

Structural & Civil Engineering Specifications

For

Replacement Boundary Wall & Associated site works

at

St Joseph's Hospital, Stranorlar, Co. Donegal

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1.0 PREAMBLES

General:

This specification is to be read in conjunction with all relevant Architects and Consulting Engineers drawings and specifications.

This is a project specification which has been prepared to address and clarify particular items relating to this specific project and should be read in conjunction with the general specifications, as itemised below and elsewhere, relevant to certain section of the works.

References to standards and codes in this specification shall imply the latest version of these standards and codes together with all addenda and appendices and all normative references contained with these standards and codes.

References to BS EN standards in this specification or any of the general specifications or normative references shall be substituted with the respective IS EN equivalents where these are available.

In this specification the term Employer's Representative shall imply the Engineer or Architect as appropriate and the three terms are, in most instances, interchangeable.

Contractors are expected to be conversant and compliant with the latest versions of all current codes of practice and standards pertaining to the various elements of the works and in particular the following:-

- Transport Infrastructure Ireland (TII) Specification for Road Works.
- National Concrete Structural Specification (NSCS) and its associated Guidance document as prepared by Construct (www.construct.org.uk) and available through the Concrete Centre (www.concretecentre.com) together with IS EN 13670:2009 – 'Execution of Concrete Structures'.
- National Structural Steelwork Specification (NSSS) for Building Construction as published by and available through The British Constructional Steelwork Association (www.steelconstruction.org) together with ISEN 1090-1:2009+A1:2011 – 'Execution of Steel Structures and Aluminium Structures-Part 1: Requirements for conformity assessment of structural components' and ISEN 1090-2:2008+A1:2011 – 'Execution of Steel Structures- Part 2: Technical requirements for steel structures'.
- Specification for Piling and Embedded Retaining Walls as published by The Institution of Civil Engineers.

In all cases where there are inconsistencies between the requirements of this project specification and those set out in other relevant documents, the requirements of this specification shall take precedence.

Quality Control Documentation:

Under the current EU directives and in particular the Construction Products Regulations 2013 it is the responsibility of the Contractor to ensure that all material and fabrications on the site have been provided in compliance with an acceptable quality control system relevant to that material and fabrication as stipulated in the appropriate harmonised European standard (hEN) and shall provide evidence of compliance with such a quality control system to the Engineer or Architect, for approval, before this material or fabrication is incorporated into the works.

This verification may be in the form of Certificate of Factory Production Control (CFPC), Declaration of Performance (DOP), CE marking or other depending on the level of assessment required in accordance with the Assessment and Verification of Constancy of Performance (AVCP). The Contractor shall seek the approval of the Engineer with regard to the required level of product certification and the Engineer's decision shall be final in this regard.

Contractor's Overall Responsibility for Stability of Structures:

Notwithstanding the duties of his individual subcontractors in relation to temporary stability of various elements of the Works the Contractor shall assume and maintain responsibility for the temporary stability of the Works at all times throughout the Contract until such time that the Works have been completed to the satisfaction of the Architect/Engineer.

Temporary Works:

1. The Contractor, at his own expense, shall be solely responsible for the sufficiency, stability and safety of all temporary works necessary to ensure maintenance of any existing support provided by structures scheduled for demolition. He shall include in his tender, rates for providing all necessary support until the Architect/Engineer is satisfied it is no longer required.
2. The Contractor shall engage a Structural Engineer to advise him and to provide design and details of the temporary works and sequence of operation. Contractor to discharge all associated fees. Design and details of temporary works to be forwarded to the Engineer for comment prior to commencement of works. Any comments so made shall not in any way mitigate the Contractor's responsibilities in this regard.

3. The Contractor shall provide all necessary tarpaulins and other means of covering to protect adjoining building/structures against inclement weather.
4. The Contractor shall take all necessary precautions to ensure that no part of the adjoining buildings and/or structures is subject to additional loads as a result of the works.

2.0 EXCAVATIONS.

GENERAL EXCAVATIONS AND FILLING:

General Requirements:

Codes of practice: Comply with BS 6031 Earthworks and BS 8004 Foundations subject to any qualifications given below.

Comply with Section 1 General requirements which shall be read in conjunction with (and forms an integral part of) the excavation specification.

Site Conditions:

The Contractor is deemed to accept that the ground conditions may vary from those indicated by the report and he shall make local enquiries and carry out his own investigations in respect of the ground conditions, water table and other factors affecting the proposed excavations.

Existing services: Make all necessary enquiries from Local Authorities and Statutory Undertakers concerning the possible existence of live services on the site: report findings to the specifier and agree procedures.

Existing waterways: Subject to approval, temporarily divert and permanently reinstate any ditches, land drains or other existing waterways.

Workmanship

Preliminary Site Work

Bench marks: Report the existence of any bench marks: protect pending instructions.

Levels: Set up and maintain an accurately ascertained site datum level based on an established bench mark. Carry out and record a site level grid.

Material to be removed from site: The term 'remove' used below in this section means the removal from the site of all unwanted material such as debris, tree roots, surplus soil, old drains and foundations, etc. Remove all such material to a tip authorised by the local authority, comply with all tipping regulations and pay all charges.

Site clearance: Before commencing excavations, clear site of rubbish, shrubs and general vegetation and remove.

Nuisance generally: Prevent smoke, dust, fumes, spillage, pollution of waterways and other harmful activities. No bonfires will be allowed. Dispose of waste foodstuffs (e.g. from messrooms) to discourage flies and other pests. Comply with any reasonable requests from the public and adjoining owners.

Noise: Keep noise down to as low a level as can be practicable attained. Avoid the use of noisy tools (e.g. percussion tools) or restrict their use to agreed times. Use mufflers and acoustic enclosures when necessary.

Preservation of plants: Mark and protect all trees and other planting to be retained. Do not cut or otherwise damage branches or roots. Erect barriers where necessary.

Reducing levels: Reduce levels down to the specified formation level and remove soil.

Excavations Safety: Take adequate precautions to ensure the safety of excavations and everything affected by them. Do not permit anyone to be near or in unsupported excavations. Comply with the procedures given in Section 1.4 of BS 6031 and Section 11 of BS 8004.

Excavating: Set out the excavations as stated in the appropriate structural work section and excavate to the required depths and profiles.

Excavating for drains and services: See Drainage sections, details & survey report.

Unexpected situations: Record any circumstances not anticipated by the drawings or otherwise; seek instructions if the Works are affected in any way.

Obstructions in the ground: Break up and remove surface beds and pavings, old foundations, disused drains and manholes and all other obstructions in the ground. The use of explosives is not permitted.

Voids in the ground: Report any voids, tanks or other potential hazards encountered and seek instructions. Backfill any voids caused by removing obstructions with hardcore thoroughly compacted.

Toxic substances: Refer to Engineer details.

Disused drains: Plug any pipes cut off at the perimeter of excavations with foundation grade concrete rammed in to refusal (but not less than 300 mm).

Existing live services: Report as soon as encountered and protect pending instructions: notify all authorities concerned. If work proceeds adjacent to live pipes and cables etc., excavate by hand and provide all necessary temporary support and protection. Backfill and compact with equal care.

Surface and ground water: Keep the site generally, and the excavations in particular, free from water arising from any cause: adopt the following procedures and precautions:

- a) Use methods that cause no harm or nuisance.
- b) Do not discharge water into any watercourses or drains without approval from the relevant authorities. Ensure that discharged water does not affect the stability of buildings on or off the site.
- c) Do not pump or use any other method that draws fine material from adjacent ground.
- d) If sumps are formed, backfill them and reinstate ground to original condition.
- e) Take special precautions against accidental or sudden flooding.

Bottom of excavations: Adopt the following procedures:

- a) Report if a firm bearing is encountered before the specified foundation depth is reached.
- b) Report if a firm bearing cannot be established at the specified foundation depth.
- c) Probe the bearing surfaces for soft spots: report the extent and location of those encountered pending instructions in respect of additional excavation and backfilling with suitable material.
- d) Obtain approval for the excavations immediately before placing foundations.
- e) Remove the final 75 mm of soil and level and compact immediately before placing the concrete.
- f) Record and agree any levels that differ from those specified or declared provisional.

Excess excavation: Should there be any excavation in excess of that required for the Works, make good the ground as directed and according to circumstances: note that reinstatement with lean-mix concrete may be ordered.

Safety of the excavations: Adopt the following procedures:

- a) Take whatever precautions necessary to eliminate any risk of collapse of the sides of the excavations. This is a Contractor's risk and if any damage occurs he shall undertake any repair work as necessary or as directed.
- b) Ensure that excavations cause no risks to adjacent roads, paths or buildings, etc.
- c) Keep raised soil well back from edges of excavations.

- d) Prevent (by barriers or other means) vehicles, plant, spoil or anything approaching the area adjacent to the edges of excavations; being a recommended distance of not less than the depth of the excavation in stable soil.

Disposal of excavated material: Dispose of soil, etc as follows:

- a) Keep all top soil separate and remove or stack on site as directed.
- b) Select the best of the excavated soil for filling and deposit in spoil heaps for that purpose.
- c) Remove all surplus spoil.

Setting Out:

Set out the foundations and excavate to the required depths and profiles to allow for accurate location of foundation and substructures in accordance with tolerances herein and good building practice. The Contractor shall be entirely responsible for accurately setting out all the work, regardless of whether the Engineer has checked the setting out or not. He shall at his own expense make good any defect arising from errors in lines or levels.

Filling:

General filling to make up levels:

Spread selected material arising from the excavations: compact in approx. 225 mm layers: level or grade to slopes as required.

Compaction: Compact all fill materials in layers as specified and in accordance with the following general requirements:

- a) Undertake all compaction with suitable mechanical plant.
- b) Compact around structures with an unsupported side (e.g. retaining walls) in thin layers and with care: otherwise fill and compact both sides together.
- c) Compact hard fill (e.g. hardcore) in layers of thickness approx. one third more than the max nominal particle size of the fill: continue compaction until there is no surface movement ahead of the roller, all surface voids are filled and the surface is smooth and level or graded as required.
- d) Undertake initial compaction over drains and ducts, etc. with care to avoid fractures.

Inspection: Do not backfill around foundations, etc. until inspected and approved.

Frozen material or ground: Do not undertake any filling when this situation occurs.

Backfilling excavations: Backfill around foundations with selected material arising from the excavations carefully compact in approx. 225 mm layers.

3.0 DRAINAGE WORKS.

General:

Drainage works shall be carried out in accordance with Irish Water Code of Practice for Wastewater Infrastructure (Document: IW-CDS-5030-03) and Irish Water Wastewater Infrastructure Standard Details (Document: IW-CDS-5030-01).

Drains & Sewers:

Drainage and sewer piping shall comply with Irish & British Standards, the most recent being deemed to be the relevant standard. The Contractor shall be responsible for locating the positions of all existing services including mains, cables, pipes, sewers and drains. Also the Contractor shall be responsible for ensuring that existing services are protected from damage during the course of the works. Rates shall include for possible hand digging and any other necessary measures required to ensure existing services are not damaged.

Pipeline Cover:

Any damage incurred shall be repaired at the expense of the Contractor to the satisfaction of the Statutory Authority concerned. All drainage pipes shall be laid with a minimum cover of 1.2m in roads and driveways and 0.9m elsewhere.

Where it is not possible to achieve these minimum covers pipes shall be bedded and surrounded in concrete not less than 150mm thick.

Trench Width:

Trench width generally shall be as small as practicable, but not less than external diameter of pipe plus 300mm or larger dimension if specified. Trench sides must be vertical from bottom up to 300mm above crown of pipe.

Pipelaying:

Drainage pipes shall be laid in a granular bed and surround of 150mm minimum.

Materials for granular bedding shall comply with IS 5 with a nominal maximum size aggregate of 10mm for pipes up to 225mm diameter and with a nominal maximum size aggregate of 15mm for pipes over 225mm diameter.

Pipes laid in roads and road margins shall be backfilled with TII Specification Clause 804 material and compacted in 200mm layers with a 'whacker' plate or mechanical compactor.

Except where special backfill material is specified, trenches shall be backfilled with selected excavated material. The fill material shall be a uniform readily compactable material free from tree roots, vegetable matter, building rubbish and frozen soil and shall exclude clay lumps retained on 75mm sieve and stone retained on 25mm sieve. Backfill shall be compacted in 100mm loose layers.

The Contractor shall ensure all excavations are kept free from water during the course of the works.

Pipe Jointing:

Drainage pipes shall have flexible joints and shall be jointed in the approved method recommended by the manufacturer of the pipe, incorporating rubber sealing rings as specified and sealed watertight.

Manhole Construction:

Manhole walls shall be constructed in precast concrete units complying with BS 5911, or constructed in solid concrete blockwork. The blocks shall be solid blocks to IS 20 with a compressive strength of at least 10N/mm². All joints shall be fully mortared and finished with a neat, flush, trowelled face as the work proceeds. Minimum wall thickness to be 225mm. Blockwork manhole walls should be scudded and rendered in two coats externally, to a minimum thickness of 20mm.

Manhole bases shall be constructed in Grade C20 in-situ concrete, 225mm thick and reinforced as required; approved precast concrete bases may also be used.

Manhole roof s shall be a reinforced concrete slab, minimum of 200mm thick , and shall be formed in Grade C30 concrete and reinforced as required to carry all imposed loadings; approved precast concrete cover slabs complying with BS 5911 may also be used.

Manholes shall be watertight, resistant to water penetration, resistant to leakage and shall be constructed so as to minimise the risk to blockage.

The minimum internal size of manholes shall be 1.2m by 1.2m or 1.2m diameter.

Channels & Benching:

Manhole benching shall be formed in Grade C30 concrete finished in sand and cement level with the pipe soffit and falling at 1 in 30 towards the main channel.

Channels and inverts shall be formed in prefabricated half-round channels bedded in concrete Grade C30 or formed in-situ in concrete Grade C30. Inverts shall be carefully formed, and where pipes of different radius enter or leave the manhole, the inverts shall be semicircular and evenly tapered.

Manhole Covers & Frames:

Manhole covers and frames shall be ductile iron complying with the requirements of IS EN 124 and shall be Class D400 with a minimum clear opening of 600mmx600mm or 500mm diameter. Two closed keyways shall be provided in each cover.

Manhole Steps & Ladders:

Step irons shall be provided in manholes between 1.0m and 2.5m in depth. Two vertical runs of step irons shall be embedded into manhole walls at 300mm apart centre to centre. The steps shall be at 300mm intervals in each run and the two runs should be staggered vertically by 150mm. The top step shall be a maximum distance of 450mm from the ground surface and the bottom step shall be a maximum distance of 300mm above the top of the benching.

Ladders shall be provided in manholes greater than 2.5m in depth. Ladders shall be manufactured from low carbon steel and hot dipped galvanised after fabrication, and with type and layout subject to approval by the Engineer.

Drainage Gullies:

Surface water drainage gully chambers shall be constructed in precast concrete units complying with BS 5911.

Gully grates and frames shall comply with IS 261. The transverse bars of the grating shall be at right angles or diagonal to the kerb and hinged to close with approaching traffic. The frame shall have a minimum size at the surface of 400mm x 325mm. Gullies shall be Grade A type or as otherwise directed by the Engineer. Gully frames shall be set accurately for level and position. Each gully shall have a separate 150mm connection surrounded with 100mm Grade C20 concrete to the surface water drain.

Testing & Cleaning of Sewers & Drains:

All sewer pipelines and drains shall be tested by one of the following methods:

- i) Water Test: The test will be conducted for a minimum of 30minutes, under a head of not less than 1.2m of water over the crown at the high point and not more than 2.5m of water over the crown at low points of the line under test. The maximum allowable water loss should not exceed 1.0litre/hr., per metre diameter, per 100m run of pipe. A period of 2 hours after filling the pipeline shall be allowed for absorption, topping up as necessary before commencing the test proper.
- ii) Air Test: The length of pipe under test shall be effectively plugged and air pumped into until a pressure of 100mm head of water is indicated in a U-tube connected to the system. The air pressure shall not fall to less than 75mm head of water during the test period of 5 minutes, without further pumping, after a 5 minutes period for requisite stabilisation.

All pipelines shall be tested in lengths between manholes or in such shorter lengths as may be approved. Testing shall be carried out before any concrete-protection or backfilling is placed.

All tests shall be carried out to the satisfaction of the Local Authority.

On completion of the works, all manholes and pipelines shall be completely cleaned and flushed from end to end with water and left clean and free from obstructions.

Reinstatement of Excavations, Disused Drains & Manholes.

Excavation in and reinstatement of existing road surfaces shall be in accordance with the requirements of the relevant authority. All disused drains and manholes shall be grubbed up completely and backfilled with D.O.E. Clause 804 hardcore or alternatively shall be filled with sand/cement grout or lean mix concrete so that no voids remain below ground.

4.0 BITUMINOUS PAVEMENTS

Surface Base Course:

Surface Base Course for paths shall be 60 mm thick Medium Textured Macadam. Rolled to required compaction.

Surface Wearing Course

Surface Wearing Course for footpaths shall be 40 mm thick Medium Textured Macadam Rolled to required compaction.

External Works: Laying Macadam: Prepare and lay macadam as follows: with specific reference to "*TII. Specification for Roadworks*" series 700

- (a) Mix surface dry aggregate in specified gradings for each course and at the correct temperatures all in accordance with Clause 902 Table 9/1.
- (b) Keep coated macadam dry until laid and compacted.
- (c) Lay each course in a manner that prevents segregation and compact without displacement.
- (d) Lap in the joints of each layer to ensure complete fusion. Joints in different courses shall not coincide.
- (e) Using rollers as specified at clause 705 roll each course when the material is at suitable temperature until no roller marks are left.
- (f) Lay and compact in restricted areas by methods that produce a compacted finish equivalent to that achieved by the heavy rollers.
- (g) Brush apply bitumen paint to manhole frames and other items in contact with the paving.
- (h) If necessary re-set frames to manholes and gratings, etc. to suit the finished paving levels.

Preparation and surface treatment of formation:

Preparation and surface treatment of the formation shall be carried out only after the completion of any specified sub-grade drainage and any services or ducts within the formation as shown in the Contracts, the trenches for which have been reinstated in accordance with the requirements of Clause 209 and, unless otherwise approved, immediately prior to laying the sub-base or road-base where no sub-base is required.

The sequence of operations shall be as follows:

Formation of Soft Materials

A. All surfaces below roads and hard standings shall, after reinstatement of any soft areas, be well cleaned and freed from mud and slurry.

- B. The surface shall be compacted by 4 passes of a smooth-wheeled roller of 8 – 10 tonnes or equivalent approved.
- C. The formation shall be regulated and trimmed to the requirements of Clause 1102.
- D. The trimmed formation shall be rolled by 1 pass of a 2.5 tonnes smooth-wheeled roller or

Formation of Rock-Fill:

The formation shall be thoroughly blinded with approved fine material to seal the surface, and shall then be completed in accordance with paragraphs C and D above.

Formation of Rock Cuttings:

Surface irregularities under formation remaining after trimming of the rock excavations shall be regulated to the requirements of Clause 1102 with clean hard broken stone or Grade C7P concrete to Clause 419 as required by the Contract.

Horizontal Alignments, and Surface Levels of Pavement Courses

1. Horizontal alignments shall be determined from one edge of the roadway or hardstanding pavement surface as shown in the Contract. This edge as constructed and all other parallel alignments shall be correct within a tolerance of + 12 millimetres there from.
2. The levels of pavement courses and formation shall be determined from the true pavement surface, which shall be the surface of the wearing course for flexible pavements or of the slab for concrete pavements, calculated from the vertical profiles and crossfalls as shown in the Contract. The vertical depth below the true pavement surface or any point on the constructed surface of the formation or intermediate courses shall be within the following tolerances:

Formation +0 -50 millimetres

Sub-base +20 millimetres

Road-base +12 millimetres

Basecourse + 6 millimetres

3. The surface level of the laid wearing course or concrete slab shall not deviate vertically at any point from the true pavement surface by more than +6 millimetres. However, for flexible pavements the adjacent tolerances shall not be applied so as to reduce the thickness of the wearing course by more than 6 millimetres.
4. The laid roadway pavement surface and the basecourse shall be tested with a 3metre straight edge parallel to the centre line of the road and shall have no greater depression under the straight edge than 3 millimetres and 6 millimetres respectively.

Transporting, laying and compacting pavement Material Containing Bitumen Binder

1. Bituminous materials shall be transported in clean, vehicles and shall be covered over when in transit or awaiting tipping. The use of dust, coated dust, oil or water on the interior of the vehicle to facilitate discharge of the mixed materials is permissible but the amount shall be kept to a minimum and any excess shall be removed by tipping or brushing.
2. Wherever practicable bituminous macadam shall be spread, levelled and tamped by approved self-propelled pavers. The mixed materials shall be delivered with minimum delay to the paver and in such quantity as to permit its continuous operation and it shall be so operated whenever practicable.
3. The rate of travel of the paver and its method of operation shall be adjusted to ensure an even and uniform flow of material across the full laying width, freedom from dragging or tearing of the material and minimum segregation.
4. The material shall be laid generally in conformity with the recommendations for laying in the British Standard to which it has been made subject also to the following additional over-riding requirements.
5. Hand laying of any bituminous material will be permitted only in the following circumstances:
 - (i) for laying regulating courses of irregular shape and varying thickness
 - (ii) in confined spaces where it is impracticable for a paver to operate
 - (iii) for footways or
 - (iv) where directed by the Engineer
6. Material shall be compacted as soon as rolling can be effected without causing undue displacement of the mixed material and while this has at least the minimum rolling temperature stated in the appropriate British Standard. The materials shall be uniformly compacted by 8-10 tonnes smooth steel wheeled roller having a width of roll not less than 450 millimetres.
7. The material shall be rolled in a longitudinal direction from the sides to the centre of the roadway, overlapping on successive passes by at least half the width of the rear roll.
8. Rollers shall not stand on newly laid materials while there is a risk that it will be deformed thereby.

9. Unless otherwise required in the Contract coated chippings shall be applied by hand operation to the surface of wearing course material. Where however, the use of a mechanical chipping spreader is specified it shall be capable of operating with even distribution and the addition of chippings by hand shall be limited to the following circumstances.

- (i) to confined spaces where it is impracticable for a chipping spreader to operate
- (ii) as a temporary expedient when adjustments have to be made to the distribution mechanism
- (iii) to correct unevenness in the distribution of chippings

10. All chippings shall be applied uniformly to the surface and be rolled into the wearing course in such a manner that they are effectively held and provide any specific texture depth.

11. Hand-raking of wearing course material which has been laid by a paver and the addition of such material by hand-spreading to the paved area for adjustment of level will be permitted only in the following circumstances:

- (i) at the edges of the layers of material and at gullies and manholes
- (ii) where otherwise directed

12. Hand laid work shall conform to all specification requirements of this clause except those relating to the manner of operating pavers.

13. When laying wearing courses, the Contractor shall so organise his work that as far as possible there are no longitudinal joints left at the end of any day's work. Where joints between laying widths or transverse joints have to be made, the material shall be fully compacted and the joint made flush by cutting back the exposed joints to a vertical face of not less than the specified thickness, discarding all loosened material and coating the vertical face completely with a grade of hot bitumen suitable for the purpose before the next width is laid.

14. All joints shall be offset at least 300 millimetres from parallel joints in the layer beneath.

15. Base course material shall not remain uncovered by either the wearing course or surface treatment which-ever is specified in the contract for more than three consecutive days after being laid. Consent may be given for the extension of this period by the minimum amount of time necessary if compliance therewith is impracticable because of weather conditions or for any other reasons such as awaiting the results of test made.

Construction requirement for Material used in Sub-bases and Road bases;

Material complying with Clause 1106.4 shall be constructed in the following manner:

(i) Transporting:

Material when mixed shall be removed at once from the mixer, transported directly to the point where it is to be laid and protected from the weather both during transit from the mixer to the laying site and whilst awaiting tipping.

(ii) Laying:

All materials shall be placed and spread evenly. Spreading shall be undertaken either concurrently with placing or without delay. Roadbase material shall be spread using a paving machine or spreader box operated with a mechanism which levels off the material to an even depth. Except where otherwise specified in individual clauses, the material shall be spread in one or two layers so as to have the required total thickness after compaction.

(iii) Compacting:

As soon as possible after the material has been spread, compaction shall be completed by not less than 10 passes of an 8-10 tonnes roller or by not less than 6 passes of a vibrating tandem roller having a mass exceeding 3 tonnes. Special care shall be taken to obtain full compaction in the vicinity of both longitudinal and transverse joints. The surface layer of any material shall on completion of compaction and immediately before overlaying be well closed, free from movement under compaction plant and from compaction planes, ridges, cracks or loose material. All loose, segregated or otherwise defective areas shall be removed to the full thickness of the layer, re-laid with new material and recompact.

Flexible Surfacing:**Regulating Course:**

Regulating course material shall be made and laid in accordance with the requirements for either the base-course or roadbase material as described in the Contract.

Macadam:

Where bituminous base and wearing courses are not to be applied to the surface of the roadbase shall be thoroughly and uniformly blinded with graded fine aggregate passing the 5 millimetres British standard sieve size of the same material as the roadbase and compacted by an 8-10 tonnes roller to a firm even surface. Where required by the Contract or directed the blinding material shall be watered and swept over the roadbase surface ahead of rolling. Upon completion excess fines shall be lightly brushed

off and removed.

Rolled Asphalt (Hot Process):

Rolled asphalt (hot process) shall be made in accordance with Clause 304.5 and laid to Clause 1105.

Surface Dressing

An approved adhesive agent shall be incorporated either in solution applied to the aggregate or contained in the binder, the percentage content and manner of application being as stated in RRL Road Note 14, or as directed

The binder shall be applied evenly to the road surface by mean of a distributor complying with B.S. 1707 and the distributor shall have been calibrated for overall rate of spread within 6 months of its current use. Hand spraying will only be permitted in locations inaccessible to the distributor.

The chippings shall be hard, tough, clean crushed rock of 10 millimetres nominal size, or as directed and comply with B.S. 63 for single sized chippings.

Surface dressing applied to bitumen macadam single courses or wearing courses shall be in accordance with the requirements of RRL Road Note 38, Recommendations for Surface Dressing with Cutback Bitumen. The binder shall be bitumen to B.S.3690 Table 2 of an approved viscosity within the specified ranges. The proportion of bitumen for coating shall be about 0.75 per cent by weight of chippings.

Rates of spread of surface binder and of coated chippings shall be as tabulated in Surface Dressing 1981 published by the Department of the Environment, for medium traffic i.e. 20-200 Commercial vehicles per day per tonne 9on normal surfaces or a directed. Immediately after being spread the coated chippings shall be rolled by a rubber-tyred roller, or a steel-typed roller, weighed not more than 8 tonnes until a uniform compact surface is obtained. Excess chippings shall be swept off and traffic shall not be permitted on the dressed surface until the binder has reached it preliminary set.

When sealing previously untreated surfaces such as gravel, crushed rock or unbound roadbases, sub-bases and sub-grades the recommendation Clause 12 of Surface dressing – 1981, Published by the Department of the Environment should be adhered to.

5.0 MASONRY BLOCKWORK & BRICKWORK:

Standards:

The materials, labour and workmanship in and connected with the execution of the blockwork and brickwork shall be the best of their kind without regard to any trade terms and the Contractor shall employ a duly qualified person experienced in blockwork and brickwork construction to supervise the work.

Materials:

Concrete Blocks shall comply with IS 20.

Hollow blocks shall be of the traditional twin cell vertical cavity type.

All concrete blocks whether fair faced or not, shall be delivered to site and transported on site banded on pallets.

Wall Ties:

Wall ties shall be stainless steel twisted metal ties conforming to IS EN 845.

Unless otherwise stated they shall generally be placed at 900mm centres horizontally and at 450mm centres vertically and shall be staggered in alternate courses. Additional ties shall be placed at 450mm centres, 150mm from all edges of openings.

Ties connecting adjacent panels of the brickwork or blockwork across vertical control joints shall be stainless steel flat bars, built into the brickwork joints at 450mm centres vertically and debonded on one side by painting with a bituminous paint or taping.

All wall panels to be tied to structural beams and columns using shot-fired ties or similar approved.

Reinforcement:

Reinforcement shall be high tensile steel to BS 4449, BS4482, BS4483 or BS6744.

Horizontal debonded bars shall be to BS 4449 and shall not be square twisted.

Brickwork or blockwork reinforcement, where used, shall be "Brickforce" or equal approved, used in accordance with the manufacturer's instructions.

Reinforcement used on external leaves shall be galvanised. Expanded metal, where used to tie blockwork walls shall conform to BS 405. Expanded metal shall not be used as dowels or ties in external walls.

Damp Proof Courses & Membranes Damp proof courses shall be suitable material conforming to the requirements of BS 743. A shear-resistant damp-proof course material shall be used.

Mortars:

The mortar mix to be used on all blockwork & brickwork above d.p.c. level shall be Table 1 mortar Designation (iii) to IS 325 and shall generally be as follows:

Cement-1

Lime - 1

Sand – 5

An approved plasticiser may be substituted for the lime only with the written approval of the Architect/ Engineer.

Cement shall be in accordance with IS 1. Rapid hardening cement may be used in mortar for filled blockwork.

Non-hydraulic (calcium) limes and semi-hydraulic limes (calcium and magnesium) should conform to BS 890.

Natural sand should conform to the requirements of BS 1198.

The materials for the mortar shall be measured accurately and mixed by machine. The mortar shall be used within two hours of mixing the cement and water, and any mortar not then used within this time period shall be discarded and shall not re-tempered.

Ready-mix mortar shall not be used without the written permission of the Architect/Engineer.

Mortar plasticiser shall comply with BS 4887 and shall be used in the proportions and manner recommended by the manufacturer. Compliance certificates in accordance with BS 5075 shall be produced for any admixtures proposed for use and the permission of the Architect shall be obtained before use.

Liquid colouring agents by approved manufacturers for colouring mortars shall be used in strict compliance with directions and shall be less than 10% of the weight of the cement.

Admixtures containing Calcium Chloride shall not be used.

Wetting:

In dry weather, the suction rate of the clay bricks shall be adjusted by wetting before use and the tops of walls left off shall be wetted before work is recommenced.

Pointing:

All bricks and blocks shall be well buttered with mortar before being laid and all joints shall be 'weather struck' as the work proceeds.

Uniformity:

Brickwork and blockwork shall be carried up in a uniform manner, no portion being raised more than 1metre above another portion at any time. All perpends, quoins, etc., shall be kept strictly true and square, and the whole properly bonded and levelled.

Rate of Laying:

The maximum height of masonry construction that should normally be built in any 1day period is 1.5metre.

Frost:

No brickwork or blockwork construction shall be carried out during frosty weather except with the written permission of the Architect. In seasons liable to frost, all brickwork and blockwork laid during the day shall be properly covered up at night with felt, sacking, boards or other approved non-conducting material.

Keeping Clean:

Brickwork shall be built in stretcher bond and otherwise as shown on drawings. Faced work shall be kept perfectly clean and no rubbing down of brickwork shall be allowed. Scaffold boards shall be turned back at night and during heavy rain to avoid splashing.

Joints:

Joints shall be generally of 10mm uniform thickness of recessed concave profile. Bed joints must be full and not excessively furrowed. Tool finishing of the joint shall be carried out after the mortar has stiffened.

Control Joints:

Control joints shall be formed and shown as described on the drawings. Half blocks and bricks shall be used to maintain the bonding pattern. Half blocks shall be standard half blocks or machine cut whole blocks or brick. Before the mortar has set it shall be raked out to a minimum depth of 20mm.

In external leaves it shall then be sealed with two part Polysulphide sealant. Such sealant shall be applied with a suitable gun. On internal leaves the joint shall be left open for at least three months and then re-pointed with a matching mortar.

Fair Faced Blockwork:

General Appearance of Finished Fair Faced Blockwork The Contractor's attention is drawn to the quality of workmanship required. The craftsmen must be fully aware at all times that the wall, as built, will be finished product, unplastered.

The Architect/ Engineer will have the final decision in rejecting faulty blockwork.

Holes for service pipes, etc., through fair faced blockwork shall be predrilled accurately and neatly by the Contractor.

Propping of Block work:

Block work shall be propped

1. During construction to ensure stability at all stages of construction.
2. Until completion of construction of, all returns and intersecting walls connected to the wall, pier or panels, all band beams connected to the wall, pier or panel all structural members connected to the wall, pier or panel and all associated supporting structure other specific members identified on the drawings.
3. When internal block work walls, piers or panels are constructed prior to the completion of the external envelope of the building (including the closure of all openings exceeding 3.5 sq.m. for a single opening and 10% of the area of any elevation for multiple openings.)
4. In other cases noted on the drawings. The propping of walls in this manner is obligatory and shall be omitted or removed only where instructed in writing by the engineer. The type and extent of propping shall be determined by the Contractor and designed as part of his temporary works.
The Contractor shall take account of his sequence of construction in determining the prop positions and loads.

The criteria for design of props shall be as follows:

1. Propping of walls of heights lower than that given below shall not be required.
 - 215mm Thick – 1.0 Height
 - 300mm Cavity – 1.0 Height
 - 415mm Cavity – 1.5 Height

2. Above this height props shall be designed to resist wind loads imposed based on BS6299 Part 2.
3. The requirement for props shall be deemed satisfied by props arranged to support a characteristic wind load of 3.6kN/sq.m. on the entire wall provided such walls are at a height not exceeding 10 m above ground level.

Lintels & Padstones:

Lintels and padstones shall be as specified on the drawings. Unless stated otherwise lintels are to bear a minimum of 150 mm onto a full length block, where due to coursing a full block below the bearing is not possible, the bearing is to be increased to 225 mm.

Padstones are to be constructed in grade 20 concrete to the sizes specified and reinforced with a minimum of one number 16mmdiameter High Yield steel bar.

Tolerances:

The permissible deviations for finished blockwork shall be as follows:

Level +/- 10mm

Position on Plan +/- 10mm

Plumbness +/- 5mm in any 1m but not more than 20m.

6.0 STRUCTURAL CONCRETE:

Concrete work:

Constituent Materials

All constituents of concrete supplied in ready-mix concrete shall be CE marked.

Cement

The cement shall be Ordinary Portland Cement certified as complying with IS EN 197-1 (Cement type CEM I or CEM II). Manufacturer's certificate of compliance with the standard shall be provided when requested by the engineer.

Fine Aggregates / Sand

Sand and fine aggregate are to be clean and sharp and from an approved pit, and shall comply with the requirements of IS 5 and BS 812.

Coarse Aggregates / Gravel

Coarse Aggregates shall consist of natural pit gravel or crushed stone. They shall be hard, strong and durable and shall be clean and free from clay films and other adherent coatings and shall be washed if so directed. The coarse aggregate is to have a nominal maximum size of 20mm unless shown otherwise. Coarse aggregates shall conform to IS 5 and BS 812.

Water

Clean fresh water shall be used and shall be free from deleterious material.

Admixtures

Admixtures may be used in the concrete at the contractors discretion in accordance with the manufacturer's instructions and best practice and shall comply with the requirements of or latest applicable B.S. or EN Standards

Concrete Mixes

The concrete mixes in the various sections of the works shall be designed mixes in accordance with BS 8500 and IS EN 206 for exposure class:

XC Carbonation induced corrosion risk

XC-2 Wet – rarely dry

XC-3 Moderate humidity, external surfaces including exposed to rain

XC-4 Cyclic wet and dry

Mix Designation	Lean Mix	Structural Concrete XC-2
Concrete Grade (Cylinder/ Cube Strength)	C17/20	C28/35
Cement Type & Strength Class	CEM I or I 42.5N/mm ²	CEM I or I 42.5N/mm ²
Nominal Max. Aggregate Size	20mm	20mm
Min. Cement Content	180Kg/m ³	280Kg/m ³
Max. Free water/cement ratio	0.75	0.60

Mix Designation	Structural Concrete XC-3	Structural Concrete XC-4
Concrete Grade (Cylinder/ Cube Strength)	C32/40	C32/40
Cement Type & Strength Class	CEM I or I 42.5N/mm ²	CEM I or I 42.5N/mm ²
Nominal Max. Aggregate Size	20mm	20mm
Min. Cement Content	300Kg/m ³	300Kg/m ³
Max. Free water/cement ratio	0.55	0.55

Submission of Mixes by Contractor

Contractor shall supply the name of ready-mix concrete supplier, together with designed mix proportions for each mix proposed for use on the project, to the structural engineer a minimum of one week prior to commencing work.

Sampling & Testing of Concrete

Compliance of concrete with the specified strength shall be judged by testing a series of 150mm concrete cubes at 7 and 28 days. The test cubes are to be made under the supervision of the Clerk of Works or Resident Engineer. The rate of sampling shall be one test sample (consisting of 3 No. test cubes) taken from a sample of fresh concrete which represents a volume of not more than:-

- 7cu.m. or 7 batches whichever is smaller, for suspended slabs, beams, columns and exposed architectural concrete;
- 15cu.m. or 15 batches whichever is smaller for walls and floating slabs;
- As directed by the Engineer.

The test sample shall be tested as follows: one test cube shall be tested at 7days, one at 28days, with the third cube being kept for testing at 56days if there are any issues with the 28day result.

Cubes shall be made, compacted by hand and stored in the approved manner. The concrete sample for the making of the test cube shall be obtained at the place of deposition of the concrete. The cubes shall be given an identification mark and an accurate register of the location and dates of each cube sample shall be kept on site, so that the location of the concrete from which the cube was made may be ascertained at any time.

The contractor shall provide a sufficient number of machined steel or cast iron cube moulds to carry out the sampling required by the specified method of quality control. The action to be taken in respect of concrete which is represented by test cubes which fail to meet the relevant compliance criterion shall be determined by the Engineer.

Compliance with the Characteristic Strength

Compliance with the Characteristic strength shall be assumed if the strength determined from any test result is not less than the specified characteristic strength unless agreed otherwise by Engineer prior to commencing work.

Tests on Fresh Concrete

Consistence:

The consistence of concrete shall be as stated in the mix design parameters given above.

Density of fully compacted concrete:

The density of the fully compacted concrete shall not be less than 2350 kg/m³

Joints in concrete

Construction Joints

Floor slabs and wall panels shall be laid in continuous pours between extremities and construction joints shall be incorporated as shown in the drawings. The surface of concrete against which new concrete is to be cast shall be free from laitance and shall be roughened to the extent that the large aggregate is exposed but not disturbed. The joint surface shall be cleaned immediately before fresh concrete is placed against it. Where practicable such preparation of horizontal and vertical joint faces shall be carried out when the concrete has set but not hardened. Dowels shall be used as shown in the drawings.

Contraction Joints

Contraction joints shall be formed or cut in all sections of floor slab or wall greater than 6m in length as approved by the Engineer. Typical contraction joint details are shown in the drawings.

- (i) Partial contraction joints (PCJ) - 50% of the main reinforcing steel shall pass through the joint.
- (ii) Total Contraction Joint (TCJ) – 0% of main reinforcing steel shall pass through the joint. However Sleeved dowels are generally used across the joint for continuity.

Expansion Joints

Expansion joints are provided to allow for expansion movements of continuous members generally in excess of 50m in length. Typical expansion joint details are shown in the drawings.

Isolation Joints

Isolation joints are generally formed between certain members to provide for relative movements. Typical isolation joint details are shown in the drawings.

Formwork

The formwork shall be of sufficient rigidity to support the concrete without deflection, and shall be securely wedged and supported. Care must be taken in striking to avoid injury to the surface. The Contractor shall be responsible for supplying, erecting, maintaining, striking and clearing away all formwork and for forming all moulds for precast work and for ensuring that it is of adequate strength and without deflection or movement when bearing load. All formwork shall receive an application of mould oil before concrete is poured.

Void Formers / Void Fillers

Void formers & void fillers to be selected / designed for intended purpose to required strength and rot proof.

All void former & void fillers shall be installed as per manufacturers specification

Concrete finish

Formed Finish

Formed surfaces to members shall be finished as follows:

Foundations - Finish Class F1

Exposed Walls and Piers - Finish Class F2

Soffits to slabs and beams – Finish Class F3

Unformed Finish to Slabs

The concrete shall be levelled and screeded to produce a uniform plain surface and then shall be floated under light pressure to eliminate surface irregularities.

Finished Floor Finish

Edges & Sharp arises:

Sharp arises are to be avoided in the exposed surfaces of the exposed columns, beams and walls. A 25mm chamfer shall be constructed on the exposed corners of all columns, beams and walls.

Placing

Concrete shall be placed from the truck by an approved method and carefully deposited into the formwork, levelled and consolidated by tamping, ramming, or mechanical vibration. The concrete shall be placed in such a way so as to minimize segregation of the mix and shall not be dropped nor poured from a height nor made flow in the formwork. Concrete shall be placed within 60 minutes of the truck arriving at the site or 90 minutes of water being added to mix.

Curing of concrete

After being placed, concrete shall not be jarred, walked on or otherwise disturbed during setting. Concrete shall be protected from inclement weather, and no concreting to be proceeded with when the temperature drops below 2C. Where temperature is expected to fall overnight recently placed concrete shall be protected from freezing; insulating blankets and heaters shall be supplied by the contractor. Striking of supporting concrete structures shall be delayed during cold weather to account for slow strength gain of concrete due to low temperatures.

In hot weather and during high winds, freshly placed concrete must be kept watered and protected by wet hessian and polythene or other approved method for at least seven days after placing.

Reinforcement

Steel bars used for reinforcement shall comply with BS 4449 as applicable to high yield steel with $f_y = 460\text{N/mm}^2$ or 500N/mm^2 . They shall be free from all loose rust, scale, grease or oil. Reinforcing steel bars shall be securely tied in position as shown in the drawings so as not to deflect due concrete placement.

Nominal concrete cover to reinforcing steel to be as follows :

Foundations: 45 mm top and bottom and sides

Columns & Beams: 35 mm top and bottom and sides

Minimum Cover for exposure class:

XC-2 = 40mm

XC-3 = 40mm

XC-4 = 40mm

7.0 PROTECTIVE BARRIERS & GUARDING

Protective barriers / guardrails to be provided to all areas with a drop exceeding 600mm and / or where specified on Architects drawings.

Barriers / guardrails to be designed, fabricated and installed in accordance with IS EN1991-1-1, EN1991-1-2, EN1991-1-3, EN1991-1-4, EN1991-1-5, EN1991-1-6 and EN1991-1-7, relevant Irish National Annex, Irish building regulations TGD part K & TGD Part M.

Design drawings and calculations to be provided for review and acceptance by Architect and Structural Engineer prior to fabrication

Materials

Barriers and guardrails formed from timber, reinforced concrete, masonry, steelwork and structural glass to be in accordance with specifications laid out in all relevant Engineers and Architects specifications.

Guarding / protective barriers

Materials to be as per Architects detail

Guarding to be fixed to steel structure or reinforced concrete structure as necessary to provide adequate structural support for the loads as per Eurocodes & building regulations

Barriers & guardrails to be designed for the vertical and horizontal loading individually and for the worst combination of both