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Civil and Structural Specifications

TENDER DOCUMENTS

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SPECIFICATION

DEMOLITION

GENERAL
Carry out all demolition and taking down work generally in accordance with BS 6187:2000.

HEALTH & SAFETY OF PERSON ON OR OFF SITE
The contractor should refer to the Health and Safety Plan Design Stage, prior to carry out there own risk assessment of the works. Ensure the safety of the works during demolition work. Carry out demolition work in such a manner as to cause the minimum inconvenience to persons in adjoining buildings.

Persons engaged to work on site must be in possession of a current registration card under the *Health and Safety at Work Construction Regulations 2006.* Person carrying out specialised tasks or operating machinery outlined in the ninth schedule must also have the appropriate skills card.

SUPERVISION
Carry out demolition work under the supervision of a responsible person experienced in demolition work who shall ensure that adequate safety precautions are taken.

EXPLOSIVES
The use of explosives for demolition shall not be permitted.

BURNING
Burn on-site materials arising from demolition is prohibited under *Air Pollution Act 1987* and Regulations S.I. No 271 of 2002 *Air Quality Standards Regulations 2002*.

NUISANCE
Take the necessary precautions to minimise nuisance arising from demolition work. The contractor is to take particular care to minimise any disruption of or damage to any adjoining properties. The contractor shall allow for carrying out a detailed survey (with photographs) of the adjacent properties internally and externally prior to commencement of the works.

DISCONNECTION OF SERVICES
Before starting demolition work, arrange with the appropriate authorities to disconnect services to the buildings scheduled for demolition. Pay all charges for disconnected services.

PROTECTION
Take all reasonable precautions to protect adjoining work and provide temporary supports, screens and coverings as required.

TEMPORARY SUPPORT
Provide and maintain all necessary temporary support. Make good any damage. The contractor shall be responsible for the design of temporary support, which shall be subject to the approval of the engineers.

The contractor shall provide temporary support to the remaining buildings as required prior to the completion of the new building. This shall be in the form of shoring or equal. Any such supports shall be designed by the contractor and submitted for approval to the engineer.

MATERIALS
Any materials and debris arising from demolition work shall become the property of the contractor unless specified otherwise, and shall be removed from site.

WASTES

Those concerned with controlled waste should comply with the Waste Management Act 1996 and current regulations and collection shall be carried out by those with a valid waste collection permit and waste shall be disposed off to a permitted facility.

The contractors attention is drawn particularly to Clause 4.2.8.2 of BS 6187 : 2000.

All hazardous or toxic materials must be clearly identified at survey stage and all necessary precautions must be taken in their removal and disposal to comply with regulation S.I No. 163 of 1998 Hazardous Waste Regulations and other relevant regulations and statutory acts.

ADJACENT PROPERTY OWNERS

Property owners immediately adjacent to the property should be notified 2 weeks prior to the start of demolition and of any key dates, when the risk of collapse or disrupted is increased.

NOISE

The noise level shall comply with the limits set out in the planning permission.

DESCRIPTION OF MATERIALS AND WORKMANSHIP
EXCAVATION AND EARTHWORKS

EXCAVATION

All excavation shall be made to the depths and dimensions shown on the drawings or as the engineer may direct. The contractor shall include for reasonable care while excavating for foundations, in particular, at those points adjacent to neighboring structures. The contractor shall not be allowed any variation in respect to excavations to be carried out by hand. Should the dimensions of any excavation exceed those shown on the drawings or ordered by the engineer, the contractor shall at his own expense fill such extra space with foundation concrete as hereafter described. The engineer on site must confirm the level of all excavations.

BLASTING

Blasting will not be allowed without written permission from the engineer, who must be fully informed by the contractor as to steps taken to safeguard the surrounding property and the contractor, must take all responsibility.

PLANKING AND STRUTTING

The description "planking and strutting" shall mean that the contractor shall take all necessary precautions to ensure the stability of the sides of the excavations. The contractor shall take all risks of collapse and shall pay for any extra excavations beyond the nett sizes necessary and for subsequent returning, filling and ramming in concrete to a foundation mix if the engineer so decides.

EXCAVATIONS FREE FROM WATER

The excavations shall be kept free from general water at all times and all mud and slurry shall be removed to present a fully undisturbed dry surface to base concrete. The position of sumps and manner of pumping shall be subject to the approval of the engineer.

INSPECTION OF TRENCHES

The contractor shall notify the engineer as soon as the trenches are excavated and no concrete is to be poured until he has examined the trenches and approved same.

CART AWAY

All surplus spoil shall be carted off site to a tip provided by the contractor who shall pay all charges in connection therewith.

OBSTRUCTION

Any obstruction at or below formation level shall be reported to the engineer and shall be dealt with as directed by him.

FORMATION TO STRIP FOUNDATIONS ETC.

To minimise moisture softening the formation shall be exposed for as short a time as possible. The last 50mm of excavation shall not be taken out until concreting is almost ready to start.

The formation shall be lightly rammed. Before any concrete is placed, the contractor shall call on the engineer or his representatives to inspect the formation.

PUMPING

The contractor shall provide all equipment and other works necessary to keep the excavation free of water and to prevent the direct access of water to the formation.

Excavation shall be so arranged that any water entering the cut is immediately drained away to a sump or other point from which it can be pumped or otherwise disposed off. Before any pumping takes place, the approval of the engineer shall be sought, but this approval will not absolve the contractor from his responsibilities for the safety of the works. If the contractor pumps or otherwise puts water into a drain he shall be responsible for seeking all permission and from removing from the system all deposits caused thereby.

HARDCORE

A layer of approved hard dry material of broken stone to pass a 75mm ring consolidated to the satisfaction of the engineer shall be placed below all ground floor slabs, on top of which a layer of an approved fine sand and shall be placed and consolidated to his satisfaction all to receive the polythene water-proof membrane placed below the ground slab as shown on the drawings.

FILLING

Where filling is to be provided below ground floor slabs of building, all vegetable soil shall be removed. Filling is to be applied only when the formation level is free of mud and slurry, the formation level shall be left exposed for a short a time as possible after removing the vegetable soil. The formation level shall be lightly rammed and generally levelled before filling commences. Filling shall consist of hard dry material as above. The filling shall be deposited in layers not exceeding 150mm when compacted and shall be at a moisture content of not exceeding 5%. Each layer shall be compacted to the satisfaction of the engineer with approved mechanical equipment. Loose rock or broken solid rock of suitable size may be used for filling under floors with the engineer's approval.

TESTING

Every facility shall be provided to enable the engineer to obtain samples and carry out tests on the materials of construction. If these tests show that any of the materials of construction do not apply with the requirements of this specification, the contractor will be responsible for the costs of the tests and the replacement of the defective materials and/or construction.

DRAINAGE

P.V.C. PIPES AND FITTINGS

P.V.C. pipes and fittings shall be Wavin or other equal and approved, in accordance with IS 424 and shall be formed in accordance with manufacturers recommendations, laid and jointed in accordance with the manufacturer's instructions.

CONCRETE PIPES AND FITTINGS

Concrete pipes and fittings shall comply with IS 6. Joints shall be spigot and socket type.

WORKMANSHIP

Drainage work generally shall be executed in accordance with BS 8301 : 1985 and shall comply with the regulations of the Local Authority.

Excavate as required for drains and lay pipes with ring shown. Concrete beds or beds and surrounds shall be provided to pipes where shown.

Trenches for uPVC pipes and for clay pipes with ring couplings shall be the minimum width possible to allow working in the trench.

EXCAVATION

The excavations for trenches shall be of such depths and widths as will allow the drains to be properly laid with adequate cover at highest points. The bottom shall be graded from point to point to that of the grade for pipe lines, as specified and shown on the drawings, and making due allowance for the thickness of beds. The contractor shall provide for all necessary trench supports.

In filling in trenches, great care is to be exercised so as not to disturb the drains. The best of the excavated material is to be used for packing around the pipe. The whole of the filling is to be carefully and thoroughly consolidated and rammed, water being added as necessary and any depression in the finished surface over drains to be made up before the contractor leaves the site. The use of mechanical rammer will not be allowed within 450mm of any pipe.

DRAIN LAYING

Each pipe shall be carefully examined on arrival, any defective pipes shall not be used and shall be segregated and marked in a conspicuous manner. Drains shall be laid in straight lines and to even gradients as shown on the drawings.

Great care shall be exercised in setting out and determining the levels of the pipes and the Contractor shall provide suitable instruments and set up and maintain all sight rails, boning rods and bench marks, etc., necessary for the purpose. All bedding and backfill details shall be strictly in accordance with the tender drawings.

All drains shall be kept free from earth, debris, superfluous cement and other obstructions during laying and until the completion of the contract when they shall be handed over in a clean condition.

Pipes shall be laid with the sockets up hill and shall rest on solid and even foundations for the full length of the barrel. Socket holes shall be formed in the foundations, as short as practicable but sufficiently deep to allow the pipe jointer room to work right round the pipes.

ANCILLARY ITEMS

All ancillary items such as manholes, gullies, etc., shall be constructed strictly in accordance with the tender drawings.

INSPECTION

The contractor shall give notice to the engineer for the purpose of inspection and measurement whenever section of:-

(a) Excavation are completed
(b) Concrete beds are laid
(c) Drains are completed

and no further works are to be excavated until the works at these stages have been approved.

DRAINAGE BYE-LAWS

All works are to comply with the requirements of the Local Bye-Laws and are to be executed to the satisfaction of the engineer and the Local Sanitary Authority, who shall be consulted before any work commences.

TESTING

The whole of the drainage system shall be tested for watertightness and straightness to the satisfaction of, and in the presence of, the engineer and the Local Authority. Drains are to be filled with water to a head of 1500mm and are to be tested in sections agreed with the engineer.

(a) After jointing
(b) After haunching and backfilling
(c) After completion of the works

The Contractor shall provide all necessary testing apparatus and shall carry out such other tests as are required by the engineer and the Local Authority and shall re-set if necessary until passed. Testing by air pressure will only be permitted when a water test is, in the opinion of the engineer impracticable.

In the event of any doubt or dispute, the method of testing laid down in BS shall be adopted.

C.C.T.V. SURVEY

All foul and surface water sewers shall be C.C.T.V. surveyed by an approved specialist firm on completion of the works. Three copies of all drawings and digital cd's shall be provided for the engineer. The main contractor shall rectify all defects highlighted by the C.C.T.V. surveys. If substantial defects are highlighted during the initial survey, then the relevant sewers shall be resurveyed on completion of remedial works.

AS CONSTRUCTED DRAWINGS

On completion of the drainage works, the Contractor shall prepare as constructed drawings showing the position and levels of all sewers. Two copies of all drawings shall be presented to the Engineer.

SETTING OUT

BENCH MARKS

Establish a master benchmark on site for the duration of the contract. Relate the master benchmark to ordnance datum. The permissible deviation in level between the master bench mark and ordnance datum shall be +2mm.

BASE REFERENCE LINES

Set out the works in accordance with the drawings. Establish in an approved manner base reference lines for setting out the works and set out additional reference lines at the following maximum spacing;-

Vertical	3.0m
Horizontal	30.0m

REFERENCE LEVELS

Establish reference levels at vertical intervals not exceeding 3.0m. The permissible deviation between any reference level and the master benchmark shall be +/-2mm.

PERMISSIBLE DEVIATIONS REFERENCE LINES

The permissible deviation in the horizontal distance between two adjacent reference lines shall be +/-2mm.

The cumulative permissible deviation in the horizontal distance between any two reference lines shall not exceed +30mm or 1 in 1000 of the cumulative distance whichever is the smaller.

The permissible deviation for the plumbness of the intersections of reference lines over the corresponding intersections of the base reference lines shall not exceed +20mm or 1 in 1000 of the vertical distance from the base reference lines whichever is the smaller.

The permissible difference in length of the diagonals of any nominally square of rectangular set of reference lines shall be +30mm or 1 in 1000 of the nominal diagonal length whichever is the smaller.

MEASUREMENTS

Do not scale the drawings. Use dimensions figured on the drawings for setting out the works.

IN-SITU CONCRETE WORK

DEFINITIONS

STANDARDS

References herein to Irish, British or other National Standards of Practice do not give the year of issue or dates of amendment. The latest relevant published version including any relevant amendments at date of invitation to tender shall apply.

Where a Standard or Code of Practice has been superseded the latest edition of the superseding publication shall apply.

TOLERANCE FOR FINISHED WORK

PAD FOUNDATIONS STRIP FOOTINGS

The permissible deviation in setting out of general concrete foundations shall be +40mm/-20mm in plan dimension and +/-10mm in vertical dimension. The permissible deviation in respect of concrete foundation work shall be +/-5mm in both plan and vertical dimensions unless otherwise approved in writing by the engineer.

ELEMENTS ABOVE FOUNDATIONS

The permissible dimensional deviation of structural concrete elements above foundation work level shall be +/-3mm in cross section, and +/-5mm in location.

FLOOR SLABS

The level of any point on the floor slab shall be within ± 5mm of the floor datum level. In addition the maximum variation in level of points on a 3m grid shall be 5mm.

PLUMB

The permissible deviation from plumb of the upper and lower edges of any nominally vertical surface shall be +/-4mm per 2m of surface subject to an overall limit of +/-12mm in any structural unit. A similar tolerance shall apply to the planarity of sloping surfaces.

DEVIATIONS AT JUNCTIONS

The maximum permissible deviation from the specified linear inter-relationship of any two surfaces at a junction shall be 6mm.

BOW

The permissible deviation arising from bow in the surfaces of columns, walls, and beams shall be +2mm per 2m of surface subject to an overall limit of +8mm in any structural unit.

BULGING AND LOCAL IRREGULARITIES

The permissible deviation for bulging and local irregularities in any surface of concrete elements shall be +/-3mm.

MATERIALS

The materials, labour and workmanship in and connected with the execution of the concrete work shall be the best of their kinds without regard to any trade terms. The contractor shall employ a duly qualified person experienced in reinforced concrete construction to supervise the work. The quality of materials and the standard of workmanship for the reinforced concrete shall comply with the relevant Clause of BS 8110, IS 326 and BS 8007 in regard to all requirements not otherwise described in the Preamble.
The engineer shall be afforded all reasonable opportunity and facility to inspect the materials and the manufacture of concrete and to take any samples or to make any tests.

CEMENT

The cement shall be Normal Portland Cement (CEM1) complying in all respects with the current European Standard I.S. EN 197-1. Cement shall be certified as complying with I.S. EN 197 and shall bear the CE Standard Mark certified by the National Standards Authority of Ireland in accordance with I.S. EN 192 -'Cement-Conformity Evaluation'.

Cement delivered in standard bags shall be properly stored in a weatherproof shed with the floor raised above ground level and having a clear space of at least 225mm between the underside of the floor beams and the ground surface. Cement delivered in bulk in a tanker shall be properly stored in a silo of BS or IS approved design.

Each consignment shall be kept separate, identified and used in order of delivery. Cement damaged in storage or handling shall not be used in the manufacture of white concrete.

AGGREGATE

The aggregates for concrete shall consist of naturally occurring material complying in all respects with IS No. 5 (Note : the use of "all-in" aggregates or marine aggregates shall not be permitted). All aggregates shall be free from laminated, and/or flaky particles, dust, silt, clay and other impurities.

The fine aggregates shall be washed natural pit or river sand, passing a 6mm sieve and shall be graded from the largest to the smallest particle sizes to the engineer's satisfaction.

The coarse aggregate shall be retained on a 6mm sieve and shall be composed of clean washed gravel or clean crushed hard stone. It shall be delivered to site in two sizes up to 19mm when maximum aggregate size of 19mm is used, and three sizes up to 38mm with maximum aggregate size of 38mm is used.

Before concreting operations are begun, samples of the aggregate shall be submitted to a laboratory, chosen by the engineer, for testing and approval. The weight of samples shall not be less than 15Kg. for each size of coarse aggregate and 5Kg. for the fine aggregate.

The quality of all aggregates delivered to the site shall be equal or superior to that of the approved samples. Separate storage facilities with adequate provision for drainage shall be provided for each different size of aggregate used.

WATER

Water shall be clean and free from harmful matter and shall be of potable quality.

ADMIXTURES

Admixtures other than those herein specified shall not be used without the written consent of the engineer.

Concrete admixtures shall comply with BS 5075 and I.S. EN 934-2 and shall be used in accordance with the manufacturers instructions. Admixtures shall be as noted on the drawings and shall be confirmed by the engineer in writing.

MIXING

The quantity of cement, the quantity of fine aggregates and the quantities of the various sizes of coarse aggregate shall be measured by weight only. A separate weighing device shall be provided for weighing the cement.
The amount of water shall be measured by volume of weight. Any solid admixture to be added shall be measured by weight only, but liquid or paste admixtures shall be measured by volume or weight.

The batch weight of aggregates shall be adjusted for the moisture content of the aggregate being used. The quantity of water contained in the aggregates shall be determined by the contractor in accordance with a method approved by the engineer, and the quantity of water to be added to the mix shall be reduced by the quantity of water contained in the aggregates being used.

CONCRETE MIXES

The responsibility for producing concrete to the required strength is entirely that of the contractor and he shall vary the cement content to achieve this strength. The minimum cement contents given in Table A are to provide a durable concrete for the various mixes.

TABLE A

MIX NO.	15N20	35N20	40N20
Characteristic 28-Day Cube Strength (N/mm^2)	15	35	40
Max. Aggregate Size (mm)	20	20	20
Min. Cement Content $Kg./m^3$	250	325	350
Max. Cement Content $Kg./m^3$	400	400	400
Slump (mm)	30-100	50-100	50-100
Water/Cement Ratio	0.60	0.50	0.50

READY MIXED

Ready-mixed concrete may be used on the basis of a designed mix, subject to the engineer's approval to the manufacturer and supplier.

Deliveries shall be accompanied by delivery dockets for each batch of concrete and they shall contain the following information; -

1. Name of the Ready-Mix Plant.
2. Serial number of the delivery docket.

3. Date.
4. Delivery truck number
5. Name of purchaser.
6. Name of contract.
7. Specified grade of concrete.
8. Specified workability.
9. Maximum aggregate size
10. Time of loading at Ready-Mix Plant.

TRIAL MIXES

Trial mixes of concrete mixes shall be made at least one month before concreting work commences.
The suitability of each mix should be noted and three test cubes shall be made from each mix. The test cubes shall be tested at 7, 14 and 28 days.

TESTING OF CONCRETE

The quality of the concrete shall be verified by 28 day cube tests carried out in accordance with BS 1881. Tests shall be taken at the minimum rate of 1 cube per 7.0m^3 of concrete poured. Each cube shall be made from a single sample taken from a batch of concrete. Compliance with the specified strength may be assumed if: -

(a) The average strength determined from any group of four consecutive cubes exceeds the specified strength by not less than 3.0N per sq.mm.
(b) Each individual test is greater than 85 per cent of the specified characteristic strength (grade in Table A).

ACTION TO BE TAKEN IN THE EVENT OF FAILURE OF TEST CUBES

When the average strength of four consecutive test cubes fail to meet the first requirements, the mix proportions shall be adjusted to provide the specified strength. The responsibility of providing concrete, which attains the specified strength, is entirely that of the contractor, and no adjustment of rates shall be permitted if additional cement is required to provide concrete.

In the event of cube failures the cost of additional test and/or the replacement of any portions of concrete deemed to be defective by the engineer shall be borne by the contractor.

CONCRETE BLINDING

The surface of the ground or hardcore under foundations, and other concrete in contact with the ground or with hardcore, shall be sealed with a layer of concrete Grade 15 average 50mm thick.

JOINTING NEW CONCRETE

Treat the surface of the existing concrete at the joint before placing new concrete as follows;-

(a) When the concrete is between 2 and 4 hours old, wet the surface with a fine spray (not a jet) and at the time brush the mortar from the face of the joint without disturbing the coarse aggregate.
(b) When the concrete is between 4 and 24 hours old and (a) has not been carried out remove the mortar from the face of the joint with a wire brush or water jet without disturbing the coarse aggregate.

(c) When the concrete is between 1 and 3 days old and (a) or (b) has not been carried out, remove the mortar from the face of the joint by grit blasting or with a needle gun without disturbing the coarse aggregate and wash off any dust from the surface. Do not hack or hammer the surface.

CONSTRUCTION JOINTS

All vertical construction joints shall be formed with well braced timber stop ends holed or slotted where necessary to allow the reinforcement to pass through the joints. The concrete shall be compacted against the stop end for the full height of the lift.

All construction joints shall be located in such positions as shall be approved by the engineer.

The vertical joints shall be stepped and staggered in approved positions and such joints shall not be located at or adjacent to quoins. Except where otherwise directed, the joints in ribbed floors shall be formed in the slab, parallel to the ribs. The joints in floors shall be located in such positions as will minimise the number of joints required.

In beams and suspended slabs an approved splayed joints shall be provided. In all other cases a tongued and grooved key shall be formed at horizontal and vertical joints.
The width of the groove shall be about one third the thickness of the concrete and shall be formed with prepared timber battens having slightly splayed edges.

In structures subject to water pressure, the joints shall be provided with a rebate at the water face, together with a water bar of approved pattern and girth as described on the drawings.

SHRINKAGE GAPS

The work shall be carried out in such a manner as the engineer shall direct to minimise the shrinkage of the concrete and shrinkage gaps shall be left at the discretion of the engineer.

FROST

Concreting work shall be suspended when the air temperature falls below 2 deg. Celsius or if less than 5 deg. Celsius on a falling thermometer or when frost is expected. Frozen aggregate shall be thawed out before use by the aid of approved equipment. Concrete placed in cold weather shall be protected from damage by frost or other weather conditions, shall be cut out and replaced by fresh concrete at the contractors expense. The contractor shall provide a minimum and maximum thermometer of approved design for the purpose of measuring the shade temperature of the outside air. The temperature of concrete at the time of placing shall be at least 5 deg. Celsius and precautions shall be taken to ensure that the concrete temperature after placing does not fall below 5 deg. Celsius until it is thoroughly hardened.

CURING

Horizontal and vertical slabs and other large areas of concrete shall be prevented from drying out for at least 7 days after the concrete has been placed. Precautions shall be taken during the initial period of at least 7 days, to protect all reinforced work from exposure to sun, wind and rain.

PLASTER SURFACES

Where a rendered or plastered finish is specified, the concrete surfaces shall be treated to provide an adequate key. Alternatively, the formwork may be coated with an approved retarding compound which shall be removed with water and wire brush as soon as possible after concreting. Precautions shall be taken to ensure that the retarding compound does not come in contact with the reinforcement.

TRAFFIC OVER CONCRETE

No traffic or temporary load of any kind will be allowed over any concrete until the following minimum time after casting unless approved protective methods are adapted to the engineers satisfaction.

1. Foundations, ground floor slabs and other concrete in contact with the ground 28 days
2. Columns: 10 days
3. Suspended Slabs: 10 days
4. Suspended Beams: 14 days

These times are given for guidance only and do not relieve the contractor of any responsibility for protecting the concrete work against damage from any cause whatsoever.

FORMWORK

The contractor shall submit dimensioned drawings of the systems of falsework which he proposes to adopt for the various sections of the work. This falsework shall be suitably proportioned and braced to withstand the weight of the freshly placed concrete, together with the weight of the workmen and materials.

Where supported on the ground the sole piece carrying the vertical supports shall be bedded on a solid base and shall have an area sufficiently large to ensure that there shall be no settlement under full load.

Adjustable screws or hardwood folding wedges shall be used for adjusting and striking the vertical supports.

All shuttering shall be removed without shock or vibration. Before the shuttering is tripped, the concrete shall be exposed in order to ascertain that the concrete has sufficiently hardened.

Shuttering to vertical surfaces may be removed whenever the concrete will not be damaged by so doing. Shuttering and supports under slabs, beams, girders, arches and structures or parts of structures carrying the loads shall not be removed without the engineers approval. The striking of the horsing shall be carried out in an approved sequence of operations so that no undue shock or other damage is caused to the permanent work.

The contractor shall be responsible for any injury to work and any consequential damage caused or arising from the removal of striking of formwork, centering and supports, and any advise, permission or approval given relative to their removal shall not relieve the contractor from the responsibility here defined.

LOCATION	MINIMUM PERIOD
	Surface Temperature of Concrete
	Cold Weather Normal Weather

	2 deg. To 5 deg. C.	16 deg. C.
	Days	Days
Sides of beams walls and columns	2	1
Slab soffit forms (props left under)	10	4
Beam soffit forms (props left under)	14	7
Props to slabs	21	7
Props to beams	28	16

The formwork should be designed taking into account the surface finish required for the concrete. The formwork should be rigid and tight to prevent loss of grout. All joints between sheets shall be fitted with loose hardwood tongues and all joints between sides and soffits shall be either tongued or sealed with foam strip or other approved material to prevent loss of grout.

The formwork and supports shall be sufficiently rigid to resist without distortion all dead loads and incidental loads resulting from placing, vibration etc.

The contractor shall prepare full size setting-out sketches of the formwork for approval.

REMOVAL OF FORMWORK

The contractor shall give the engineer not less than 24 hours notice of his attention to strike any formwork.

The time at which formwork is struck shall be the contractor's responsibility but the minimum periods between concreting and the removal of forms unless otherwise approved shall be as stated in Table B.

Days during which the average temperature is below 2 deg. C. shall be disregarded in calculating the minimum time which shall elapse before forms are removed.

MOULD OIL AND GREASE

All formwork shall be treated with approved mould oil or grease before use and shall be carefully cleaned down and further oiled or greased before re-use.

The type of mould oil or grease and its methods of application to be used for shuttering for exposed surfaces shall be as recommended by the manufacturer for this kind of work and shall be subject to the engineers approval. The use of specially faced boards of plywood shall not be permitted except with the approval of the engineer.

HOLES AND CHASES IN CONCRETE

Holes, chases and other openings required for the passage of pipes, conduits, etc., shall be formed by inserting suitable sleeves, cores and sinkings before placing the concrete.

The sub-contractors shall be required to furnish full information in regard to the position of such opes and chases, and the position of bolts, clips, holes or other openings in the finished work shall not be permitted without the sanction of the engineer. Such holes and chases shall be made only in approved locations and shall be cut with approved tools.

COMPACTION

Thoroughly compact all concrete using a method appropriate to the workability of the concrete and nature of the work.

Loose hardwood tongues shall be used between all plywood sheets and foam sealing strips fully compressed between formwork and concrete shall be used at all construction joints.

Formwork shall be effectively watertight. Formwork ties shall be arranged in a uniform pattern as directed by the engineer and shall be provided with rubber cones against the formwork so that a neat recess about 50mm diam. x 40mm deep is left at the tie after stripping. The recess shall be treated as a minor surface blemish.

The concrete surface shall be smooth, free from honeycombing, lipping and grout loss, shall have true clean arises and shall be of uniform colour and texture. Only very minor surface blemishes shall be permitted.

While the concrete is still green all surface blemishes shall be filled with a fresh, specially prepared paste of cement and fine aggregate to match the colour of the concrete. After curing the blemished and surface where necessary shall be rubbed down with a fine carborundum stone to produce a smooth even surface.

For ribbed or waffled slabs exposed to view an approved G.R.P. or polypropylene mould shall be temporarily supported by an approved system compatible with the mould. Joints between adjacent moulds shall be featured in the manner indicated on the engineer's drawings and the contractor shall prepare a detailed scheme, for approval, by which this feature may be achieved. Removal of moulds shall be achieved by the use of compressed air carried out strictly in accordance with the manufacturers recommendations.

CONCRETE FINISHES

All exposed fair faced concrete will have a Type C finish in accordance with Clause 6.2.7.3 of BS 8110.

Test samples shall be prepared by the contractor for approval in advance of construction. All non exposed concrete can be Type A finish in accordance with Clause 6.2.7.3 of BS 8110.

Exposed concrete shall have a Type C finish in accordance with BS 8110. All underground work and concrete which will not be exposed shall have a Type A finish in accordance with BS 8110.

REINFORCEMENT

Rolled mild steel bars, cold twisted bars and high tensile fabric reinforcement shall comply with the requirements of BS 4449 and BS 4483 respectively.
The contractor shall deliver free of charge, samples of the various reinforcements for testing as directed. Any consignment of reinforcement failing to comply with the tests shall be removed from site. Certificates of origin for all reinforcement shall be provided.

In the measurement of the weight, the net lengths as shown on the drawings and schedules shall be taken in conjunction with the net weight per metre on the nominal diameter or size of the reinforcement.

The sizes and other dimensions of the reinforcement shall be checked against the drawings and site dimensions before the material is ordered.

The reinforcement shall be cut, cold bent and hooked to the dimensions shown on the drawings and schedules or to such other dimensions as may be directed.

ALTERNATIVE BAR SIZES

No alteration or substitution shall be made in the lengths, sizes or arrangement of the reinforcement, without the prior written approval of the engineer.

FIXING REINFORCEMENT

Reinforcement shall be provided as indicated on the drawings and maintained in its correct position by means of suitable clips, soft tying wire or welding, supplied by the contractor at his own expense. The correct cover shall be maintained by means of suitable metal or plastic spacers or small stools wired to reinforcement.

Such spacers and stools shall be supplied at the contractors expense. The contractor shall not commence concreting on any section of the work until the formwork and reinforcement have been approved by the engineer. Reinforcement in slabs shall be supported at points sufficiently close to ensure that the correct cover is accurately maintained. Each corner bar in beam and column reinforcement shall be similarly supported, at such intervals as will ensure that the correct cover is accurately maintained.

All reinforced concrete elements shall be checked by the engineer prior to pouring of concrete for which adequate notification shall be provided.

SCREED

The proportion of cement and the quality and grading of the aggregate for screeds shall be approved by the engineer.

The screeds shall be laid not more than four hours after the casting of the concrete base except by the permission of the engineer. All joints in screeds shall be set out to the engineer's approval. Where screeds are constructed more than four hours after the casting of the base concrete shall be thoroughly cleaned and a bonding agent applied as approved by the engineer. The satisfactory adhesion of all screeds to the base concrete shall be the contractors sole responsibility and no approval or advice of the engineer regarding the method of construction hall relieve him of his responsibility.

BLOCKWORK

MATERIALS

Materials shall comply with the following specifications:-

Solid concrete blocks	=	IS 20
Hollow concrete blocks	=	IS 20
Concrete stock bricks	=	BS 1180, Class B
Cement	=	IS 1
Aggregates	=	IS 5
Lime	=	IS 8
Wall Ties	=	IS 1243

CONCRETE BLOCKS

Concrete blocks shall be steam cured factory made blocks of uniform texture and shall be obtained from an approved manufacturer. The average compressive strength of the solid concrete blocks shall be 5N/mm square for blocks tested on edge. The average compressive strength for hollow blocks shall be 3N/mm square for blocks tested on edge.

MORTARS

The mortar mix shall be composed by volume of 1 part cement, 1 part lime and 5 parts sand.

A 1:1:5: cement : lime : sand mix shall have the following preliminary strengths as determined in the laboratory:-

at 7 days	3.0 N per sq. mm
at 28 days	5.0 N per sq. mm

The work strengths shall be not less than two thirds of the preliminary strengths.

Coloured mortar shall be obtained by the addition of an approved waterproofing agent used in strict accordance with the manufacturer's instructions.

Ready mixed mortars shall not be used without the engineer's approval.

All mortar shall be well mixed and tempered on a clean floor or boarded platform and where cement is used as a matrix in whole or in part, mixed only in quantities sufficient for immediate use. Any mortar, which has, partly set is not to be re-used and shall be discarded.

MORTAR TESTS

The 1:1:5: cement : lime : sand mortar shall be tested as follows:-

Preliminary tests shall be made of six 100mm mortar cubes, made, cured and tested and the results recorded in accordance with the recommendations of BS 1881.

The cubes shall be made in steel moulds of approved design. Three cubes shall be tested at seven days and the remaining three at twenty eight days. The cubes shall comply with the strengths previously specified.

The engineers representatives may, at any time, direct the 100mm test cubes be taken in his presence from typical batches of mortar.

WORKMANSHIP

Workmanship shall be in accordance with BS 5628, Part 3 and IS 325, Parts 1 and 2.

WALLING

Walling shall be carried out in a uniform manner, no one portion being raised more than 900mm above another, with bed and vertical joints average 10mm thick.

Vertical joints shall be fully flushed up as the work proceeds and all walling shall be carried up in a uniform manner with true and vertical quoins and shall be properly bonded.

CAVITY WALL TIES

The leaves of a cavity wall should be tied together by vertical twist stainless steel or equal approved wall ties embedded in the horizontal mortar joints at the time the course is laid, to a minimum depth of 50mm. The length of the wall tie should be chosen to suit the width between the two leaves. The ties should be placed at a frequency of 750mm horizontally and 450mm vertically and they should be provided within 225mm of all openings and control joints so that there is one for each 225mm of height of the opening.

COLLAR TIED WALLS

Collar tied walls shall be formed from two number 100mm walls with a 15mm space between, filled solidly with mortar. The two walls shall be tied with flat stainless steel wall ties ragged ended with a cross sectional area 20mm x 3mm placed at 450mm centres vertically and horizontally with a minimum embedment of 60mm in each wall.

DAMP PROOF COURSES

Damp proof course shall be bitumen hessian based damp proof course weighing not less than 4.36Kg. per square metre or other equal and approved complying with the requirements of BS 743. Damp proof courses shall be laid in accordance with the requirements of CP 102, Part 2.

TESTING OF BLOCKS

For the purpose of testing conformity of the block with this specification, ten blocks shall be selected at random from every batch of 1000 blocks and tested at the Institute for Industrial Research and Standards in accordance with IS 20.

CERTIFICATES

A Manufacturer's Certificate of the quality of the blocks shall be produced for all batches of blocks delivered to site.

TOLERANCES

The permissible deviation for blockwork shall be as follows:-

Level:

For any nominally horizontal surface when measured from the nearest reference level : +/-10mm.

Position on Plan:

For the position of any nominally vertical surface at the lower edge when measured horizontally from the nearest reference line : +/-10mm.

Plumbness:

The permissible deviation from plumb of the upper and lower edges of any nominally vertical surface shall be 3mm in any 1m but not more than 10mm.

The permissible deviation from straightness, measured horizontally shall be +/-10mm.

The permissible deviation for abrupt change in a nominally continuous surface shall be +/-3mm.

The permissible deviation from the specified relationship of any two surfaces at a junction shall be +/-3mm.

The permissible deviation in joint thickness shall be as follows: -

Horizontal joints : joint thickness +/-3mm combined thickness in any 1m height +/-10mm.

Vertical joints : joint thickness +/-3mm combined thickness in any 3m length +/-10mm.

The permissible deviation for bed joints from the nearest horizontal reference shall be +/-10mm.

CONSTRUCTION & DEMOLITION WASTE

The Waste Management Act 1996, defines waste as any substance which the holder discards or intends to discard, or is required to discard. Any material that is surplus to the immediate requirements of the contract is by definition a waste. The fact that the material may be useful or have a monetary value has no bearing on whether it is a waste.

In accordance with the Waste Permit Regulations 1998 the Contractor is required to apply to the relevant local authority for a Waste Permit when intending to:

- Dispose of less than 5,000 tonnes of material at a site or
- Carry out certain waste recovery activities at a site

The Contractor is required to apply for a Certificate of Registration from the relevant local authority when intending to store quantities of hazardous material on-site, which exceeds 25,000 litres of liquid waste or 40m^3 of non-liquid waste.

The Contractor shall only dispose of Construction & Demolition (C&D) Waste by landfill when the facility has a valid Waste Licence.

The Contractor shall only dispose of C&D waste by means other than landfill to a facility, which holds a valid waste licence (where the quantities involved exceeds 5,000 tonnes per annum) or valid waste permit (where the quantities are less than 5,000 tonnes per annum).

The Contractor shall not transport waste to or from the site or transport waste for disposal or recovery without a valid waste collection permit unless the particular activity or the waste quantity does not require a permit. The requirement for a collection permit includes transporting surplus rubble/fill/spoil from the site if the material is going for disposal or recovery at a licensed facility. If the Contractor does not hold a waste collection permit then a licensed waste collector must be employed to remove any waste from the site.

The Contractor must check with the local authorities that any waste collectors employed at the site have a valid waste collection permit and are disposing of the waste at an authorised facility.

Waste mixtures on the site containing dangerous substances classifying the material as hazardous waste cannot be used as fill on sites even if a waste licence is held. The Contractor must dispose of the waste at a licensed hazardous waste facility. The Contractor must transfer the waste material off site. The contractor must obtain a waste collection permit and a consignment note (C1 Form) from the local authority to transport the material off site.

If waste is being shipped across national boundaries the competent authority in the country receiving the waste and in the EPA must be notified in accordance with the Waste Management (Transfrontier Shipment of Waste) Regulations 1998.

The Contractors should assess their packaging production and determine the source, nature and quantity of packaging waste on site. Contractors should establish whether the suppliers of packaged material to a site are members of Repak or not. If a supplier is not a member of Repak then all packaging waste supplied to the site must be taken back and recovered. It is encouraged that uncontaminated packaging materials arising on site be separated into glass, paper, steel, aluminium, fibreboard, wood and plastic sheeting fractions and arrangements be made for it to be collected by a Repak approved waste contractor if possible.