlled manner.
2. Water spraying will be employed throughout the site to reduce air contamination dusty activities will be dampened with water spray while work is proceeding.
3. All on-site stored materials will be located internally or secured adequately to prevent them being dislodged or blown away in windy conditions.
4. All mechanical equipment used on site will be properly maintained to prevent excessive smoke, pollutants and/or fumes being emitted.

The Contractor shall take all steps necessary to minimise vibration caused by plant and machinery used on the site. No machine shall be permitted which uses a system of dropping a heavy weight, whether power assisted or by gravity, for the purpose of breaking up paving or foundations. Vibrations shall be monitored by vibrometer where instructed by the Engineer. Vibrations associated with mechanical plant

shall typically not exceed 2.5 mm/s as peak particle velocity in any perpendicular direction at the property boundary (assuming the vibration frequency is between 10 and 60Hz).

The Contractor shall protect and minimise the existing buildings from dust infiltration during demolitions works. This is to include for a full height weathered, insulated and dust sealed partition (150x44 at 400mmCC) from floor level to the underside of the roof above (including the ceiling void). This is to have all necessary returns to ensure the full weathering of any exposed finishes external to the partition line. Contractor shall ensure that the existing fire detection system must not be interfered with by dust arising from demolition works.

15.14 COINS, ANTIQUES, ETC

Any coins or antiquities found on the site are to become the property of the Employer and are to be handed over to the Employer's Representative.

15.15 PLANT

The Contractor is to provide all requisite plant, scaffolding, gangways, planks, gantries, tarpaulins, hoist, etc. and any cartage, workmanship and materials which although not specifically mentioned, may be necessary for the proper protection and execution of the work described herein.

15.16 SALVAGED MATERIALS

Should the Employer's Representative decide that parts of any buildings are of historic interest or of particular use to the Employer, these parts shall be carefully dismantled and stored in a convenient area of the site for retention by the Employer and if the Engineer deems it to be reasonable an allowance will be made for the value thereof.

15.17 WATER FOR WORKS

Provide water for the whole of the Works together with all necessary temporary arrangements for storing and distributing about the site and pay all fees and charges in connection therewith.

15.18 ARTIFICIAL AND TEMPORARY LIGHTING AND POWER

The Contractor is to provide all artificial and temporary lighting and power required for the proper execution of the works (including safety lights on any hoardings or gantries projecting on to or over the public road and or footpath) and is to pay all charges in connection therewith.

15.19 WELFARE AND SAFETY MEASURES

The Contractor is to maintain welfare and safety measures and amenities up to suitable standard in accordance with Building (Safety, Health and Welfare) regulations any and all relevant Acts of the Oireachtas. The Contractor should provide at his own expense for his workmen proper sanitary accommodation of a good standard and should remove it at the completion of the works. If it is not practicable to connect W.C.s to the sewer chemical closets should be provided. Also all other site facilities, offices, huts etc. required for workmen.

15.20 PROTECTION OF SITE

Provide all temporary and permanent hoardings, barriers, fans, gantries, tarpaulins, guard-rails, watching and protective lighting, and the like as may be necessary for protecting the public and adjacent properties for the proper execution of the Works and for meeting the requirements of any local or other authority. Completely enclose the site with a substantial hoarding as shown on the Employer's Representative's drawings.

15.21 GIVE ALL NOTICES

Before commencing the demolition of any part of the structure the Contractor shall conform to the provision of any Acts of the Oireachtas relating to the works and to the Regulations and By-Laws and pay all fees in respect thereof. The Contractor shall give all notices to water, gas, lighting and power Authorities and to Eircom and should they so require allow them facilities for removing any fixtures, fitting or services which may belong to them and shall include for all charges for this work. All such services shall be terminated at their point of entry to the site.

Any existing services servicing adjoining properties, which may be connected through the site shall be established by the Contractor, protected and maintained as directed by the Engineer.

15.22 SHORING AND TEMPORARY WORKS

The Contractor is required to inspect adjoining buildings to ascertain the nature of the construction. The Contractor shall be responsible for the design and positioning of temporary supports during the various stages of the work. Where in the opinion of the Contractor propping, shoring and tying are required they shall be designed, erected and removed in accordance with recommendations given in BS 8004 1986 as the works may warrant. The Contractor shall engage the services of Chartered Consulting Engineer experienced in this work to design, detail and inspect all necessary temporary works to the adjoining buildings. Copies of the detailed drawings shall be submitted to all interested parties including the Non-Negligence Insurance Company's Engineers at least 4 weeks before commencing work on site. The Contractor shall provide, erect and maintain all necessary needles dead and raking shores to the entire satisfaction of the Employer's Representative and Local Authorities. The construction location design and

efficiency of the shoring and temporary works for the purpose for which it is erected shall be the entire responsibility of the Contractor. Should any subsidence or any other damage occur due to the inefficiency of the shoring or any other support provided, the damage shall be made good by the Contractor at his own expense. Foundations to temporary work shall be adequate to support all temporary loading.

15.23 TRADESMEN

None but fully qualified, competent tradesmen shall be employed by the Contractor.

15.24 SUB-LETTING

No part of the work shall be sub-let without the written permission of the Employer's Representative. If, with the Employer's Representative's approval the Contractor sub-lets any portion of the work the specification shall apply to such sub-contractors.

15.25 PROCEDURE FOR CARRYING OUT THE WORKS

Before entering upon the site, the Contractor shall inform the Employer's Representative of the procedure he proposes to follow in carrying out the works. The Employer's Representative shall have the power to require the execution of any measures he may deem necessary to safeguard life and property. The adequacy of such arrangements shall be the sole responsibility of the Contractor.

15.26 DISMISSAL OF PERSONS

The Contractor shall at once discontinue the employment on the site of any person employed by him who shall in the opinion of the Employer's Representative, misconduct himself or be incompetent.

15.27 WATCHMEN

A competent watchman is to be appointed by the Contractor and will be required to be in attendance at weekends and during hours of darkness.

15.28 ARRANGEMENT WITH LOCAL AUTHORITY

Make such arrangements with the local authority as may be necessary, pay all fees and undertake all responsibility for damage to or interference with the public road and public services.

15.29 SURVEY OF CONDITIONS AND DEFECTS

Before commencing work on site, the Contractor shall undertake an adequate survey of the condition of the existing buildings and structures adjacent to the site and he shall submit to the Employer's Representative written and photographic records of all existing defects at least four weeks before commencing work on site.

15.30 VIBRATION

15.30.1 Limits of vibration

All methods of demolition, piling and excavation should limit induced vibrations to adjacent buildings to 2.5mm/s assuming the frequency of the vibration is between 10 and 60Hz.

15.30.2 Monitoring of vibration

Vibration monitoring should comply with the requirements of the German standard DIN 4150.

- a) Continuous monitoring of vibrations on all adjacent buildings should take place initially at the start of demolition, using a velocity transducer.
- b) Transducers should be placed in accordance with the recommendations of DIN 4150.
- c) The transducers should have a sensitivity and frequency range to cover frequencies and velocities ranging from 4 to 150Hz and 0.2 to 50mm respectively.
- d) The transducers should be arranged on the buildings so that one of the directions of measurement should be parallel to one of the side walls of the buildings, and the other be made on the side of the wall facing the source to the vibration, as near as possible to the source.
- e) The transducer should measure particle motion in three directions, giving the true peak resultant velocity. Three single axis transducers on one triple axle transducer is required.
- f) Transducers should be fixed rigidly to parts of the buildings or masonry windowsills or masonry brick.
- g) Monitored vibration should be downloaded to excel format and forwarded to the Engineer daily, for that particular day monitoring
- h) 6 number vibration monitors should be provided in total, fitted the each structure located adjacent to the works - at locations to be agreed with DFCE prior to excavation and demolition works.

15.31 EXISTING SERVICES ON AND ADJACENT TO THE SITE

The Contractor shall ensure that all existing services are properly identified and isolated and rendered harmless before work commences in a particular area and notify the Employer's Representative and any necessary Statutory Authorities at the commencement of the work.

The Contractor shall locate, disconnect and seal with concrete all disused drain connections within the site.

15.32 DISPOSAL OF RAINWATER

The Contractor shall allow for the disposal of rainwater for the duration of the Contract to ensure that ponding and flooding does not occur.

15.33 WORKMANSHIP

The Contractor shall provide all appropriate measures for the protection of the public and adjoining owners and occupiers by way of fans, temporary hoardings, barriers etc, to be erected prior to the commencement of any major demolition works.

Debris shall be removed from the site to authorized tips.

The Contractor shall take all necessary precautions to limit the nuisance caused by the loading and removal from site of demolition material and rubbish.

Special care must be taken to prevent debris from site being carried or blown onto surrounding areas and provision shall be made for the cleaning and inspection of vehicle wheels before the vehicle leaves the site.

15.34 SUPERVISION

The Contractor shall provide on site, at all times, suitable and qualified supervision personnel.

15.35 EXPLOSIVES

The use of explosives will not be permitted.

15.36 BURNING

The Contractor shall not burn any materials on the site.

15.37 FLAME CUTTING

Where flame cutting of existing metal is required, the Contractor shall take all necessary precautions to prevent the outbreak of fire(s) or causing explosion of noxious gases from any adjacent combustible or ignitable materials such as timber, paper, paint, or adjacent gaseous or flammable liquids in pipes, tanks, contaminated ground etc. Petrol and oil storage tanks and tanks that have been used or the storage of gaseous, flammable or toxic liquids shall be removed in conformity with statutory regulations.

15.38 TIMBER AFFECTED BY DRY ROT AND OTHER RUBBISH

The Contractors shall take all timber out of houses affected by dry rot, or any other infestation, carry it away to suitable site and burn it.

15.39 WASTE ARISING

Provide for all carting on or in connection with the Works and carrying away from day to day all surplus materials as they accumulate. On completion, leave the site clean and tidy and in a condition that is satisfactory to the Employer's Representative. Location of any stock piling of demolition material on site shall be agreed with the Engineer. No surcharging of adjoining walls with demolition material shall be permitted.

The main contractor for the project will be responsible in minimising the dispatch of waste material to landfill. This will be achieved by segregating the waste into dedicated streams and providing appropriate recycling and waste skips, which will be managed during the entire course of the works.

The waste streams are identified below:

- Wood
- Construction Debris
- Metals
- Plastics
- Paper
- Chemicals
- Electrical Batteries

All chemicals will be handled, stored and disposed of in accordance with the associated. Material Safety Data sheet. The waste disposal company will be registered with the EPA and certified for the disposal of the particular waste. All carting away of waste arisings shall be in compliance with the Waste Regulations to landfill facility licensed to receive the waste stream being transported.

16 PRECAST

16.1 GENERAL

Proprietary precast units shall be manufactured, handled and assembled by methods which are safe and yield a completed structure which is satisfactory in relation to its stability, performance, durability and appearance. Proprietary precast units to be approved by DFCE in accordance with the span and loading applicable. To comply fully with the applicable requirements of Eurocode 0, Eurocode 1, and Eurocode 2.

16.2 INFORMATION FROM PRECAST CONCRETE MANUFACTURER

The contractor shall submit to the Engineer for agreement the following precast concrete information:-

- (a) Minimum age for handling and transportation.
- (b) Position and design of lifting points.
- (c) Method of lifting.
- (d) Type of lifting equipment.
- (e) Methods of supporting and stacking both while being stored and transported.
- (f) Method of assembly and erection.
- (g) Accuracy of assembly and erection.
- (h) Method of providing temporary support.
- (i) Method of providing final structural connections.
- (j) Composition of concrete or mortar used to fill joints.
- (k) Method of protecting the units from damage at all times.

16.3 PRECAST CONCRETE MANUFACTURER'S DESIGN AND DRAWINGS.

All design, manufacture & erection shall be carried out in accordance with BS EN 1992. The Manufacturer shall supply such drawings and calculations as required by the Engineer in order to demonstrate that the design is carried out in accordance with the specification.

Revised drawings shall have a suffix letter added to the number and a description in the notes stating the change that was made and the date.

Drawing offices system shall ensure that revised drawings are issued and the earlier copies withdrawn or clearly marked superseded. General Arrangement drawing shall be prepared by the precast concrete manufacturer showing plans and elevations of a scale such that identification mark for all members can be shown on them. Preferred scales are 1:100 or larger. The drawing should show the grid locations as indicated on the design drawings, main dimensions and member levels. Details at an enlarged scale shall also be made if these are necessary to show the assembly of members. Foundation plan drawings should show the base locations, position and orientation of columns, identification marks of all columns and any other members in direct contact with the foundations, base location and base level. The drawings shall show complete details of fixing to the foundations including the method of adjustment and packing.

Reinforcement drawings shall show all necessary details and dimensions to enable manufacture of components to proceed.

A drawing register shall be made and used to control the issue of drawings. It shall incorporate a system so that identification marks of the components can be readily identified with each drawing.

The reinforcing drawings shall show details of holes and fixings necessary to comply with safety requirements to provide for lifting and erection of the components.

When preparing reinforcing drawings the precast concrete manufacturer shall take account of:

1. The need for clearances between the components to be manufactured, making provision so that the permitted deviation in manufacture and erection is not exceeded.
2. The Engineer's requirements for pre-set cambers.

When necessary to amplify the information given in the erection method statement, the precast concrete manufacturer shall prepare erection drawings. Details and arrangement of temporary propping necessary for erection purposes shall be shown on the erection drawings.

Drawings made by the precast concrete manufacturer shall be approved by the Engineer.

Approval by the Engineer of drawings prepared by the precast concrete manufacturer implies that the P.C. concrete manufacturer has correctly interpreted the design requirements.

Approval does not relieve the P.C Concrete manufacturer of the responsibility for accuracy of calculations, detail dimensions on neither the drawings, nor the general fit up of parts to be assembled on site.

The following designations as shown in Table 8.1 may be used by the Engineer approving drawings.

Table 16.1 Approval of third party drawings

CLASSIFICATION	MEANING
"Approved"/"Reviewed"/"No Comment".	Drawing is accepted and may be released for construction.
"Not approved".	Drawing must be amended in line with the comments and not resubmitted for approval.
"Approved subject to comments".	Drawing must be amended in the way indicated and resubmitted for approval.

On completion of the contract the contractor shall provide the Engineer with one set of paper prints of "as erected" drawings comprising of:-

- General Arrangement Drawings.

- Reinforcement Drawings.
- Drawings showing revisions made after manufacture.
- Drawing Register.

16.4 ERECTION OF PRECAST UNITS

All precast units shall bear adequate identity, location and orientation marks. No P.C. unit damaged by frost shall be incorporated in the works.

Temporary works or connections to newly positioned units shall be provided as soon as practicable. These connections shall be completed before the lifting equipment is removed. Final structural connections shall be completed as soon as practicable. Contact surfaces intended to be bonded with insitu concrete shall be prepared in the manner detailed on the drawings. All reinforcement shall be accurately located, particularly in the ends of members. All beams shall be symmetrically loaded with precast floor slabs.

Structural steel sections in the ends of members and additional reinforcement needed to complete connection shall be accurately located.

All joints shall be properly packed.

All levelling devices such as nuts and wedges which have no load bearing function in the finished structure shall be slackened and released or removed to the satisfaction of the Engineer. All lifting hooks and devices cast into precast members shall be removed. All lifting holes, eyes, sockets etc, not required in the final structure shall be grouted in to the satisfaction of the Engineer.