Appendix D

Structural Specification

24 - 26 Redington Gardens

Structural Specification

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To be read with Preliminaries/General conditions

GENERAL REQUIREMENTS

110 DESK STUDY/ SURVEY

- Scope: Before starting deconstruction/ demolition work, examine available information, and carry out a survey of:
  - the structure or structures to be deconstructed/ demolished,
  - the site on which the structure or structures stand, and
  - the surrounding area.
- Report and method statements: Submit, describing:
  - Form, condition and details of the structure or structures, the site, and the surrounding area.
    Extent: As Architects Drawings .
  - Type, location and condition of features of historical, archaeological, geological or ecological importance.
  - Type, location and condition of adjoining or surrounding premises that might be adversely affected by removal of the structure or structures, or by noise, vibration and/ or dust generated during deconstruction/ demolition.
  - Identity and location of services above and below ground, including those required for the Contractor's use, and arrangements for their disconnection and removal.
  - Form and location of flammable, toxic or hazardous materials, including lead-based paint, and proposed methods for their removal and disposal.
  - Form and location of materials identified for reuse or recycling, and proposed methods for removal and temporary storage.
  - Proposed programme of work, including sequence and methods of deconstruction/ demolition.
  - Details of specific pre-weakening required.
  - Arrangements for protection of personnel and the general public, including exclusion of unauthorized persons.
  - Arrangements for control of site transport and traffic.
  - Special requirements:
  - Results of tests to determine the precise nature of hazardous materials;
  - Site waste management plan development and proposals; and - Structural calculations in support of method statements .
- Format of report: Electronic PDF format .

120 EXTENT OF DECONSTRUCTION/ DEMOLITION

- General: Subject to retention requirements specified elsewhere, deconstruct/ demolish structures down to *foundation level: Break up and dig out foundations*.

130 GROUNDWORKS

- Old foundations, slabs and the like: Break out in locations and to the extents stated.
- Contaminated material: Remove, and carry out remediation required by the Enforcing Authority.

140 BENCH MARKS

- Unrecorded bench marks and other survey information: Give notice when found. Do not remove marks or destroy the fabric on which they are found.

150 FEATURES TO BE RETAINED
- General: Keep in place and protect the following:
  - *Boundary walls;*
  - *Gates and gate pillars; and*
  - *Trees noted on drawings; protect in accordance with BS 5837* .

SERVICES AFFECTED BY DECONSTRUCTION/ DEMOLITION

210 SERVICES REGULATIONS
- Work carried out to or affecting new and/ or existing services: Carry out in accordance with the byelaws and/ or regulations of the relevant Statutory Authority.

220 LOCATION OF SERVICES
- Services affected by deconstruction/ demolition work: Locate and mark positions.
- Mains services marking: Arrange with the appropriate authorities for services to be located and marked.
  - Marking standard: In accordance with National Joint Utilities Group 'Guidelines on the positioning and colour coding of underground utilities' apparatus'.

240 DISCONNECTION OF DRAINS
- General: Locate, disconnect and seal disused foul and surface water drains.
- Sealing: Permanent, and within the site.

250 LIVE FOUL AND SURFACE WATER DRAINS
- Drains and associated manholes, inspection chambers, gullies, vent pipes and fittings:
  - Protect; maintain normal flow during deconstruction/ demolition.
  - Make good any damage arising from deconstruction/ demolition work.
  - Leave clean and in working order at completion of deconstruction/ demolition work.
- Other requirements: *Post completion camera survey; extent to suit Thames Water requirements*.

260 SERVICE BYPASS CONNECTIONS
- General: Provide as necessary to maintain continuity of services to occupied areas of the site on which the deconstruction/ demolition is taking place and to adjoining sites/ properties.
- Minimum notice to adjoining owners and all affected occupiers: 72 hours, if shutdown is necessary during changeover.

270 SERVICES TO BE RETAINED
- Damage to services: Give notice, and notify relevant service authorities and/ or owner/ occupier regarding damage arising from deconstruction/ demolition.
- Repairs to services: Complete as directed, and to the satisfaction of the service authority or owner.

DECONSTRUCTION/ DEMOLITION WORK

310 WORKMANSHIP
- Standard: Demolish structures in accordance with BS 6187.
- Operatives:
  - Appropriately skilled and experienced for the type of work.
  - Holding, or in training to obtain, relevant CITB Certificates of Competence.
- Site staff responsible for supervision and control of work: Experienced in the assessment of risks involved and methods of deconstruction/ demolition to be used.

320 GAS OR VAPOUR RISKS
- Precautions: Prevent fire and/ or explosion caused by gas and/ or vapour from tanks, pipes, etc.

330 DUST CONTROL
- General: Reduce airborne dust by periodically spraying deconstruction/ demolition works with an appropriate wetting agent. Keep public roadways and footpaths clear of mud and debris.
- Lead dust: Submit method statement for control, containment and clean-up regimes.

340 HEALTH HAZARDS
- Precautions: Protect site operatives and general public from hazards associated with vibration, dangerous fumes and dust arising during the course of the Works.

350 ADJOINING PROPERTY
- Temporary support and protection: Provide. Maintain and alter, as necessary, as work proceeds. Do not leave unnecessary or unstable projections.
- Defects: Report immediately on discovery.
- Damage: Minimize. Repair promptly to ensure safety, stability, weather protection and security.
- Support to foundations: Do not disturb.

360 STRUCTURES TO BE RETAINED
- Extent: *As EHRW drawing 1281/TW/080*.
- Parts which are to be kept in place: Protect.
- Interface between retained structures and deconstruction/ demolition: Cut away and strip out with care to minimize making good.

370 PARTLY DEMOLISHED STRUCTURES
- General: Leave in a stable condition, with adequate temporary support at each stage to prevent risk of uncontrolled collapse. Make secure outside working hours.
- Temporary works: Prevent overloading due to debris.
- Access: Prevent access by unauthorized persons.

380 DANGEROUS OPENINGS
- General: Provide guarding at all times, including outside of working hours. Illuminate during hours of darkness.
- Access: Prevent access by unauthorized persons.

391 ASBESTOS-CONTAINING MATERIALS – UNKNOWN OCCURRENCES
- Discovery: Give notice immediately of suspected asbestos-containing materials when discovered during deconstruction/ demolition work. Avoid disturbing such materials.
- Removal: Submit statutory risk assessments and details of proposed methods for safe removal.

410 UNFORESEEN HAZARDS
- Discovery: Give notice immediately when hazards such as unrecorded voids, tanks, chemicals, are discovered during deconstruction/ demolition.
- Removal: Submit details of proposed methods for filling, removal, etc.

420 OPEN BASEMENTS, ETC

- Temporary support: Leave adequate buttress walls or provide temporary support to basement retaining walls up to ground level.
- Safety: Make remaining sections of retaining and buttress walls safe and secure.
- Water movement: Make holes in basement floors to allow water drainage or penetration (depending on water table). Provide a hole for every 10 m², not less than 600 mm in diameter.

450 SITE CONDITION AT COMPLETION

- Debris: Clear away and leave the site in a tidy condition.
- Other requirements: *None*.

MATERIALS ARISING

510 CONTRACTOR'S PROPERTY

- Components and materials arising from the deconstruction/ demolition work: Property of the Contractor except where otherwise provided.
- Action: Remove from site as work proceeds where not to be reused or recycled for site use.

520 RECYCLED MATERIALS

- Materials arising from deconstruction/ demolition work: Can be recycled or reused elsewhere in the project, subject to compliance with the appropriate specification and in accordance with any site waste management plan.
- Evidence of compliance: Submit full details and supporting documentation.
  - Verification: Allow adequate time in programme for verification of compliance.

D20 Excavating and filling

To be read with Preliminaries/General conditions

GENERALLY/THE SITE

110 SITE INVESTIGATION
- Report: *Refer to report by Site Analytical Services Ltd (SAS) dated May 2015 appended to this specification*.

145 VARIATIONS IN GROUND WATER LEVEL
- Give notice: If levels encountered are significantly different from levels in the site investigation report or previously measured.

150 EXISTING SERVICES, FEATURES AND STRUCTURES
- Services: See section A12 for locations.
- Site features to be retained: See section A12 for details.
- Structures: See section A34 for details of protection.

CLEARANCE/EXCAVATING

240 ADJACENT EXCAVATIONS
- Requirement: Where an excavation encroaches below a line drawn at an angle from the nearest formation level of another higher excavation, the lower excavation, all work within it and backfilling thereto, must be completed before the higher excavation is made.
- Angle of line below horizontal: *30°*.
- Backfill material: *As clause 248 when upper excavation will contain a foundation otherwise compacted hardcore filling as clause 710*.

242 EXCAVATIONS ADJACENT TO EXISTING BACKFILLED TRENCHES
- Proximity: When width of undisturbed ground between the two excavations will be less than *900 mm*.
- Action: Assume that the ground between the trenches is unstable and provide side support accordingly.

244 EXCAVATIONS ADJACENT TO EXISTING FOUNDATIONS
- Prior to commencing excavation:
  - Excavate trial pits adjacent to existing foundations to determine extent and formation levels.
  - Allow for inspection of trial pits.
  - Allow time for amendment of details if required.
  - Time period: 4 working days .
- Backfill material to new excavation: As clause 248 where excavation has been specified below a foundation, otherwise compacted hardcore filing as clause .

246 EXCAVATIONS ADJACENT TO PILE SUPPORTED STRUCTURES
- Proximity: When the formation level of an excavation will be lower than the pile cut off level and the distance between the near faces of the pile cap/ ground beam and the excavation is less than *the difference in depth between the pile cap and the excavation formations*.
  - Complete all work within the excavation and backfilling before casting the pile cap/ ground beam, or
  - Delay the adjacent excavation until *3 days after casting the pile cap/ ground beam*.

248 BACKFILL TO EXCAVATIONS LOWER THAN FOUNDATION FORMATION LEVEL

- Critical level:
  - Distance between near faces of foundation and lower excavation less than 1 m: *150 mm above foundation level*.
  - Otherwise: *150 mm above level at which line defined in clause 240 cuts near face of lower excavation*.
- Backfill material:
  - Below critical level: *Concrete as E10/105*.
  - Above critical level: *Hardcore filling as clause 710*.

250 PERMISSIBLE DEVIATIONS FROM FORMATION LEVELS

- Beneath mass concrete foundations: ±25 mm.
- Beneath ground bearing slabs and r.c. foundations: ±15 mm.
- Embankments and cuttings: ±50 mm.
- Ground abutting external walls: ±50 mm, but such as to ensure that finished level is not less than 150 mm below dpc.

255 ACCURACY - LINEAR DIMENSIONS

- Permissible deviations from linear dimensions generally: *Refer to architect's specification and clause A33* .

260 INSPECTING FORMATIONS

- Give notice: Make advance arrangements for inspection of formations for *foundations and filling formations*.
  - Notice (minimum): *4 working days*.
- Preparation: Just before inspection remove the last 150 mm of excavation. Trim to required profiles and levels.
  - Loose material: *Remove*.
- Seal: Within 4 hours of inspection, seal formations with *blinding concrete*.

265 INSPECTING FORMATIONS IN SAND AND GRAVEL

- Notice for inspection (minimum): *4 days*.
- Preparation: Just before inspection remove the last 150 mm of excavation. Trim to required profiles and levels and mechanically compact formation.
- Seal: Within 4 hours of inspection, seal formations with *lean mix concrete*.

267 INSPECTION OF FORMATIONS IN SHRINKABLE SOILS

- Inspect formation: For signs of conducting and fine moisture absorbing roots.
- Give notice: If significant quantities of roots are visible in the formation or in the bottom 75 mm of the walls of the excavation.

270 FOUNDATIONS GENERALLY

- Give notice if:
  - A natural bearing formation of undisturbed subsoil is not obtained at the depth shown on the drawings.
  - The formation contains soft or hard spots or highly variable material.

275 FOUNDATION BEARING

- Requirement: Foundations are designed to bear on:
  - Strata: *Bagshot Beds beneath the Made Ground*.
  - Safe bearing capacity (minimum): *250 kN/m² at a factor of safety of 2.5*.
- Give notice: If the material at the design depth of the foundation does not comply with this description, or contains soft or hard spots or highly variable material.

280 TRENCH FILL FOUNDATIONS

- Excavation: Form trench down to formation in one operation.
- Safety: Prepare formation from ground level.
- Inspection of formations: Give notice before commencing excavation.
  - Period of notice: *Four working days*.
- Shoring: Where inspection of formation is required, provide localised shoring to suit ground conditions.
- Concrete fill: Place concrete immediately after inspection and no more than four hours after exposing the formation.

283 FORMATIONS FOR PILE SUPPORTED STRUCTURES

- Excavate: To the design formation level.
- Compact: As necessary to ensure formation will support weight of concrete without settlement.
- Blinding to formation: *GEN 1 concrete 50 mm thick*.

285 STEPS IN FOUNDATION FORMATIONS

- Depth of formation below ground level (minimum):
  - Existing ground level: *Not applicable*.
  - Finished ground level: *2500 mm* .
- Step dimensions:
  - Distance between steps (minimum): *1000mm*.
  - Height of step (maximum): *500mm*.
  - Length of overlap (minimum): *500mm*.

290 FOUNDATIONS IN MADE UP GROUND

- Depth: Excavate down to a natural formation of undisturbed subsoil.
- Discrepancy: Give notice if this is greater or less than depth given.

310 UNSTABLE GROUND

- Generally: Ensure that the excavation remains stable at all times.
- Give notice: Without delay if any newly excavated faces are too unstable to allow earthwork support to be inserted.
- Take action: If instability is likely to affect adjacent structures or roadways, take appropriate emergency action.

320 RECORDED FEATURES

- Recorded foundations, beds, drains, manholes, etc: *Break out and seal drain ends*.
- Contaminated earth: Remove and disinfect as required by local authority.

330 UNRECORDED FEATURES

- Give notice: If unrecorded foundations, beds, voids, basements, filling, tanks, pipes, cables, drains, manholes, watercourses, ditches, etc. not shown on the drawings are encountered.

335 NEW FOUNDATIONS CROSSING OLD FOUNDATIONS OR WALLS

- Break out: The old foundation/ wall where it crosses the new foundation/ wall:
  - Length of breaking out: Width of the new foundation/ wall plus *50 mm on either side of new foundation*.
  - Depth of breaking out: *As necessary to permit the construction of the new foundation to its design cross section*.
- Disturbed/ softened soil: When the formation for the old foundation/ wall is deeper than the formation of the new foundation.
  - Excavate: Soil that has been disturbed and/ or softened on either side of the old wall/ foundation, and for *100 mm into undisturbed ground on either side*.
- Step up: The formation for the new foundation as necessary on either side of the old foundation/ wall until the formation is at its design level.
  - Size of steps: *Minimum distance between steps 600 mm and maximum height of step 200 mm unless noted otherwise on the drawings*.
- Backfilling beneath design formation level: *Fill with concrete as foundation is cast*.

337 OLD FOUNDATIONS OR WALLS BENEATH NEW GROUND SUPPORTED SLAB

- Break out: The old foundation/ wall to a depth below the slab formation level of at least *300 mm*.
  - Excavate: Soil that has softened on either side of the old wall/ foundation.
- Backfill: Obtain instructions if depth of fill will be greater than 600 mm, otherwise backfill with compacted hardcore.

350 EXISTING WATERCOURSES

- Diverted watercourses which are to be filled: Before filling, remove vegetable growths and soft deposits.

360 EXCESS EXCAVATION

- Excavation taken wider than required:
  - Backfill: *As clause 700*.
- Excavation taken deeper than required:
  - Backfill: *Under foundations: Concrete grade the same grade as that specified for the foundations, under ground bearing slabs, hardcore as clause 710*.

370 UNDERGROUND STRUCTURES IN LANDSCAPE AREAS

- Generally: Remove walls, roads, foundations, disused services, drains, manholes and the like to minimum depth.
- Minimum depth below finished levels:
  - Grass, ground cover and perennial planting: 500 mm.
  - Shrub planting: 750 mm.
  - Within 2 m of tree planting: 1000 mm.
- Walls and slabs remaining: In every 10 m² of wall or slab, make a drainage hole at least 600 mm diameter.

DISPOSAL OF MATERIALS

450 WATER

- Generally: Keep all excavations free from water until:
  - Formations are covered.
  - Below ground constructions are completed.
  - Basement structures and retaining walls are able to resist leakage, water pressure and flotation.
- Drainage: Form surfaces of excavations and fill to provide adequate falls.
- Removal of water: Provide temporary drains, sumps and pumping as necessary. Do not pollute watercourses with silt laden water.

454 GROUND WATER LEVEL, SPRING OR RUNNING WATER
- Give notice: If it is considered that the excavations are below the water table.
- Springs/ Running water: Give notice immediately if encountered.

457 PUMPING
- General: Do not disturb excavated faces or stability of adjacent ground or structures.
- Pumped water: Discharge without flooding the site or adjoining property.
- Sumps: Construct clear of excavations. Fill on completion.
  - Locations: *Submit proposals* .

FILLING

500 PROPOSED FILL MATERIALS
- Details: Submit full details of proposed fill materials to demonstrate compliance with specification, including:
  - Type and source of imported fill.
  - Proposals for processing and reuse of material excavated on site.
  - Test reports as required elsewhere.
- Timing: *At least 14 days before starting filling*.

510 HAZARDOUS, AGGRESSIVE OR UNSTABLE MATERIALS
- General: Do not use fill materials which would, either in themselves or in combination with other materials or ground water, give rise to a health hazard, damage to building structures or instability in the filling, including material that is:
  - Frozen or containing ice.
  - Organic.
  - Contaminated or noxious.
  - Susceptible to spontaneous combustion.
  - Likely to erode or decay and cause voids.
  - With excessive moisture content, slurry, mud or from marshes or bogs.
  - Clay of liquid limit exceeding 80 and/or plasticity index exceeding 55.
  - Unacceptable, class U2 as defined in the Highways Agency 'Specification for highway works', clause 601.

512 LIMITATION OF SULFATE CONTENT IN FILL MATERIALS
- Test specification: To *BS 1377-3*.
- Sulfate content: Expressed as *SO4*.
  - Water soluble sulfate (maximum): *1500 mg/L in 2:1 water/ soil extract*.
  - Total potential sulfate (maximum): *0.6%*.
  - Oxidizable sulfides (maximum): *0.3% of total potential sulfate*.
- Certificates of test result: Submit.

520 FROST SUSCEPTIBILITY

- General: Except as allowed below, fill must be non frost-susceptible as defined in Highways Agency 'Specification for Highway Works', clause 801.8.
- Test reports: If the following fill materials are proposed, submit a laboratory report confirming they are non frost- susceptible:
  - Fine grained soil with a plasticity index less than 20%.
  - Coarse grained soil or crushed granite with more than 10% retained on a 0.063 mm sieve.
  - Crushed chalk.
  - Crushed limestone fill with average saturation moisture content in excess of 3%.
  - Burnt colliery shale.
- Frost-susceptible fill: May only be used:
  - At depths below the finished ground surface greater than: *450 mm*.
  - Within the external walls of buildings below spaces that will be heated. Protect from frost during construction.
  - Where frost heave will not affect structural elements.

525 TESTING OF SUITABILITY OF FILL MATERIALS BEFORE START OF FILLING

- Laboratory: *UKAS/NAMAS accredited laboratory*.
- Submit report to: *Structural engineer (two copies)*.
  - Timing: *21 days before starting filling*.
- Samples: Deliver to laboratory as required.
  - Additional requirements: *None*.
- Tests: *As directed*.
- Frequency: *Submit with tender proposed rate and frequency of testing to demonstrate continuing compliance of imported or reprocessed fill with specified properties*.

530 PLACING FILL

- Surfaces of excavations and areas to be filled: Free from loose soil, topsoil, organic material, rubbish and standing water.
- Freezing conditions: Do not place fill on frozen surfaces. Remove material affected by frost. Replace and recompact if not damaged after thawing.
- Adjacent structures, membranes and buried services:
  - Do not overload, destabilise or damage.
  - Submit proposals for temporary support necessary to ensure stability during filling.
  - Allow 14 days (minimum) before backfilling against in situ concrete structures.
- Layers: Place so that only one type of material occurs in each layer.
- Earthmoving equipment: Vary route to avoid rutting.

535 COMPACTION GENERALLY

- General: Compact fill not specified to be left loose as soon as possible after placing.
- After compaction: Surface of each layer must be well closed, showing no movement under compaction plant, and without cracks, holes, ridges, loose material and the like.
- Defective areas: Remove and recompact to full thickness of layer using new material.

540 BENCHING IN FILL

- Adjacent areas: If, during filling the difference in level between adjacent areas of filling exceeds 600 mm, cut into edge of higher filling to form benches 600 mm minimum width and height equivalent to depth of a layer of compacted filling.
- New filling: Spread and compact to ensure maximum continuity with previous filling.

650 PROTECTION OF COMPACTED FILLING

- Temporary protective filling: Before allowing construction traffic, raise level of compacted cohesive soil filling at least 150 mm above formation level using properly compacted temporary filling.
- Removal: Remove temporary protective filling from site before permanent construction.

700 BACKFILLING AROUND FOUNDATIONS

- Under oversite concrete and pavings: Hardcore as clause 710.
- Under grassed or soil areas: Material excavated from the trench, laid and compacted in 300 mm maximum layers.

710 HARDCORE FILLING

- Fill: Granular material, free from excessive dust, well graded, all pieces less than 75 mm in any direction:
  - Test requirements:
    Minimum 10% fines value tested in a soaked condition to BS 812-111 *50 kN*.
    Impact value SZ tested to BS EN 1097-2 *Not required*.
- Material:
  - In any one layer only one of the following:
    Crushed rock (other than argillaceous rock) or quarry waste with not more binding material than is required to help hold the stone together.
    Crushed concrete, crushed brick or tile, free from plaster, timber and metal.
    Crushed non-expansive slag.
    Gravel or hoggin with not more clay content than is required to bind the material together, and with no large lumps of clay.
    Well-burned non-plastic colliery shale.
    Natural gravel.
    Natural sand.
- Filling: Spread and level in 150 mm maximum layers. Thoroughly compact each layer.

730 BLINDING

- Surfaces to receive sheet overlays or concrete:
  Blind with:
  - Concrete where shown on drawings; or
  - Sand, fine gravel, or other approved fine material applied to fill interstices. Moisten as necessary before final rolling to provide a flat, closed, smooth surface.
- Sand for blinding: To BS EN 12620, grade 0/4 or 0/2 (MP).
- Permissible deviations on surface level: +0 -25 mm.

D30 Piling

To be read with Preliminaries/ General conditions.

TENDERING

GENERAL

110A PILING SPECIFICATION

- Standard: Comply with the current edition of 'Specification for piling and embedded retaining walls' (SPERW).
- With reference to SPERW, B1.2, Project specification:
  a) Role of the engineer: *Is undertaken by the Contract Administrator.*
  b) Location and description of the site: *As described in the main contract documents.*
  c) Nature of the works: *As described in the main contract documents.*
  d) Working area: *As described in the main contract documents.*
  e) Sequence of the works: *The anticipated sequence of works is as described in the main contract documents. The assumed sequence of works, on the basis of which the structural design has been developed is as follows:*
  - Demolish existing structures.
  - Clear potential obstructions.
  - Prepare working platform
  - Install piles
  - Construct substructure

  The contractor shall be responsible for submitting a design package for review and approval to the Local Authority Building Control. A copy of this package shall also be submitted to the contract administrator for review.
  f) Contract drawings: As described in the main contract documents.
  g) Office and facilities for the engineer: As described in the main contract documents.
  v) Restrictions on permissible working hours: As described in the main contract documents.
  w) Restrictions on noise and vibration levels: AS described in the main contract documents.
- Design working life category: 50 years

130 PILES

- Standard: To SPERW, sections B2-B6, as appropriate to the pile type.
- Permitted types: *Contractor's choice*.
- Project specification: Submit proposals to cover the SPERW requirements in clause B1.2 and listed under this heading for the chosen pile type.
- Other requirements: *Part of the retaining basement walls*.

180 AUGURED CAST-IN-PLACE PILES

- Standard: To SPERW, section B4.
- Method of construction: *Continuous flight auger*.
  - Splitting of auger: *Not permitted*.
- Filling:
  - Material: *Designed concrete as clause 480*.
  - Placing: Inject through hollow stem of auger.
  - Control of concreting/ grouting: *Contractors choice*.
- Pile group designation: *All*.
  - Diameter: *As drawing GA*-01.
  - Length: *Submit proposals*.
  - Reinforcement:
    Quantity: *Submit proposals*.
    Extent: *Submit proposals*.
  - Other requirements: *None*.

SYSTEM PERFORMANCE

210 CONTRACTOR DESIGN

- Structural requirements:
  - Generally: As section B50.
  - Modifications: *None*.
- Design responsibility:
  - Piles: *Complete design of piles in accordance with SPERW, clause B1.4, option 2*.
  - Other: *None*.
- Pile layout: *As drawing GA/001*.
- Performance criteria for piles: *As clauses 130 and 280*.
- Other requirements: *None*.
- Submission of information: As required by SPERW, table B1.1 and elsewhere, as appropriate for the pile type, materials and tests specified.
  - Amendments to requirements specified in SPERW for information required:
    Prior to commencing design:
    - Proposals for reducing noise and vibration from piling operations.
    - Proposals for monitoring noise, vibration or ground movements.
    - Proposals working close to existing facades.
    - Confirmation that the installation of piles will not damage adjacent structures/services.
    - Confirmation that the contractor's proposed retaining wall system will comply with the water exclusion requirements of the specification. Comments on the pile spacing and pile verticality required to achieve the specified water exclusion requirements. .

    Prior to commencing the works:
    - Method for stabilizing excavations in the event of delay in concreting.
    - Method of maintaining constant positive concrete pressure.
    - Details of equipment used to determine depth and verticality of bore.
    - Details of torque capacity of rig at rotation speed >10rpm and confirmation that proposed rig/ auger configuration is not susceptible to flighting for pile diameters and soil conditions under consideration. .

230 EUROCODES

National Annexes: Reference to a Eurocode shall be deemed to include the appropriate United Kingdom National Annex, and nationally determined parameters shall apply.
Substitution of alternative design rules for Application Rules: Permitted when it can be demonstrated that the alternative rule is in accordance with the relevant principles and that the structural safety, serviceability and durability of the resulting structure will be at least that required by the Eurocode.

260 SPECIFIED WORKING LOADS FOR PILES

- Design factor of safety (minimum):
  - 3.0* (compression or tension)
  - * subject to satisfaction of the requirements of London District Surveyors Association 2009 publication Guidance Note No.1 ('Guidance Notes for the Design of Straight Shafted Bored Piles in London Clay'), this document may be used to establish minimum factors of safety. Other factors as proposed by the Contractor.
  - The factor(s) used are to be approved by the Local Authority Building Control. .
- Pile group designation: All .
  - Load magnitude: As drawing 180107-08.

285 DAMAGE TO ADJACENT STRUCTURES AND SERVICES

-Permissible damage criteria:
-Structures: No worse than BRE Digest 251 Category of Damage 1.
-Services: To be maintained in a serviceable condition and measures must be taken to ensure that piling operations do not cause damage or disrupt their continued operation. Drains are to be tested upon completion of the piling works to ensure their satisfactory performance.
-Other requirements: The Contractor shall be responsible for the control of all ground movements and any resulting damage to adjacent structures. Neighbouring buildings shall not suffer significant damage. Significant damage shall be defined as greater than BRE Digest 251 Category of Damage 1. The Contractor shall design both the temporary and permanent works to ensure that ground movements are minimised.

290 BASIS FOR SETTING OUT

- Site datum: *Ordnance (Newlyn) datum*.
- Site grid: *As Architects drawing*.

300 COMMENCING SURFACE

- Level: *Submit proposals. The commencing surface (piling platform level) is to be agreed with the Contract Administrator is to be a suitable level to construct piles to the pile head level. Commencing level assumed to be 300mm above cut-off level.* .

310 PILE LENGTH – PENETRATION

- Pile group designation: *All*.
- Pile cut-off level: *As schedule*.
  - Stratum: *Refer to site investigation*.
  - Penetration of pile into stratum (minimum): *Submit proposals*.
  - Other requirements: *None*.

340 INSTALLATION TOLERANCES FOR PILES

- Requirement: Substitute the following for the standard installation tolerances given in SPERW, table B1.4: *Deviation from the vertical at any level, 1 in 100 and plan position at cut-off level, 75mm in any direction*.
- Application/ reason: *All piles*.

PRODUCTS

470 CONCRETE GENERALLY

- Standards: To BS 8500-2 and SPERW, section B19.
- Project compressive strength testing of concrete: *Required as SPERW, clause B19.8*.
- Exchange of information: Provide concrete producer with information required by BS 8500-1, clauses 4 and 5.

480 DESIGNED CONCRETE *For all piles*
- Embedded metal: *Carbon steel reinforcement*.
- Compression strength class (cylinder/ cube minimum): *C30/37*.
- Target density (oven-dry): Normal.
- Fibres: *Not required*.
- Aggregates:
  - Size (maximum): *20 mm*.
  - Type/ Density: Normal weight.
  - Coarse recycled aggregates: *RCA permitted*.
  - Additional aggregate requirements: *None*.
- Design chemical class: DC1
- Limiting values for composition:
  - Water:cement ratio (maximum): *As DC-class*.
  - Cement/ Combination content (minimum): *As DC-class*.
  - Cement/ Combination content (maximum): *No requirement*.
  - Air content in situ (minimum): *No requirement*.
- Consistence class: *Contractor's choice*.
- Permitted cement/ combinations: *All in BS 8500-1, table A.6*.
- Chloride class: Cl 0.40
- Sulphate Class: DS-2
- Admixtures: *Concrete producer's choice*.
- Additional requirements: *None*.

530 REINFORCEMENT GENERALLY
- Steel reinforcement: To *BS 4449*.
  - Type/ Strength grade: *Ribbed bar, grade B500B*.
- Supplier: Firm holding a valid certificate of approval issued under a product certification scheme operated by a third party certification body with appropriate Category 2 accreditation from the United Kingdom Accreditation Service (UKAS).
- Other requirements: *Allow for reinforcement to project a minimum of 500mm above cut-off level unless detailed otherwise on the drawings.*.

540 COVER TO REINFORCEMENT
- Cover (nominal): *75 mm*.
- Method of ensuring correct cover: Submit details.

550 LAPS IN REINFORCEMENT
- Length (minimum): *40xbar diameter*.

EXECUTION

610 METHOD STATEMENT
- Requirement: Submit proposed method of installation to achieve the design parameters, including:
  - Details of equipment.
  - Programme showing sequence and resources.
  - Confirmation that performance requirements for load and settlement will be achieved.

615 RECORDS AND SUBMISSION OF INFORMATION DURING THE WORKS
- Generally: As required in SPERW, tables B1.1, B1.6 and elsewhere, as appropriate for the pile types, materials and tests specified.
- Amendments to requirements: *Report integrity test results and findings within 5 days of testing*.

655 TESTING EXCAVATED MATERIAL
- Contamination tests: Undertake at following rates:
  - Made up ground: *One test per 10m³ excavated material*.
  - Other soil types: *Not required*.

685 EXCAVATED MATERIAL
- Disposal: *Remove from site*.

690 DISPOSAL OF PILE HEADS
- Cutting down and disposal: Contractor's responsibility.

705 MONITORING CONSTRUCTION OF AUGURED PILES
- Requirements additional to SPERW, clause B4.4.5 and B4.9:
  - Monitor the following and record with pile records: *Rate of concrete flow divided by rate of auger extraction*.

710 INSTRUMENT FAILURE WHEN AUGURING PILES
- Manual monitoring: Use a stop watch.

755 PREPARATION OF PILE HEADS FOR INTEGRITY TESTING
- Preparation: To suit test method.
- Inconsistencies: Submit report on inconsistencies which could inhibit execution or interpretation of test.

760 PILE INTEGRITY TESTING - GENERAL
- Method: *Submit proposals*.
  - Satisfactory evidence in support of proposals: Submit.
- Period between casting and testing (minimum): *10 days*.
- Piles to be tested:
  - Pile group designation: *All*.
  - Number of piles to be tested: *All*.
  - Locations: *As drawings*.
- Programme: *Submit proposals*.
- Other requirements: *None*.

COMPLETION

910 HEALTH AND SAFETY FILE
- Piling completion report: Collate and submit a full set of pile records for inclusion in the health and safety file.
- Content and date for submission: As SPERW, clause B1.12.2.
  - Record plan: Give the number of each pile and its final location relative to *nearest grid line*.
  - Additional requirements: *None*.

920 PILING GUARANTEE
- Type: Insurance backed. Administered by an independent insurance protection company.
  - Guarantee period (minimum): *12 years from completion* .
  - Documentation: Provide certificates/ guarantees at completion of piling works.

D40 Embedded retaining walls

To be read with Preliminaries/ General conditions.

GENERAL

110 EMBEDDED RETAINING WALL SPECIFICATION
- Standard: Comply with the current edition of 'Specification for piling and embedded retaining walls' (SPERW) except where specified otherwise.
- Substitution of British Standards for SPERW requirements: *None* .
- References to the Engineer in SPERW: For the purpose of this contract, interpret such references as being to the person named in section A10 as administering the contract on behalf of the Employer.

115 GENERAL REQUIREMENTS FOR PILES *Forming contiguous pile walls*
- Requirement: Comply with clauses *D30*.

130 EMBEDDED RETAINING WALL
- Standard: To SPERW, sections B8-B12, as appropriate to the pile type.
- Permitted types: *Contiguous bored cast-in-place pile*.
- Particular specification: Submit proposals to cover the SPERW requirements in clause B1.2 and listed under this heading for the chosen wall type.
- Other requirements: *None*.

175 CONTIGUOUS BORED PILE WALLS
- SPERW, sections *B4 and B10*.
- Piles: *Flight augered cast in place as clause D40/433 and D30*.
  - Diameter (minimum): *450*.
  - Spacing (maximum): *525*.
- Recesses: *Not required*.
- Guide walls: *Submit proposals*.
- Tolerances on concrete protrusions: *Protrusions from general wall face greater than 75 mm not permitted*.
- Removal of protrusions: *When outside permitted tolerance*.
- Other requirements: *None*.

SYSTEM PERFORMANCE

210 CONTRACTOR DESIGN

- Standards to be used for design: To *BS EN 1992-1 and BS EN 1997-1*.
- Requirement: Complete the design of embedded retaining walls and construct in accordance with SPERW, clause B1.4, option 3.
- Construction type: *Cantilever during construction and propped in permanent condition except where noted on the drawings*.
  - Sequence: Top down *construction*.
- Embedded retaining wall layout: *As* Engineers *drawings*.
- Water resistance: *Not required*.
  - Other components of water resistance systems: *None*.
- Special requirements: None.
- Site investigation: Confirm as adequate or propose further investigation as considered necessary.
- Submission of information: As required by SPERW, table B1.1 and elsewhere, as appropriate for the wall type, materials and tests specified.
  - Amendments to requirements specified in SPERW for information required.
    Prior to commencing design: *Proposals for monitoring noise or ground movement.*.
    Prior to commencing works: *Confirmation that installation of walls will not damage adjacent structures/ services*.

250 PERFORMANCE CRITERIA FOR STRUCTURE TO BE SUPPORTED ON WALLS

- Permitted settlement at working load (maximum): *Any part of the structure - 10 mm*.

265 LOADS ON WALLS AND EXCAVATION DEPTHS

- Standards: *BS EN 1991-1-1 and BS EN 1997-1*.
  Characteristic vertical loads: *As* Engineers *drawing*.
- Retention loads: Calculate taking into account the following:
  - Soil representative strength parameters: *As assessed from site investigation report*.
  - Design ground water level: *1m below adjacent ground level*.
- Over excavation to be assumed in front of wall: *0.5 m*.
  - Uniform surcharge loading on surface of retained soil: *10 kN/m²*.
  - Additional surcharge loading: Adjacent Properties as noted on engineers drawings.
- Excavation depths: *As drawings*.

268 LATERAL WALL MOVEMENT DURING EXCAVATION AND CONSTRUCTION

- Action values: *Contractor to submit proposals for approval*.
- Trigger values: *Contractor to submit proposals for approval*.
- Movement approaching critical values:
  - Trigger: Submit proposals for ensuring action values are not exceeded.
  - Action: Stop work.

275 PERFORMANCE CRITERIA FOR MOVEMENT UNDER VERTICAL LOAD

- Element: *All wall piles*.
  - Load: *As drawing*.
  - Settlement (maximum): *10mm*.

285 DAMAGE TO ADJACENT STRUCTURES AND SERVICES

- Permissible damage criteria:
  - Structures: *No worse than BRE Digest 251 Category of damage 1*.
  - Services: *No damage permitted*.

290 BASIS FOR SETTING OUT

- Site datum: *Ordnance (Newlyn) datum*.
- Site grid: *As Architects drawings*.

300 COMMENCING SURFACE

- Level: *Submit proposals. The commencing surface (piling platform level) is to be agreed with the Contract Administrator is to be a suitable level to construct piles to the pile head level. Commencing level assumed to be 300mm above cut-off level* .

310 WALL PENETRATION

- Panel: *All*.
- Cut-off level: *As* Engineers *drawings*.
- Stratum: *Refer to site investigation*.
- Penetration into stratum (minimum): *Submit proposals*.
- Other requirements: *None*.

340 INSTALLATION TOLERANCES FOR WALLS

- Requirement: Substitute the following for the standard installation tolerances given in SPERW, table B1.4: *Deviation from the vertical at any level, 1 in 100 and plan position at cut-off level, 25mm in any direction*.
- Application/ reason: *All piles*.
- Tolerance on concrete protrusions: *Protrusions from general wall face greater than 75 mm not permitted*.
- Removal of protrusions: *When outside permitted tolerance*.

433 **PRODUCTS**

CAST IN PLACE PILES *All*.

- Standard: To SPERW, section *B4*.
- Method of construction: *Continuous flight auger*.
- Filling:
  - Material: *Designed concrete as clause 480*.
- Placing: *Submit proposals*.
- Pile diameter: *450mm*.
- Reinforcement: *Submit proposals*.
  - Extent: *Submit proposals but to contractors design and projecting 600mm minimum (or a full tension lap if greater) above cut-off level* .
  - Floor starter bars/ dowels: *600mm long by 16mm diameter tie bars as* engineers *drawing and section E40, chemically bonded into holes drilled in wall* .
- Tolerance on concrete protrusions: *Protrusions from general wall face greater than 75 mm not permitted*.

470

- Removal of protrusions: *When outside permitted tolerance*.
- Other requirements: *None*.

CONCRETE GENERALLY

- Standard: To BS 8500-2 and SPERW, section B19.
- Project compressive strength testing of concrete: *Required as SPERW, clause B19.8*.
- Exchange of information: Provide concrete producer with information required by BS 8500-1, clauses 4 and 5.

480 DESIGNED CONCRETE *All piles*.
- Embedded metal: *Carbon steel reinforcement*.
- Compression strength class (cylinder/ cube minimum): *C30/37*.
- Target density (oven-dry): Normal.
- Fibres: *Not required*.
- Aggregates:
  - Size (maximum): *Contractor's choice*.
  - Type/ Density: Normal weight.
  - Coarse recycled aggregates: *RCA permitted*.
  - Additional aggregate requirements: *None*.
- Design chemical class: *DC-1*.
- Limiting values for composition:
  - Water:cement ratio (maximum): *As DC-class*.
  - Cement/ Combination content (minimum): *As DC-class*.
  - Cement/ Combination content (maximum): *No requirement*. -
  Air content in situ (minimum): *No requirement*.
- Consistence class: *Contractor's choice*.
- Permitted cement/ combinations: *Contractor's choice*.
- Chloride class: *Cl 0.40*.
- Sulphate Class: DS-2
- Admixtures: *Concrete producer's choice*.
- Additional requirements: *None*.

530 REINFORCEMENT GENERALLY
- Steel reinforcement: To *BS 4449*.
  - Type/ Strength grade: *Ribbed bar, grade B500B*.
- Supplier: Firm holding a valid certificate of approval issued under a product certification scheme operated by a third party certification body with appropriate Category 2 accreditation from the United Kingdom Accreditation Service (UKAS).
- Other requirements: *Debond reinforcement that is more than 600 mm above cut-off level,* .

540 COVER TO REINFORCEMENT
- Cover (nominal): *75 mm*.
- Method of ensuring correct cover: Submit details.

550 LAPS IN REINFORCEMENT
- Length (minimum): *40x bar diameter*.

EXECUTION

610 METHOD STATEMENT
- Requirement: Submit proposed method of installation to achieve the design parameters including:
  - Details of equipment.
  - Programme showing sequence and resources.
  - Confirmation that performance requirements for load and settlement will be achieved.

612 CONTRACTOR DETAILING OF REINFORCEMENT

- Requirement: Complete the detailing and scheduling of the reinforcement.
- Standards:
  - Drawings: *'Standard method of detailing structural concrete', published by IStructE/ Concrete Society*.
  - Reinforcement schedules: To *BS EN ISO 3766*.
- Design information:
  - Designed reinforcement: *Design calculations to be submitted by the contractor for review*.
  - Additional reinforcement:
    Control of cracking: Provide additional reinforcement and adjust spacing of reinforcement as design standard requirements for the control of cracking.
    Other: *None*.
- Special detailing requirements: *None*.
- Finished product: To comply with the requirements of design standard.

615 RECORDS AND SUBMISSION OF INFORMATION DURING THE WORKS

- Generally: As required in SPERW, tables B1.1, B1.6 and elsewhere, as appropriate for the wall type, materials and tests specified.
- Amendments to requirements: *As SPERW section B4.5.1*.

655 TESTING EXCAVATED MATERIAL

- Contamination tests: Undertake at following rates:
  - Made up ground: *One test per 10m³ excavated material*.
  - Other soil types: *Not required*.

685 EXCAVATED MATERIAL

- Disposal: *Remove from site*.

690 DISPOSAL OF PILE HEADS

- Cutting down and disposal: Contractor's responsibility.

704 MONITORING GENERALLY

- Ground conditions: Observe soil and groundwater levels.
  - Conditions that are not in accordance with design data, including unforeseen obstructions: Report.
- Ground movements: Establish measuring points in the locations and at the depths *Contract or to submit proposals for approval*.
  - Period of monitoring: *Prior to commencement of construction. Repeat readings weekly*.
  - Frequency of monitoring: *Weekly*.
    During excavation and construction of permanent supports: *Weekly*.
    Thereafter: *Weekly until the permanent structure has been completed and cured.*.
- Wall movements: Establish measuring points *Contractor to submit proposals for approval*.
  - Period of monitoring: *During excavation and until monitoring point is hidden by permanent construction*.
  - Frequency of monitoring: *Weekly*.
    During excavation and construction of permanent supports: *Weekly*.
    Thereafter: *Contractor to submit proposals for approval*.
- Other requirements: *Submit proposals for increasing frequency of monitoring if target movements exceed the target values.*.

705 MONITORING CONSTRUCTION OF AUGERED PILES

- Requirements additional to SPERW, clause B4.5 and B4.9:
  - Monitor the following and record with pile records: *Rate of concrete flow divided by rate of auger extraction*.

710 INSTRUMENT FAILURE WHEN AUGURING PILES
- Manual monitoring: Use a stop watch.

755 PREPARATION OF PILE HEADS FOR INTEGRITY TESTING
- Preparation: To suit test method.
- Inconsistencies which could inhibit execution or interpretation of test: Submit report.

760 INTEGRITY TESTING *For contiguous bored pile walls*.
- Method: *Submit proposals*.
- Period between casting and testing (minimum): *7 days*.
- Piles/ walls to be tested:
  - Number: *All*.
  - Location: *As drawings*.
- Programme: *Contractor to submit proposals*.
- Other requirements: *None*.

860 TEMPORARY BACKFILL MATERIAL
- *Arisings*.

COMPLETION

910 HEALTH AND SAFETY FILE
- Walling completion report: Collate and submit a full set of records for inclusion in the health and safety file.
  - Number of copies: *Two*.
- Content and date for submission: As SPERW, clause B1.12.2.
  - Record plan: Giving the number of each wall element and its final location relative to *Nea rest grid line*.
  - Additional requirements: *None*.

920 PILING GUARANTEE
- Type: Insurance backed. Administered by an independent insurance protection company.
  - Guarantee period (minimum): *12 years from completion*.
  - Documentation: Provide certificates/ guarantees at completion of piling works.

E05 In situ concrete construction generally

To be read with Preliminaries/General conditions.

223 STRUCTURAL DRAWINGS AND SCHEDULES
- Standards:
  - Drawings: To *'Standard method of detailing structural concrete' published by the Institution of Structural Engineers*.
  - Reinforcement schedules: To *BS 8666*.

225 TEMPERATURE RECORDS
- Requirement: Throughout period of concrete construction record:
  - Daily: *Maximum and minimum atmospheric shade temperatures*.
  - Under adverse temperature conditions: Temperature at commencement and end of placing.
- Equipment: *Contractor's choice* .
  - Location: In the shade, close to the structure.

235 OPENINGS, INSERTS AND FIXINGS
- Requirement: Collate all information.
- Submit: Details where openings, inserts and fixings can only be accommodated by adjustments to reinforcement.
- Locate reinforcement: To ensure specified minimum cover at openings and inserts and to be clear of fixing positions.

290 ACCURACY OF CONSTRUCTION
- Setting out: To BS 5964-1.
- Geometrical tolerances: *To Section 7 of the 'National Structural Concrete Specification for Building Construction'*.
  - Conflicts: Notwithstanding tolerances specified elsewhere, do not exceed requirements for compliance with the designated code of practice.
  - Substitution of alternative requirements: *None*.

300 LEVELS OF STRUCTURAL CONCRETE FLOORS
- Tolerances (maximum):
  - Level of floor: *±10 mm as measured from nearest temporary bench mark*.
  - Steps in floor level: *±5 mm, otherwise not applicable*.

310 SURFACE REGULARITY OF CONCRETE FLOORS TO BS 8204 - GENERAL
- Standard: To BS 8204-1 or -2.
- Measurement: From underside of a 2 m straightedge (between points of contact) placed anywhere on surface and using a slip gauge.

410 IN SITU CONCRETE CONSTRUCTION - SUPERVISION/ CHECKING
- Standard: *To BS EN 13670, Execution Class 2*.

E10 Mixing/casting/curing in situ concrete

To be read with Preliminaries/General conditions.

CONCRETE

101 SPECIFICATION
- Concrete generally: To BS 8500-2.
- Exchange of information: Provide concrete producer with information required by BS 8500-1, clauses 4 and 5.

105 DESIGNATED CONCRETE *FOR MASS CONCRETE BLINDING*
- Designation: *GEN1*.
- Fibres: *Not required*.
- Aggregates:
  - Size (maximum): *20 mm*.
  - Coarse recycled aggregates: *No special requirements*.
  - Additional aggregate requirements: *None*.
- Special requirements for cement/ combinations: *None*.
- Consistence class: *Contractor's choice*.
- Chloride class: *Cl 1.0*.
- Sulphate Class: DS-2
- Admixtures: *Concrete producer's choice*.
- Additional mix requirements: *None*.

105A DESIGNATED CONCRETE *FOR UNREINFORCED FOUNDATIONS*

- Designation: *GEN3*.
- Fibres: *Not required*.
- Aggregates:
  - Size (maximum): *20 mm*.
  - Coarse recycled aggregates: *No special requirements*.
  - Additional aggregate requirements: *None*.
- Special requirements for cement/ combinations: *None*.
- Consistence class: *Contractor's choice*.
- Chloride class: *Cl 1.0*.
- Sulphate Class: DS-2
- Admixtures: *Concrete producer's choice*.
- Additional mix requirements: *None*.

105B DESIGNATED CONCRETE *FOR REINFORCED FOUNDATIONS*

- Designation: *RC32/40*.
- Fibres: *Not required*.
- Aggregates:
  - Size (maximum): *20 mm*.
  - Coarse recycled aggregates: *No special requirements*.
  - Additional aggregate requirements: *None*.
- Special requirements for cement/ combinations: *None*.
- Consistence class: *Contractor's choice*.
- Chloride class: *Cl 0.40*.
- Sulphate Class: DS-2
- Admixtures: *Concrete producer's choice*.
- Additional mix requirements: *None*.

105C DESIGNATED CONCRETE *FOR REINFORCED CONCRETE GENERALLY*
- Designation: *RC32/40*.
- Fibres: *Not required*.
- Aggregates:
  - Size (maximum): *20 mm*.
  - Coarse recycled aggregates: *No special requirements*.
  - Additional aggregate requirements: *None*.
- Special requirements for cement/ combinations: *None*.
- Consistence class: *Contractor's choice*.
- Chloride class: *Cl 0.40*.
- Admixtures: *Concrete producer's choice*.
- Additional mix requirements: *None*.

125 SUBSTITUTION OF STANDARDIZED PRESCRIBED CONCRETE FOR DESIGNATED CONCRETE
- General: Conform to BS 8500-2, clause 9.
- Substitution: In accordance with BS 8500-1, Table A.14.
  - Proposals: Submit for each substitution, stating reasons.
- Site mixing: *Not permitted for anything other than GEN 1 concrete and RC25/30 mass concrete padstones*.

MATERIALS, BATCHING AND MIXING

215 READY-MIXED CONCRETE
- Production plant: Currently certified by a body accredited by UKAS to BS EN ISO/IEC 17065 for product conformity certification of ready-mixed concrete .
- Source of ready-mixed concrete: Obtain from one source if possible . Otherwise, submit proposals .
  - Name and address of depot: Submit before any concrete is delivered .
  - Delivery notes: Retain for inspection .
- Declarations of nonconformity from concrete producer: Notify immediately .

218 SITE MIXED CONCRETE
- Batching by mass:
  - Restrictions: *Maximum pour size 3 m³*.
  - Accuracy of measuring devices: To BS EN 206, clause 9.6.2.2.
    Tolerances for quantity of constituent material: To BS EN 206, Table 27.
- Batching by volume:
  - Restrictions: *Maximum pour size 0.5 m³*.
- Mixing: To BS 8000-2.1, subsections 2, 3 and 4.

221 INFORMATION ABOUT PROPOSED CONCRETES
- Submit when requested:
  - Details listed in BS 8500-1, clause 5.2.
  - Additional information: *Data concerning the anticipated rate of strength gain*.

225 CHANGES TO SPECIFICATION
- Changes to specification of fresh concrete (outside concrete producer's responsibility): *Pro hibited*.

230 INTERRUPTION OF SUPPLY DURING CONCRETING
- Elements without joints: Where elements are detailed to be cast in a single pour without joints, make prior arrangements for a back-up supply of concrete.
- Elsewhere:
  - Preparation: Manage pour to have a full face, and have materials available to form an emergency construction joint while concrete can still be worked.
  - Before pour is completed: Submit location and details of joint, make proposals for joint preparation.

315 AGGREGATES FOR EXPOSED VISUAL CONCRETE
- Limitations on contaminants: Free from absorbent particles which may cause 'popouts', and other particles such as coal and iron sulfide which may be unsightly or cause unacceptable staining .
- Colour: Consistent .
- Supply: From a single source and maintained throughout the contract .
- Samples: Submit on request .

325 MATERIALS FOR EXPOSED VISUAL CONCRETE
- Alterations to sources, types and proportions: Submit proposals .

415 ADMIXTURES
- Calcium chloride and admixtures containing calcium chloride: Do not use .

490 PROPERTIES OF FRESH CONCRETE
- Adjustments to suit construction process: Determine with concrete producer . Maintain conformity to the specification .

PROJECT TESTING/ CERTIFICATION

508A REGULAR PROJECT TESTING OF CONCRETE: FOR ALL OTHER THAN DESIGNATED CONCRETE MIXES
- Tests: *Compressive strength*.
- Sampling:
  - Point: *At point of discharge from delivery truck*.
  - Rate: *One sample per 12 m³*.
- Other requirements: *Cubes for early age strength testing to be stored under same conditions as concrete in members*.

520 TESTING LABORATORY
- Laboratory: Accredited by UKAS or other national equivalent.
  - Name and UKAS reference number: Submit well in advance of making trial mixes or concrete for use in the works.

530 TESTS RESULTS
- Submission of reports: Within one day of completion of each test.
  - Number of copies: *Three*.
- Reports on site: A complete set, available for inspection.

550 BROKEN CUBES FROM FAILED STRENGTH TESTS
- Nonconformity: Keep separately the pieces of each cube which fail to meet the conformity requirements for individual results.
- Period for keeping cubes: Obtain instructions.

PLACING/ COMPACTING/ CURING AND PROTECTING

610 CONSTRUCTION/ SEQUENCE/ TIMING REQUIREMENTS
- *Contractor to provide proposed sequence of construction for comment* .

620 TEMPERATURE OF CONCRETE
- Application: *Water retaining concrete and concrete slabs with thickness exceeding 500mm*.
- Objective: Limit maximum temperature of concrete to minimize cracking during placing, compaction and curing. Take account of:
  - High temperatures and steep temperature gradients: Prevent build-up during first 24 hours after casting. Prevent coincidence of maximum heat gain from cement hydration with high air temperature and/ or solar gain.
  - Rapid changes in temperature: Prevent during the first seven days after casting.
- Proposals for meeting objective: Submit.

630 PREMATURE WATER LOSS
- Requirement: Prevent water loss from concrete laid on absorbent substrates .
  - Underlay: Select from:
    Polyethylene sheet: 250 micrometres thick .
    Building paper: To BS 1521, grade B1F .
  - Installation: Lap edges 150 mm .

640 CONSTRUCTION JOINTS
- Location of joints: *As shown on drawings*.
- Preparation of joint surfaces: *As section E40* .

645 SPACING OF CONSTRUCTION JOINTS
- Type of construction: *As shown on the drawings*.
  - Distance between joints (maximum): *As shown on the drawings*.
  - Area of pour (maximum): *As shown on the drawings*.
  - Other requirements: *None*.

648 ADVERSE TEMPERATURE CONDITIONS
- Requirement: Submit proposals for protecting concrete when predicted ambient temperatures indicate risk of concrete freezing or overheating.

650 SURFACES TO RECEIVE CONCRETE
- Cleanliness of surfaces immediately before placing concrete: Clean with no debris, tying wire clippings, fastenings or free water .

660 INSPECTION OF SURFACES
- Notice: Give notice to allow inspections of reinforcement and surfaces before each pour of concrete.
  - Period of notice: Obtain instructions.
- Timing of inspections: *To be agreed*.

670 TRANSPORTING
- General: Avoid contamination, segregation, loss of ingredients, excessive evaporation and loss of workability . Protect from heavy rain .
- Entrained air: Anticipate effects of transport and placing methods in order to achieve specified air content .

680 PLACING

- Records: Maintain for time, date and location of all pours.
- Timing: Place as soon as practicable after mixing and while sufficiently plastic for full compaction.
- Temperature limitations for concrete: 30°C (maximum) and 5°C (minimum), unless otherwise specified. Do not place against frozen or frost covered surfaces.
- Continuity of pours: Place in final position in one continuous operation up to construction joints. Avoid formation of cold joints.
- Discharging concrete: Prevent uneven dispersal, segregation or loss of ingredients or any adverse effect on the formwork or formed finishes.
- Thickness of layers: To suit methods of compaction and achieve efficient amalgamation during compaction.
- Poker vibrators: Do not use to make concrete flow horizontally into position, except where necessary to achieve full compaction under void formers and cast-in accessories and at vertical joints.

690 COMPACTING

- General: Fully compact concrete to full depth to remove entrapped air. Continue until air bubbles cease to appear on the top surface.
  - Areas for particular attention: Around reinforcement, under void formers, cast-in accessories, into corners of formwork and at joints.
- Consecutive batches of concrete: Amalgamate without damaging adjacent partly hardened concrete.
- Methods of compaction: To suit consistence class and use of concrete.

720 VIBRATORS

- General: Maintain sufficient numbers and types of vibrator to suit pouring rate, consistency and location of concrete .
- External vibrators: Obtain approval for use .

730 PLASTIC SETTLEMENT

- Settlement cracking: Inspect fresh concrete closely and continuously wherever cracking is likely to occur, including the top of deep sections and at significant changes in the depth of concrete sections .
  - Timing: During the first few hours after placing and whilst concrete is still capable of being fluidized by the vibrator .
- Removal of cracks: Revibrate concrete.

810 CURING GENERALLY

- Requirement: Keep surface layers of concrete moist throughout curing period, including perimeters and abutments, by either restricting evaporation or continuously wetting surfaces of concrete.
  - Surfaces covered by formwork: Retain formwork in position and, where necessary to satisfy curing period, cover surfaces immediately after striking.
  - Top surfaces: Cover immediately after placing and compacting. If covering is removed for finishing operations, replace it immediately afterwards.
- Surface temperature: Maintain above 5°C throughout the specified curing period or four days, whichever is longer.
- Records: Maintain details of location and timing of casting of individual batches, removal of formwork and removal of coverings. Keep records on site, available for inspection.

811 COVERINGS FOR CURING

- Sheet coverings: Suitable impervious material .
- Curing compounds: Selection criteria:
  - Curing efficiency: Not less than 75% or for surfaces exposed to abrasion 90% .
  - Colouring: Fugitive dye .
  - Application to concrete exposed in the finished work: Readily removable without disfiguring the surface .
  - Application to concrete to receive bonded construction/ finish: No impediment to subsequent bonding .
- Interim covering to top surfaces of concrete: Until surfaces are in a suitable state to receive coverings in direct contact, cover with impervious sheeting held clear of the surface and sealed against draughts at perimeters and junctions .

812 PREVENTING EARLY AGE THERMAL CRACKING

- Deep lifts or large volume pours: Submit proposals for curing to prevent early age thermal cracking, taking account of:
  - Temperature differentials across sections .
  - Coefficient of thermal expansion of the concrete .
  - Strain capacity of the concrete mix (aggregate dependent) .
  - Restraint .

815 ADDITIONAL CURING REQUIREMENT - WATER CURING

- Commencement of water curing: As soon as practicable after placing and compacting concrete .
  - Surfaces covered by formwork: Expose to water curing as soon as practicable .
  - Top surfaces: Cover immediately with impermeable sheeting to prevent evaporation before commencement of water curing .
- Water curing: Wet surfaces continuously throughout curing period .
  - Select methods from:
    Mist spray .
    Wet hessian covered with impermeable sheeting .

818 CURING PERIODS GENERALLY

- Minimum periods: When not otherwise indicated, to *BS EN 13670, Annex F.8.5*.

840 PROTECTION

- Prevent damage to concrete, including:
  - Surfaces generally: From rain, indentation and other physical damage .
  - Surfaces to exposed visual concrete: From dirt, staining, rust marks and other disfiguration .
  - Immature concrete: From thermal shock, physical shock, overloading, movement and vibration .
  - In cold weather: From entrapment and freezing expansion of water in pockets, etc .

E20 Formwork for in situ concrete

To be read with Preliminaries/ General conditions.

GENERALLY/ PREPARATION

110 LOADINGS
- Requirement: Design and construct formwork to withstand the worst combination of the following:
  - Total weight of formwork, reinforcement and concrete.
  - Construction loads including dynamic effects of placing, compacting and construction traffic.
  - Wind and snow loads.

120 FORMWORK DETAILS
- Provide the following: *Drawings (plans and elevations) showing layout of panel joints and all cast in details where concrete is exposed to view*.

132 PROPPING
- General: Prevent deflection and damage to the structure. Carry down props to bearings strong enough to provide adequate support throughout concreting operations.
- Method statement: Submit proposals for prop bearings and sequence of propping/ repropping and backpropping.
  - Timing of submission: *To be agreed between the permanent works designer and the temporary works coordinator* .

145 PERMANENT FORMWORK
- Location and materials: Submit proposals.
- Standard: Design profiled steel shuttering as permanent formwork in accordance with BS EN 1993-1-3.

160 CAMBERS
- Application of specified upward cambers: To the concrete immediately before formwork is struck.
  - Formwork: Allow for deflection under weight of fresh concrete.
  - Top surfaces of concrete: Camber to maintain the required structural depths and profiles.
- Checks after striking of formwork and removal of props: Levels to determine extent of any residual camber. Submit results.
- Upward cambers: Construct forms to achieve the following:
- - *Slabs and beams with spans greater than 3m: 0.1% of span measured at centre. Cantilever beams: -0/1% of cantilever measured at centre* .

170 WORK BELOW GROUND *FOR ALL REINFORCED CONCRETE STRUCTURES*
- Casting vertical faces against faces of excavation: *Obtain consent*.
  - Requirements: *Increase nominal cover to reinforcement to 75 mm and Prevent contamination of concrete by loose soil*.

182 COLLAPSIBLE BOARD SUBSTRUCTURE FORMWORK
- Type: Plastics cellular core, collapsed by predetermined fail load.
- Manufacturer: *Coredek Limited*.
  - Product reference: *Cellcore HX S 225mm 18/24*.
- Thickness: *225mm*.
- Load bearing capacity: *Safe load 18 kN/m²; fail load 24 kN/m²*.

CONSTRUCTION

310 ACCURACY
- General requirement for formwork: Accurately and robustly constructed to produce finished concrete in the required positions and to the required dimensions.
- Formed surfaces: Free from twist and bow (other than any required cambers).
- Intersections, lines and angles: Square, plumb and true.

315 SUBSTRUCTURE FORMWORK AND UNDERSLAB INSULATION
- Cutting: Neat and accurate to edges, and around penetrations and downstands.
- Laying: Tightly butted and fully supported on firm, even substrate.
- Vertical faces: Stiffen as necessary to act as shutter.
- Formwork/ insulation surfaces: Protect from indentation by spacers and other items.
- Joints in formwork/ insulation and with edge structure and penetrations: Seal to prevent penetration of concrete.
- Concrete placement: Restrain formwork/ insulation against movement.

320 JOINTS IN FORMS
- Requirements including joints in form linings and between forms and completed work:
  - Prevent loss of grout, using seals where necessary.
  - Prevent formation of steps. Secure formwork tight against adjacent concrete.

330 INSERTS, HOLES AND CHASES
- Positions and details:
  - Dimensioned on drawings provided on behalf of the Employer: Do not change without consent.
  - Undimensioned or from other sources: Submit proposals.
- Positioning relative to reinforcement: Give notice of any conflicts well in advance of placing concrete.
- Method of forming: Fix inserts or box out as required. Do not cut hardened concrete without approval.

340 KICKERS
- Method statement: Submit proposals including means of achieving quality of concrete consistent with that specified for the column or wall.
  - Kicker height: *75 mm*.

350 FORM TIES
- Metal associated with form ties/ devices: Prohibited within cover to reinforcement. Compatible with reinforcement metal.

351 PROHIBITION OF FORM TIES
- Do not use ties in the following work: *Concrete surfaces exposed to view* .

360 PROPRIETARY FORM TIES FOR WATER RESISTANT CONCRETE
- Tie manufacturer: *Submit proposals*.
  - Product reference: *Submit proposals*.
- Sealing mortar manufacturer: *Submit proposals*.
  - Product reference: *Submit proposals*.
- Making good of holes: Fully fill.

470 RELEASE AGENTS
- Use: *Obtain Approval*.
- General: Achieve a clean release of forms without disfiguring the concrete surface.
- Product types: Compatible with formwork materials, specified formed finishes and subsequent applied finishes. Use the same product throughout the entire area of any one finish.
- Protection: Prevent contact with reinforcement, hardened concrete, other materials not part of the form face, and permanent forms.

480 SURFACE RETARDERS
- Use: Obtain approval.
- Reinforcement: Prevent contact with retarder.

STRIKING

510 STRIKING FORMWORK
- Timing: Prevent any disturbance, damage or overloading of the permanent structure.

521 MINIMUM PERIOD FOR RETAINING FORMWORK/ TEMPORARY SUPPORTS IN POSITION
- Concrete strength at time of formwork removal (minimum): *5 N/mm² cube strength for Columns and 60% of 28 day strength for beams and slabs* .
- Assumptions: *Imposed load will not exceed 0.75 kN/m² until concrete reaches full maturity. Maturity of permanent supports and adjacent elements of structure is at least equal to element under consideration*.
  - Before removing formwork: Submit proposals if assumptions will not be realised.
- Method to be used in assessing early age strength of concrete: *Application of appropriate table in CIRIA report R136*.

FORMED FINISHES

610 BASIC FINISH
- Location: *Faces below ground level*.
- Finish: Faces fully compacted and cover to reinforcement provided.

615 FINISH TO RECEIVE ASPHALT TANKING
- Finish: Even and suitable to receive asphalt.
- Permissible deviation of surfaces:
  - Sudden irregularities (maximum): 3 mm.
  - Gradual irregularities (maximum): 3 mm, when measured from underside of a 1 m straightedge, placed anywhere on surface.
- Surface blemishes:
  - Permitted: Blowholes less than 10 mm in diameter.
  - Not permitted: Voids, honeycombing, segregation and other large defects.
- Projecting fins: Remove.
- Formwork tie holes: Filled with mortar.

620 PLAIN FINISH

- Location: *Hidden surfaces and minimum requirement for exposed surfaces subject to architect's specification*.
- Finish: Even and dense. Arrange formwork panels in a regular pattern as a feature of the surface.
- Permissible deviation of surfaces:
  - Sudden irregularities (maximum): 3 mm.
  - Gradual irregularities (maximum): 3 mm, when measured from the underside of a 1 m straightedge, placed anywhere on surface.
- Variations in colour:
  - Permitted: Those caused by impermeable formwork linings.
  - Not permitted: Those caused by contamination or grout leakage.
- Surface blemishes:
  - Permitted: Blowholes less than 10 mm in diameter and at an agreed frequency.
  - Not permitted: Voids, honeycombing, segregation and other large defects.
- Formwork tie holes: In a regular pattern and filled with matching mortar.

750 ARRISES, MARGINS AND JUNCTIONS

- Requirements:
  Corners to receive asphalt tanking - chamfered with a 30 mm wide face .

E30 Reinforcement for in situ concrete

To be read with Preliminaries/ General conditions.

REINFORCEMENT

110 QUALITY ASSURANCE OF REINFORCEMENT
- Standards:
  - Reinforcement: To BS 4449, BS 4482, BS 4483 or BS 6744.
  - Cutting and bending: To BS 8666.
- Source of reinforcement: Companies holding valid certificates of approval for product conformity issued by the UK Certification Authority for Reinforcing Steels (CARES).

140 PLAIN BAR REINFORCEMENT
- Standard: To BS 4482.
  - Strength grade: 250.

150 RIBBED BAR REINFORCEMENT
- Standard: To BS 4449.
  - Strength grade: *B500B*.

160 GALVANIZED STEEL REINFORCEMENT
- Galvanizing: To BS EN ISO 1461 after cutting but before bending.

170 STAINLESS STEEL PLAIN BAR REINFORCEMENT
- Standard: To BS 6744.
  - Designation: *1.4301* .
  - Strength grade: 200.

180 STAINLESS STEEL RIBBED BAR REINFORCEMENT
- Standard: To BS 6744.
  - Designation: *1.4301* .
  - Strength grade: *500* .

210 STANDARD FABRIC REINFORCEMENT
- Standard: To BS 4483.
- Strength grade: *Generally B500A but wrapping fabric plain wire grade 250* .

WORKMANSHIP

310 CUTTING AND BENDING REINFORCEMENT
- General: To schedules and to BS 8666.
- Bending on site, including minor adjustments: *Not permitted for B500B ribbed bar reinforcement*.

320 PROTECTION OF REINFORCEMENT
- Dropping from height, mechanical damage and shock loading: Prevent.
- Cleanliness of reinforcement at time of pouring concrete: Free from corrosive pitting, loose mill scale, loose rust and contaminants which may adversely affect the reinforcement, concrete, or bond between the two.

410 LAPS OR SPLICES
- Details not shown on drawings: Obtain instructions.

425 LAPS NOT DETAILED ON DRAWINGS

- Laps in bar reinforcement (minimum): *40 x bar diameter*.
- Laps in fabric reinforcement (minimum): *40 x bar diameter*.
  - Laps at corners: Avoid four layer build-up.

427 LAPS IN FABRIC REINFORCEMENT

- Terms: As defined in BCA publication 97.321.
- Lap type:
  - Long edge of fabric: *Unless noted otherwise butt end bars in adjacent fabric sheets and provide loose bars of the same diameter and type as the fabric bars, tied to and with a full lap with the bars in each sheet*.
  - Short edge of fabric: *Unless noted otherwise butt end bars in adjacent fabric sheets and provide loose bars of the same diameter and type as the fabric bars, tied to and with a full lap with the bars in each sheet*.
- Other requirements: *Stagger laps in fabric to each face*.

430 WELDING REINFORCEMENT

- Standard: *To BS EN ISO 17660-1 or -2 as appropriate and in conjunction with the National Annexes*.
- Joint type/ dimensions: *Submit proposals*.
  - Location: *Submit proposals, showing joints in principal tension reinforcement staggered* .
- Site welding: *Not permitted*.

451 FIXING REINFORCEMENT

- Standard: To BS 7973-1 and -2.
- Installation: In addition to any spacers and chairs shown on drawings or schedules, provide adequate support, tie securely and maintain the specified cover.
- Tying:
  - Wire type: 16 gauge black annealed. Use stainless steel wire for stainless steel reinforcement.
  - Ends of tying wire: Prevent intrusion into the concrete cover. Remove loose ends.
- Compatibility of metals: Prevent contact between ordinary carbon steel and stainless or galvanized reinforcement.

470 TOLERANCES ON COVER

- Tolerance (maximum): *walls 5 mm, floors and slabs 10 mm* .
- Checking specified cover dimensions: Before concreting check that cover dimensions will be achieved.

480 NOMINAL COVER TO REINFORCEMENT

- Top face: *Where not shown on the drawings obtain instruction*.
- Formed faces: *Where not shown on the drawings obtain instruction*.

510 RUST STAINING

- Staining of surfaces of concrete which will be exposed to view in the finished work: Prevent.

E40 Designed joints in in situ concrete

To be read with Preliminaries/General conditions.

120 CONSTRUCTION/ MOVEMENT JOINTS GENERALLY

- Accuracy: Position and form joints accurately, straight, well-aligned and truly vertical or horizontal or parallel with setting out lines of the building.
- Modifications to joint design or location: Submit proposals.
- Placing concrete to form movement joints:
  - Maintain effectiveness of joints. Prevent concrete entering joints or penetrating or impregnating compressible joint fillers.
  - Do not place concrete simultaneously on both sides of movement joints.

132 ADDITIONAL REQUIREMENTS FOR CONSTRUCTION JOINTS

- Limitations: *Not permitted in watertight concrete and concrete exposed to view*.

210 FORMED JOINTS

- Forms/ stop ends generally: Rigid and grout-tight.
- Forms/ stop ends for projecting continuity reinforcement: To accommodate bars or fabric without temporary bending or displacement.

211 FORMED JOINTS IN CONCRETE WEARING SURFACES

- Temporary forms: Square edged with a steel top surface.
- Placing concrete: Compact thoroughly at edges to give level, closely abutted joints with no lipping.

230 PREPARATION OF CONSTRUCTION JOINTS

- Roughening of joint surfaces: Select from:
  - Brushing and spraying: Remove surface laitance and expose aggregate finish while concrete is still green.
  - Other methods: Submit proposals.
- Condition of joint surfaces immediately before placing fresh concrete: Clean and damp.

260 SAWN CRACK INDUCING GROOVES

- Groove dimensions:
  - Depth: *50 mm*.
  - Width: As narrow as practicable.
- Sawing: Sufficiently early to prevent random cracking (within 24 hours of casting slab) and to produce strong, well defined arrises.
- Groove filling: *Sealant, contractor's choice unless specified otherwise by architect*.

310 FLEXIBLE WATERSTOPS

- Manufacturer: *Submit proposals*.
  - Product reference: *Submit proposals*.
- Junctions and angles: Use factory formed junction pieces.
- Placing concrete: Fully compact concrete around waterstops with no voids or porous areas.

320 HYDROPHILIC WATERSTOPS
- Manufacturer: *Submit proposals*.
  - Product reference: *Submit proposals*.
- Location: *Located in groove in first cast concrete surface*.
- Method of fixing: *Bonded using an adhesive approved by waterstop manufacturer*.
- Condition of concrete surface at time of fixing: Clean and free from ponded or running water.
- Protection: Prevent wetting of exposed sections of waterstop.

410A CARBON STEEL TIE BARS: FOR TIED LONGITUDINAL JOINTS
- Standard: To *BS 4449*.
  - Product form: *Ribbed*.
  - Strength grade: *B500B*.
- Cleanliness: Free from corrosive pitting, loose mill scale, loose rust and contaminants which may adversely affect the tie bars, reinforcement, concrete, or bond between the two.
- Position: Centred on joint.
- Other requirements: *None*.

415 STAINLESS STEEL TIE BARS
- Standard: To BS 6744.
  - Product form: *Ribbed*.
  - Designation: *1.4301*.
  - Strength grade *500*.
- Cleanliness: Free from contaminants which may adversely affect the tie bars, concrete, or bond between the two.
- Position: Centred on joint.

435A STAINLESS STEEL DOWEL BARS: FOR CONTRACTION JOINTS
- Standard: To BS 6744.
  - Designation: *1.4362*.
  - Product form: Plain.
  - Strength grade: 200.
  - Properties: Perfectly straight, with sawn (not sheared) ends.
- Debonding: Achieve effective debonding of each bar
  - Material: *Suitable proprietary debonding compound or Suitable plastics sleeve*.
  - Extent: *Half length of bar*.
- Position: At right angles to and centred on joint.
- Other requirements: *None*.

520 SHEET JOINT FILLER *FOR ISOLATION JOINTS*
- Manufacturer: *Submit proposals*.
  - Product reference: *Submit proposals*.
- Joints finished with sealant: Leave sufficient space for sealant by using temporary formers.

530 SEALANT *FOR CONSTRUCTION JOINTS*.
- Manufacturer: *Submit proposals*.
  - Product reference: *Submit proposals*.
  - Colour of surfaces exposed to view: *Grey*.
- Preparation and application: As section Z22.
- Guarantee: *Required*.
  - Period: *20 years*.
  - Requirements: *Compatible with retained liquid and joint filler*.

590 INSPECTION OF TIED AND PARTIALLY TIED JOINTS

- Purpose: To determine whether shrinkage is concentrated at occasional joints.
- Timing: At intervals from one month after casting of slab for duration of works.
- Joints that have opened significantly more than the average: Submit proposals for grouting.

E41 Worked finishes to in situ concrete

To be read with Preliminaries/ General conditions.

150 FINISHING
- Timing: Carry out at optimum times in relation to setting and hardening of concrete.
- Prohibited treatments to concrete surfaces:
  - Wetting to assist surface working.
  - Sprinkling cement.

210 TAMPED FINISH
- Surface on completion: *Even array of parallel ribs*.

230 BRUSHED FINISH
- Surface on completion: Light even texture.

240 WOOD FLOATED FINISH
- Surface on completion: Slightly coarse, even texture with no ridges or steps.

310 SMOOTH FLOATED FINISH
- Surface on completion: Even with no ridges or steps.

530 SLIP RESISTANCE TESTING OF WEARING SURFACES
- Test: To BS 7976-2 using a Transport Research Laboratory (TRL) Pendulum.
  - Timing: Give adequate notice.
  - Test results: Submit, inclusive of slip resistance values (pendulum test value [PTV]), in the wet and dry states.

G10 Structural steel framing

To be read with Preliminaries/ General conditions.

INFORMATION FOR CONTRACTOR/FABRICATOR
The contractor and/or fabricator is to undertake detailed site measurements/site survey to ensure that all steelwork is fabricated to fit in accordance with the drawings and the tolerances given in the NSSS where the steelwork is reliant upon existing structures or site features

GENERAL REQUIREMENTS/ INFORMATION

115 DESIGN CONSTRAINTS - GENERAL
- Members forming bracing systems or girders of lattice construction: Unless detailed or instructed otherwise, position so that their lines of action intersect at a point.
- Bolts:
  - Diameter (minimum): *16 mm*.
  - Number per connection (minimum): Two, unless otherwise indicated.
  - Other requirements: *Choose bolt dimensions to ensure that threads do not occur in shear plane of joint. HSFG bolts or shop welded connections to be used in trusses and bracing to avoid slip*.
- Punching of bolt holes: *Permitted other than in preloaded joints*.
- Welds: *At least 6 mm fillet*.
- Other constraints: *Use continuous welds*.

116 DESIGN CONSTRAINTS - STEELWORK TO BE GALVANIZED
- Steel grades: Do not use steel downgraded from a higher specification.
- Detail design: Avoid details that will increase the risk of initiating liquid metal assisted cracking (LMAC).
  - Particular restrictions: *Use full end plates and stiffeners*.
- Other requirements: *Use continuous welds*.

120 DRAWINGS AND CALCULATIONS
- Information required: *As submission schedule*.
- Requirement: Before preparing detailed fabrication drawings, submit:
  - General arrangement drawings with individual steel members clearly identified.
  - Calculations for major connections.

121 DRAWING AND DESIGN SUBMISSION
- Form of each submission: *The main contractor to issue to paper copies to* Cranston Consulting *and the CA. Design calculations to be submitted to* Cranston Consulting .
- Time: *Allow 10 working days following the receipt of each submission for* Cranston Consulting*/CA to return comments. Allow an additional 5 working days following receipt for any subsequent resubmission*.
- Co-ordination of comments: *The main contractor will be responsible for co-ordinating comments from all parties and for liaising with the steel contractor to ensure that all comments are taken into account*.
- Comments on submission: *The extent of the design review will cover those items listed in the NSSS*.
- Fabrication: *Do not commence until all comments have been incorporated onto fabrication drawings*.
- As-erected drawings: *To be provided in accordance with the requirements of the NSSS*

123 DRAWINGS AND CALCULATIONS PREPARED BY CONTRACTOR
- Information required: *As submission schedule*.
- General arrangement drawings: Submit before preparing calculations. Clearly identify:
  - Individual steel members.
  - Conflicts with other work.
  - Proposed changes to contract drawings.
- Member and joint calculations: Submit before preparing fabrication drawings.

125 SPECIFICATION STANDARD
- Standard: Comply with latest edition of National Structural Steelwork Specification (NSSS CE Marking version).
  - Additional requirements: *UNO Steelwork to be fabricated to execution class 2 as defined in BS EN 1090-2*.
  - Document availability: For the duration of the work, at fabrication shop and on site.
- References to Engineer in NSSS CE Marking version: For the purpose of this contract, interpret such references as being to *the person named in section A10 as Consulting Structural Engineer*.
  - Exceptions: *None*.

130 GENERAL STEEL SECTIONS AND PLATES *FOR ALL STEELWORK*
- Standard: *To BS EN 10025-2*.
- Grade: *S275J0 or S355J0*.
  - Options: *None*.
- Source: Obtain steel from a source accredited to a national or internationally accepted quality standard.
- Other requirements: *None*.

135 HOLLOW STEEL SECTIONS *FOR ALL STEELWORK*
- Standard: *To BS EN 10210-1*.
- Grade: *S275J0H*.
  - Options: *None*.
- Source: Obtain steel from a source accredited to a national or internationally accepted quality standard.
- Other requirements: *None*.

FABRICATION

180 NOTIFICATION OF COMMENCEMENT
- Notice: Give notice before fabrication is due to start.
  - Period of notice (minimum): *Five working days* .

190 MARKING
- Identifying and recording materials and components: Submit details of proposed methods.
- Location of marks:
  - Generally: Visible for checking after erection.
  - Weathering steel: On surfaces not exposed to open view in the completed work.
- Steel to be blast cleaned, pickled, metal sprayed or galvanized: Marked so that subsequent treatment cannot obliterate the marking.

195 HARD STAMPING
- Usage: Not permitted except as indicated on drawings.

210 END CONNECTIONS
- Angle cleats: Project 10 mm beyond ends of simply supported members.

215 HOLLOW SECTIONS
- Insides of sections: Debris and moisture removed before sealing ends and openings.

220 ACCESS/ VENTILATION HOLES IN BASE PLATES
- Base plates larger than 1 m²: Make 25 mm diameter holes as necessary for pressure grouting, escape of entrapped air or direct compaction of filling/ bedding material.

225 STEELWORK TO BE GALVANIZED
- Cutting, drilling and shop welding: Complete before galvanizing.
- Vent and drain holes: Provide as necessary.
  - Locations: Submit proposals.
  - Sealing: *Submit proposals* .

WELDING

255 SITE WELDING
- Usage: Permitted only where indicated on drawings.
- Working conditions: Suitable and safe. Do not weld when surfaces are wet or when ambient temperature is below 0°C.

270 ADDITIONAL WELDS
- Welds (including tack welds) not indicated on drawings: Not permitted without approval.

BOLT ASSEMBLIES

302 NON-PRELOADED BOLT ASSEMBLIES
- Designation: *Hexagon head bolts to BS EN ISO 4014, grade B* .
  - Threading: *Part length*.
- Nuts and washers: To suit grade of bolt, as NSSS CE Marking version, clause 2.4.3.
- Coating applied by manufacturer: *Galvanised where connecting galvanised members or sherardized where connecting painted members* .
- Other requirements: *For bolts to ??? ensure that unthreaded length of shank extends at least 5 mm beyond shear plane.* .

305 PROPRIETARY ANCHORS
- Manufacturer: *Submit proposals*.
  - Product reference: *Submit proposals*.
- Anchor type: *Bonded anchor* .
- Material: *Stainless steel*.

325 DIRECT TENSION INDICATORS
- Standard: To BS EN 14399-9.
- Manufacturer: *Contractor's choice*.
  - Product reference: *Submit proposals*.
- Grade: Appropriate for grade of bolt and nut assembly.
- Finish: *Sherardized* .
- Ancillary components: Washers to BS EN 14399-9.
- Post installation and inspection treatment: Where no further protective coating is specified, apply a butyl rubber sealing compound to seal measuring gap around indicators.

370 GALVANIZED COATING TO BOLT ASSEMBLIES
- Standard: To BS 7371-6.
- Galvanizing: Applied by fastener manufacturer. Passivated and lubricated if no additional coatings are specified. Nuts tapped after galvanizing.
- Use/location: *Where connecting galvanised members, also can be used instead of sheradized fixings*.

375 SHERARDIZED COATING TO BOLT ASSEMBLIES
- Standard: To BS 7371-8.
  - Class: *30*.
- Sherardizing: Applied by fastener manufacturer and passivated.
- Post treatment: *Stained - blacked* .
- Use/location: *All shop and site connections in shop painted steelwork* .

390 SEALED HOLLOW SECTIONS
- Holes: Sealed to prevent access of moisture.
  - Method of sealing: *Submit proposals*.

ERECTION

405 OUTLINE METHOD OF ERECTION
- *Submit proposals*.

410 PRE-ERECTION CHECKS
- Scope: At least 7 days before proposed erection start date, check the following:
  - Foundations and other structures to which steelwork will be attached: Accuracy of setting out.
  - Holding down bolts: Position, protruding length, slackness and condition.
- Inaccuracies and defects: Report without delay.
- Permission to commence erection: Obtain.

420 SETTING OUT
- Permissible deviations: In addition to the requirements of the NSSS CE Marking version, add permissible deviations for different types of dimension and locations, as necessary.

425 MODIFICATIONS
- Steelwork: Do not modify without approval.
- Temporary fabrication/ erection attachments: *Remove*

440 COLUMN BASES
- Levels: Adjust using steel shims or folding wedges no larger than necessary.
- Location of shims/ wedges: Position symmetrically around perimeter of base plate. Do not use a single central pack.
- Give notice: If space beneath any column base is outside specified limits for bedding thickness.
- Accuracy of erection: Check, and correct errors before filling and bedding beneath bases and carrying out other adjacent work.

441 MORTAR FILLING/ BEDDING OF COLUMN BASES

- Bedding thickness range: *25-40 mm*.
- Bolt pockets: Completely filled with neat cement slurry.
- Spaces beneath base plates: Completely filled as follows:
  - Spaces 0-25 mm deep: Neat Portland cement, CEM 1.
  - Spaces 25-50 mm deep: 1:1 cement:fine aggregate mortar, just fluid enough to pour. Tamped well as filling proceeds.
  - Spaces 50 mm and above: 1:2 cement:fine aggregate mortar, just damp, tamped well against properly fixed supports as filling proceeds.
- Cement: Portland cement BS EN 197-1 - CEM I 42.5 or 52.5.
- Fine aggregate: To BS EN 12620, grade 0/4 or 0/2 (MP).
- Additives: *Not required*.

442 FINE CONCRETE FILLING/ BEDDING OF COLUMN BASES

- Bolt pockets: Completely filled with neat cement slurry.
- Spaces beneath base plates: 50 mm and above, completely filled with a 1:1.25:2 cement:fine aggregate:coarse aggregate mix, tamped well against properly fixed supports as filling proceeds.
- Cement: Portland cement BS EN 197-1 - CEM I 42.5 or 52.5.
- Fine aggregate: To BS EN 12620, grade 0/4 or 0/2 (MP).
- Coarse aggregate size (maximum): 10 mm.
- Additives: *Not required*.

443 PROPRIETARY FILLING/ BEDDING OF COLUMN BASES

Bedding thickness range: *25-40 mm*.

- Preparation: Concrete surfaces scarified to provide a good mechanical key.
- Bolt pockets and spaces beneath base plates: Completely filled with *Fosroc Conbextra GP*.

445 MOVEMENT JOINTS

- Joint type: *As detailed on drawings*.
  - Requirements: *As detailed on drawings*.
- Appearance and fit: Bolts centred in slotted holes unless otherwise indicated. Joints free to move.

447 BONDED ANCHORS

- Holes: Clean and free from dust at time of installing anchor.
- Permeable sleeves: Use in conditions where otherwise the loss of bonding agent would be unacceptably high.
- Other requirements: *None*.

TESTING

465 TESTING

- Testing: Arrange the following tests. Prepare test pieces as necessary.
- Test: *Welding, comply with the latest edition of the NSSS*.
  - Testing authority: *An independent NAMAs accredited or others CA approved laboratory*.
  - Frequency/ Number: *As specified in the NSSS*.
  - Level of acceptability: *As specified in the NSSS*.
  - Other requirements: *As specified in the NSSS*.
- Test and examination results: Submit *2* copies immediately they are available.

470 SITE TESTING OF ANCHORS TO MASONRY
- Standard: To BS 5080.
- Preliminary tests: *Not required*.
- Proof tests: *Test 10% of working fixings to 1.5 times the working load*.
- Test results: Report failures and seek instructions.

475 PRODUCTS
- Steel: Submit test certificates.

PROTECTIVE COATINGS

510 SURFACES NOT TO BE COATED
- Location: *Steelwork indicated on drawings as having a concrete surround*.
- Other requirements: *None*.

521 ALTERNATIVE MANUFACTURERS
- Short list of manufacturers: Obtain coating materials from one only of the following: *Sherwin Williams*.
- Selected manufacturer: Submit details before ordering materials.

523 COMPATIBILITY OF SHOP PRIMER WITH SITE APPLIED INTUMESCENT COATING
- Intumescent coating: M61/ *Refer to Architect's specification*.
- Primer: Compatible with coating under general and fire conditions.
- Manufacturer's recommendations and test evidence: Submit before priming. Include fire test data to BS 476-20 and -21, or BS EN 1363-1 and BS EN 1365-2, -3, and/or -4 as appropriate.

535 INSPECTION OF COATING WORK
- Work in progress: Permit coating manufacturer to inspect and take samples of products.
- Notice: Give notice of dates for:
  - Start of surface preparation and coating.
  - Coated members or components leaving the works.
  - Period of notice (minimum): 5 working days.

550 POST-GALVANIZING INSPECTION
- Inspector: Submit, on request, evidence of training and competence in visual inspection for liquid metal assisted cracking.
- Components for which visual inspection is not required (procedure PGI-0): *Not applicable*.
- Components requiring additional inspection:
  - Procedure PGI-2A: *None*.
  - Procedure PGI-2B: *None*.
- Timing: Before erection of steelwork or application of other coatings.
- Action in event of non compliance:
  - Submit: Full records of all post-galvanising inspections, drawing attention to any erected components that are required to be quarantined.
  - Procedure PGI-3: Carry out on all quarantined components, and submit report.
  - Sites of suspected defects: Remove zinc coating by grinding back to bright metal for a distance of not less than 50 mm around each defect and from a similar area on opposite face of member and inspect.
  - Remedial actions: Submit proposals.

PROTECTIVE COATING SYSTEMS

620 GALVANIZING TO BLAST CLEANED STEEL

- Use/ location: *As shown on the drawings, for steelwork in contact with masonry out skin refer to clause G10/630*.
- Preparation: Blast cleaning to BS EN ISO 8501-1, preparation grade Sa2½ using chilled angular iron grit grade G24 to give a coarse surface profile, followed by chemical cleaning.
- Galvanizing: To BS EN ISO 1461.
  - Minimum mean coating thickness: 140 micrometres.

630 GALVANIZING PLUS SITE APPLIED *HEAVY DUTY BITUMEN*

- Use/ location: *Steelwork in contact with masonry outer skin*.
- Shop preparation: *Blast cleaning to BS EN 8501-1, preparation grade Sa2½ using chilled angular iron grit grade 24 to give a coarse surface profile, followed by chemical cleaning* .
- Galvanizing: To BS EN ISO 1461.
  - Minimum mean coating thickness: *85 micrometres*.
- Paint manufacturer: *As clause 521*.
- Pretreatment primer: *As required by paint manufacturer*.
- Site intermediate coat: *None*.
  - Dry film thickness: *N/A*.
- Site top coat: *2 coats heavt duty bitumen*.
  - Dry film thickness: *200 micrometres*.
  - Colour: *N/A*.
- Special requirements: *None*.

630A GALVANIZING PLUS SITE APPLIED *SITE APLIED RECOATABLE POLYURETHANE FINISH OVER SHOP APPLIED HIGH BUILD RECOATABLE EPOXY MICACEOUS IRON OXIDE OVER ZINV PHOSPHATE EPOXY SEALER COAT*

- Use/ location: *??? of visually exposed external steelwork supporting the building* .
- Shop preparation: *Blast cleaning to BS EN 8501-1, preparation grade Sa2½ using chilled angular iron grit grade 24 to give a coarse surface profile, followed by chemical cleaning* .
- Galvanizing: To BS EN ISO 1461.
  - Minimum mean coating thickness: *85 micrometres*.
- Paint manufacturer: *As clause 521*.
- Pretreatment primer: *As required by the paint manufacturer*.
- Shop primer/sealer: *Zinc phosphate sealer coat*
  - Dry film thickness: *50 micrometres*
- Shop intermediate coat: *High build recoatable epoxy micaceous iron oxide*.
  - Dry film thickness: *100 micrometres*.
- Site top coat: *Recoatable polyurethane finish*.
  - Dry film thickness: *60 micrometres*.
  - Colour: *As required by Architect's specification*.
- Special requirements: *For visual steelwork, all coats are to be applied evenly and be free of drips and runs*.

638 SHOP PRIMING FOR *INTERNAL STEELWORK TO RECEIVE APPLIED INTUMESCENT COATINGS*

- Use/ location: *Steelwork to accept applied intumescent coatings located in clear separation from the external skin (clear separation beining minimum 40 mm ventilate air gap or 25 mm impermeable insulation*.
- Shop preparation:
  - Generally: Blast cleaning to BS EN ISO 8501-1, preparation grade *Sa 2½*.
  - Welds/ edges/ areas with surface imperfections: To BS EN ISO 8501-3, preparation grade *Generally P1 but P2 within 3 m of FFL*.
- Primer: *Water based epoxy zinc phosphate primer*.
  - Manufacturer: *As clause 521*.
    Product reference: *As recommended by the decorative manufacturer as required*.
  - Dry film thickness: *80 microns*.
- Special requirements: *None*.

638A SHOP PRIMING FOR *INTERNAL STEELWORK TO RECEIVE APPLIED DECORATIVE COATINGS*

- Use/ location: *Steelwork to accept applied decorative coatins located in clear separation from the external skin (clear separation being minimum 40 mm ventilated air gap or 25 mm impermeable insulation*.
- Shop preparation:
  - Generally: Blast cleaning to BS EN ISO 8501-1, preparation grade *Sa 2½*.
  - Welds/ edges/ areas with surface imperfections: To BS EN ISO 8501-3, preparation grade *generally P1, but P2 within 3 m of FFL*.
- Primer: *Water based epoxy zin phosphate primer*.
  - Manufacturer: *As clause 521*.
    Product reference: *As recommended by the decorative manufacture as required*.
  - Dry film thickness: *80 microns*.
- Site top coat: *Water based epoxy finish*
- Special requirements: *For visual steelwork, all coats are to applied evenly and be free of drips and runs*.

640 SHOP PAINTING WITH *ZINC PHOSPHATE EPOXY PRIMER*

- Use/ location: *All hidden steelwork located in clear separation from the external skin (clear separation being minimum 40 mm ventilated air gap or 25 mm impermeable insulation* .
- Paint manufacturer: *As clause 521*.
- Shop preparation:
  - Generally: Blast cleaning to BS EN ISO 8501-1, preparation grade *Sa 2½*.
  - Welds/ edges/ areas with surface imperfections: To BS EN ISO 8501-3, preparation grade *generally P1 but P2 within 3 m of FFL*.
- Shop primer: *Zinc phosphate epoxy primer*.
  - Dry film thickness: *80 micrometres*.
- Shop intermediate coat: *N/A*.
  - Dry film thickness: *N/A*.
- Shop top coat: *N/A*.
  - Dry film thickness: *N/A*.
  - Colour: *N/A*.
- Special requirements: *None*.

640A SHOP PAINTING WITH *HIGH BUILD RECOATABLE EPOXY MICACEOUS IRON OXIDE OVER HIGH SOLID EPOXY ZINC PHOSPHATE PRIMER*

- Use/ location: *All hidden steelwork located within the depth of external walls where clear separation from the breather membrane/boarding is not acheivable (clear separation being minimum 40 mm ventilated air gap or 25 mm impermeable insulation)* .
- Paint manufacturer: *As clause 521*.
- Shop preparation:
  - Generally: Blast cleaning to BS EN ISO 8501-1, preparation grade *Sa 2½*.
  - Welds/ edges/ areas with surface imperfections: To BS EN ISO 8501-3, preparation grade *generally P1 but P2 within 3 m of FFL*.
- Shop primer: *High solid epoxy zinc phosphate primer*.
  - Dry film thickness: *80 micrometres*.
- Shop intermediate coat: *High build recoatable epoxy micaceous iron oxide*.
  - Dry film thickness: *120 micrometres*.
- Shop top coat: *N/A*.
  - Dry film thickness: *N/A*.
  - Colour: *N/A*.
- Special requirements: *None*.

PREPARATION FOR PAINTING

710 OFFSITE PREPARATION AND PAINTING

- Working area: Covered and properly lit, heated and ventilated.
- Sequence of working: Select from the following and submit proposals:
  - Fabricate, blast clean, prime.
  - Blast clean, fabricate, remove flash rust with a light overall sweep blast, prime.
  - Blast clean, apply weldable prefabrication primer, fabricate, prime.
- Prefabrication primer (option 3): Type recommended by manufacturer of post fabrication primer.
  - Thickness of post fabrication primer coat: May be reduced if and as recommended by manufacturer.
- Surfaces inaccessible after assembly: Apply full treatment and coating system including, if necessary, local application of site coatings.

725 MANUAL CLEANING OF NEW STEELWORK

- Preparation: Remove fins, burrs, sharp edges, weld spatter, loose rust and loose scale.
- Surface finish: Clean but unpolished to BS EN ISO 8501-1, grade St 2.
- Finishing: Thoroughly degrease and clean down. Remove any consequent rusting back to grade St 2. Prime without delay.

730 PREPARATION FOR SITE WELDING OF SHOP PAINTED STEELWORK

- Method: Select from the following:
  - Mask weld areas immediately after blast cleaning and before coating steelwork. If paint system comprises more than one coat, step each coat 30 mm back from edge of preceding coat and away from masked areas. Remove masking immediately before welding.
  - Prepare and paint steelwork including weld areas. Grind off to bare steel around each weld area immediately before welding.

735 TREATMENT OF SITE WELDED JOINTS IN PAINTED STEELWORK

- Preparation: After welding, and without delay, remove scale and weld spatter from weld areas. Remove traces of rust. Wash with clean water and allow to dry. Prime without delay.
- Protective/ Decorative coatings: Apply to weld areas to match surrounding painted areas.

736 TREATMENT OF SITE WELDED JOINTS IN GALVANIZED STEELWORK

- Preparation: After welding, and without delay, remove scale and weld spatter from weld areas. Remove traces of rust. Wash with clean water and allow to dry.
- Coating: Reinstate using one of the methods given in BS EN ISO 1461, clause 6.3.

740 BOLTED JOINTS (OTHER THAN PRELOADED JOINTS)

- Steelwork to be shop painted: Apply full shop specification to joint faces.
- Steelwork to be erected with mill finish then site painted: Before erection, prepare and prime joint faces and allow to dry.
- Bolted joints in externally exposed steelwork:
  - Immediately before assembling, apply a further coat of primer and bring surfaces together while still wet.
  - After assembling and before applying site coatings, seal crevices to bolts and joint perimeters with a compatible sealant.

745 FAYING SURFACES OF PRELOADED JOINTS

- Protection: Immediately after blast cleaning and before coating surrounding areas, mask faying surfaces to protect from contamination and deterioration.
  - Paint systems comprising more than one coat: Step each coat 30 mm back from edge of preceding coat and away from masked areas.
- Removal of protection: Immediately before bolting, remove masking. Check faying surfaces are free from adhesive. Clean with solvent if necessary.

750 PRELOADED JOINTS IN SHOP PAINTED STEELWORK

- Post assembly treatment of bolts and surrounding areas: After final tightening of bolts and inspection of joints:
  - Thoroughly degrease and clean uncoated areas including bolts.
  - Prime without delay.
  - Apply full shop coating specification.
- Direct tension indicators: Seal measuring gap to prevent ingress of moisture.

755 UNCOATED FASTENERS

- Treatment: After steelwork erection and before applying site coatings, thoroughly degrease and clean. Without delay, coat to match adjacent shop painted areas.

760 GALVANIZED FASTENERS

- Treatment: After steelwork erection and before applying site coatings, thoroughly degrease and clean. Etch prime.

765 SITE PREPARATION OF SHOP PAINTED STEELWORK

- Preparation: Touch in shop coats, as necessary, and allow to dry. Before applying site coats (when specified), abrade surfaces or wash down or both, as recommended by paint manufacturer.

770 SITE PREPARATION OF GALVANIZED SURFACES FOR PAINTING

- Preparation: Thoroughly degrease. Remove white corrosion products. Wash off and allow to dry before applying etching wash or primer.

PAINTING

810 ENVIRONMENTAL CONDITIONS

- General requirements prior to starting coating work:
  - Surfaces: Unaffected by moisture or frost.
  - Steel temperature: At least 3°C above dew point, with conditions stable or improving, and not high enough to cause blistering or wrinkling of the coating.
  - Relative humidity: Below 85%.

815 COATINGS

- Surfaces to be coated: Clean, dust free and suitably dry. Previous coats to be adequately cured.
- Multiple coats of same material: Use different tints to assist checking of complete coverage.
- Penultimate coat: Colour recommended by paint manufacturer to suit top coat colour.
- Finish required: Smooth and even, of uniform thickness and colour, free from defects.

820 FILM THICKNESS

- Wet film thickness: During application, check thickness of each coat with a wheel or comb gauge used in accordance with BS EN ISO 2808.
- Accumulated dry film thickness: After each coat has dried, check total accumulated film thickness.
  - Method: Magnetic or electromagnetic meter.
  - Number and position of measurements: As directed.
  - Validation: Measurements to be independently witnessed.
  - Meter calibration: Check against standard shims and recalibrate regularly against a smooth steel reference plate.
- Average dry film thickness:
  - At least specified thickness over any square metre.
  - No reading to be less than 75% of specified thickness.
- Top coat dry film thickness: Sufficient to give an even, solid, opaque appearance.

825 STRIPE COAT

- External angles, nuts, bolt heads, rough weld seams, and areas difficult to coat: Apply an additional stripe coat of *primer* .

850 JUNCTIONS WITH CONCRETE

- Exposed steelwork partially embedded or encased in concrete: Apply two coats of bituminous coating locally to the steel/concrete junction.
- Bituminous coating: *To BS 6949, type 1, class A*.

G20 Carpentry/ timber framing/ first fixing

To be read with Preliminaries/ General conditions.

GENERAL

105 TIMBER PROCUREMENT

- Timber (including timber for wood based products): Obtained from well managed forests/ plantations in accordance with:
  - The laws governing forest management in the producer country or countries.
  - International agreements such as the Convention on International Trade in Endangered Species of wild fauna and flora (CITES).
- Documentation: Provide either:
  - Documentary evidence (which has been or can be independently verified) regarding the provenance of all timber supplied, or
  - Evidence that suppliers have adopted and are implementing a formal environmental purchasing policy for timber and wood based products.

120 STRUCTURAL DESIGN PROVIDED

- Description: *Refer to drawings*.
- Requirements:
  - Generally: As section B50/B51.
  - Additional requirements: *None*.

150 STRENGTH GRADING OF TIMBER

- Grader: A company currently registered under a third party quality assurance scheme operated by a certification body approved by the UK Timber Grading Committee.

160 GRADING AND MARKING OF SOFTWOOD

- Timber of a target/ finished thickness less than 100 mm and not specified for wet exposure: Graded at an average moisture content not exceeding 20% with no reading being in excess of 24% and clearly marked as 'DRY' or 'KD' (kiln dried).
- Timber graded undried (green) and specified for installation at higher moisture contents: Clearly marked as 'WET' or 'GRN'.
- Structural timber members cut from large graded sections: Regraded to approval and marked accordingly.

PRODUCTS

210 STRUCTURAL SOFTWOOD (GRADED DIRECT TO STRENGTH CLASS) *FOR STRUCTURAL USE GENERALLY*

- Grading standard: To BS 4978, BS EN 14081-1, or other national equivalent and so marked.
- Strength class to BS EN 338: *C24*.
- Treatment:
  - Preservative treatment: *In accordance with NHBC standards*.
    Design service life: *30 years*.
  - Fire retardant treatment: *To architect's specification*.

310 STRUCTURAL PLYWOOD *For roof deck*

- Standard: To BS EN 636.
- Service class to BS EN 1995-1-1: *Class 2*.
- Load duration class to BS EN 12369-2: *Medium-term*.
- Characteristic strength class to BS EN 12369-2: *F40*.
- Characteristic modulus class to BS EN 12369-2: *E40*.
- Appearance class to BS EN 635: *II*.
- Bonding quality to BS EN 314-2: *Class 2*.
- Nominal thickness: *18 mm*.
- Finish: *Unsanded*.
- Treatment: *For roof deck*.
  - Preservative treatment: *In accordance with NHBC Standards*. Design service life: *50 years*.
  - Fire retardant treatment: *To architects specificatin*.

WORKMANSHIP GENERALLY

401 CROSS SECTION DIMENSIONS OF STRUCTURAL SOFTWOOD AND HARDWOOD

- Dimensions: Dimensions in this specification and shown on drawings are target sizes as defined in BS EN 336.
- Tolerances: The tolerance indicators (T1) and (T2) specify the maximum permitted deviations from target sizes as stated in BS EN 336, clause 4.3:
  - Tolerance class 1 (T1) for sawn surfaces.
  - Tolerance class 2 (T2) for further processed surfaces.

403 CROSS SECTION DIMENSIONS OF NONSTRUCTURAL HARDWOOD

- Dimensions: Dimensions in this specification and shown on drawings are finished sizes.
- Maximum permitted deviations from finished sizes: As stated in BS EN 1313-2:
  - Clause 6 for sawn sections.
  - Clause NA.3 for further processed sections.

420 WARPING OF TIMBER

- Bow, spring, twist and cup: *Not greater than the limits set down in BS 4978, BS EN 14081-1 and BS EN 844-3*.

430 SELECTION AND USE OF TIMBER

- Timber members damaged, crushed or split beyond the limits permitted by their grading: Do not use.

435 NOTCHES, HOLES AND JOINTS IN TIMBER

- Notches and holes:
  - General: Avoid if possible.
  - Sizes: Minimum needed to accommodate services.
  - Position: Do not locate near knots or other defects.
  - In same joist: Minimum 100 mm apart horizontally.
  - Notches in joists:
    Position: Locate at top. Form by sawing down to a drilled hole.
    Depth (maximum): 0.15 x joist depth.
    Distance from supports: Between 0.1 and 0.2 x span.
  - Holes in joists:
    Position: Locate on neutral axis.
    Diameter (maximum): 0.25 x joist depth.
    Centres (minimum): 3 x diameter of largest hole.
    Distance from supports: Between 0.25 and 0.4 of span.
  - Notches in roof rafters, struts and truss members: Not permitted.
  - Holes in struts and columns: Locate on neutral axis.
    Diameter (maximum): 0.25 x minimum width of member.
    Centres (minimum): 3 x diameter of largest hole.
    Distance from ends: Between 0.25 and 0.4 of span.
- Scarf joints, finger joints and splice plates: Do not use without approval.

440 PROCESSING TREATED TIMBER

- Cutting and machining: Carry out as much as possible before treatment.
- Extensively processed timber: Retreat timber sawn lengthways, thicknessed, planed, ploughed, etc.
- Surfaces exposed by minor cutting/ drilling: Treat with two flood coats of a solution recommended by main treatment solution manufacturer.

450 MOISTURE CONTENT

- Moisture content of wood and wood based products at time of installation: Not more than:
  - Covered in generally unheated spaces: 24%.
  - Covered in generally heated spaces: 20%.
  - Internal in continuously heated spaces: 20%.

451 MOISTURE CONTENT TESTING

- Procedure: When instructed, test timber sections with an approved electrical moisture meter.
- Test sample: Test 5% but not less than 10 lengths of each cross-section in the centre of the length.
- Test results: 90% of values obtained to be within the specified range. Provide records of all tests.

510 PROTECTION

- Generally: Keep timber dry and do not overstress, distort or disfigure sections or components during transit, storage, lifting, erection or fixing.
- Timber and components: Store under cover, clear of the ground and with good ventilation. Support on regularly spaced, level bearers on a dry, firm base. Open pile to ensure free movement of air through the stack.
- Trussed rafters: Keep vertical during handling and storage.

520 EXPOSED END GRAIN PROTECTION

- Components: Seal exposed end grain of the following before delivery to site:
  .
- Sealer: *Clear end grain sealer*.

530 PAINTED FINISHES
- Structural timber to be painted: Primed as specified before delivery to site.

540 CLEAR FINISHES
- Structural timber to be clear finished: Keep clean and apply first coat of specified finish before delivery to site.

550 EXPOSED TIMBER
- Planed structural timber exposed to view in completed work: Prevent damage to and marking of surfaces and arrises.

JOINTING TIMBER

570 JOINTING/ FIXING GENERALLY
- Generally: Where not specified precisely, select methods of jointing and fixing and types, sizes and spacings of fasteners in compliance with section Z20.

580 FRAMING ANCHORS
- Manufacturer: *Simpson Strong-Tie unless noted otherwise on the drawings*.
  - Product reference: *Refer to the drawings*.
- Material/ finish: *Galvanized*.
- Fasteners: Galvanized or sherardized square twist nails.
  - Size: Not less than size recommended by anchor manufacturer.
- Fixing: Secure using not less than the number of nails recommended by anchor manufacturer.

630 BOLTED JOINTS
- Bolt spacings (minimum): To BS EN 1995-1-1, section 8.5.
- Holes for bolts: Located accurately and drilled to diameters as close as practical to the nominal bolt diameter and not more than 2 mm larger.
- Washers: Placed under bolt heads and nuts that would otherwise bear directly on timber. Use spring washers in locations which will be hidden or inaccessible in the completed building.
- Bolt tightening: So that washers just bite the surface of the timber. Ensure that at least one complete thread protrudes from the nut.
  - Checking: At agreed regular intervals up to Completion. Tighten as necessary.

670 ANTI-CORROSION FINISHES FOR FASTENERS
- Galvanizing: To BS 7371-6, with internal threads tapped and lightly oiled following treatment.
- Sherardizing: To BS 7371-8, Class 1.
- Zinc plating: To BS EN ISO 4042 and passivated.

ERECTION AND INSTALLATION

710 PROPOSALS FOR ERECTING STRUCTURAL TIMBER
- Proposals: Submit details of:
  - Method and sequence of erection.
  - Type of craneage.
  - Temporary guys and bracing proposed for use during erection.
- Latest date for submission: *10 days before erection starts*.

715 BONDED ANCHORS
- Manufacturer: *Hilti unless noted otherwise on the drawings*.
  - Product reference: *Refer to drawings*.
- Size: *Refer to drawings*.
- Material/ finish: *Refer to drawings*.
- Spacing/ edge distance (minimum): *Refer to drawings*.
  - Obtain instructions if specified spacing or edge distance cannot be achieved.
- Installation holes: Drilled to diameter and depth recommended by manufacturer. Clean and free from dust.
- Permeable sleeves: Use in conditions where otherwise loss of bonding agent would be unacceptably high.
- Installation/ tightening: To manufacturer's instructions.

721 EXPANSION ANCHORS
- Manufacturer: *Hilti unless noted otherwise on drawings*.
  - Product reference: *Refer to drawings*.
- Size: *Refer to drawings*.
- Material/ finish: *Refer to drawings*.
- Spacing/ edge distance (minimum): *Refer to drawings*.
  - Obtain instructions if specified spacing or edge distance cannot be achieved.
- Installation holes: Drilled to diameter and depth recommended by manufacturer. Clean and free from dust.
- Installation/ tightening: To manufacturer's instructions.

725 HAMMER-IN FASTENERS
- Manufacturer: *Fischer unless noted otherwise on the drawings*.
  - Product reference: *Refer to drawings*.
- Type: *Refer to drawings*.
- Size: *Refer to drawings*.
- Spacing/ edge distance (minimum): *Refer to drawings*.
  - Obtain instructions if specified spacing or edge distance cannot be achieved.
- Installation holes: Drilled to diameter and depth recommended by manufacturer. Clean and free from dust.

740 PRE-ERECTION CHECKING
- Timing: Not less than 10 days before proposed erection start date.
- Checklist:
  - Foundations and other structures to which timber structure will be attached: Check for accuracy of setting out.
  - Holding down bolts: Check for position, protruding length, condition and slackness.
- Inaccuracies and defects: Report without delay.
- Erection: Obtain permission to commence.

750 MODIFICATIONS/REPAIRS
- Defects due to detailing or fabrication errors: Report without delay.
- Methods of rectification: Obtain approval of proposals before starting modification or remedial work.
- Defective/damaged components: Timber members/ components may be rejected if the nature and/or number of defects would result in an excessive amount of site repair.

760 TEMPORARY BRACING
- Provision: As necessary to maintain structural timber components in position and to ensure complete stability during construction.

770 ADDITIONAL SUPPORTS
- Provision: Position and fix additional studs, noggings and/ or battens to support edges of sheets materials, and wall/ floor/ ceiling mounted appliances, fixtures, etc. shown on drawings
- Material properties: Additional studs, noggings and battens to be of adequate size and have the same treatment, if any, as adjacent timber supports.

775 BEARINGS
- Timber surfaces which are to transmit loads: Finished to ensure close contact over the whole of the designed bearing area.
- Packings: Where provided, to cover the whole of the designed bearing area.
  - Crushing strength: Not less than timber being supported.
  - In external or inaccessible locations: Rot and corrosion proof.

780 WALL PLATES
- Position and alignment: To give the correct span and level for trusses, joists, etc.
- Bedding: Fully in fresh mortar.
- Joints: At corners and elsewhere where joints are unavoidable use nailed half lap joints. Do not use short lengths of timber.

784 JOISTS GENERALLY
- Centres: Equal, and not exceeding designed spacing.
- Bowed joists: Installed with positive camber.
- End joists: Positioned approximately 50 mm from masonry walls.

786 JOISTS ON HANGERS
- Hangers: Bedded directly on and hard against supporting construction. Do not use packs or bed on mortar.
- Joists: Cut to leave not more than 6 mm gap between ends of joists and back of hanger. Rebated to lie flush with underside of hangers.
- Fixing to hangers: A nail in every hole.

790 STANDARD JOIST HANGERS *WHERE NOT SPECIFIED ON THE DRAWINGS*.
- Standard: To BS EN 845-1.
- Size and type: To suit joist, design load and crushing strength of supporting construction.
- Material/ finish: *Galvanized low carbon steel*.

791 PROPRIETARY JOIST HANGERS *WHERE SPECIFIED ON THE DRAWINGS*.
- Manufacturer: *Simpson Strong-Tie unless noted otherwise on drawings*.
  - Product reference: *Refer to drawings*.
- Material/ finish: *Galvanized low carbon steel sheet*.
- Size: To suit joist, design load and crushing strength of supporting construction.

795 TRIMMING OPENINGS
- Trimmers and trimming joists: When not specified otherwise, not less than 25 mm wider than general joists.

800 TRUSSED RAFTER INSTALLATION

- Erection: To Trussed Rafter Association (TRA) Technical handbook. Site installation guide and TRA Product data sheet PD3.
- Trusses generally: Do not modify without approval.
- Damaged trusses: Do not use.
- Fixing: With truss clips. Bottom chords of standard trusses and rafters of raised tie trusses bearing fully on wall plates.
  - Bottom chords of standard trusses: Do not fix to internal walls until roofing is complete and cisterns are installed and filled.
- Tolerances: To NA to BS EN 1995-1-1.

805 TRUSS CLIPS

- Manufacturer: *Simpson Strong-Tie unless noted otherwise on drawings*.
  - Product reference: *TCP unless noted otherwise on drawings*.
- Material/ finish: *Galvanized steel*.
- Fasteners: *32 x 3.5 mm galvanized or sherardized square twisted nails in every hole*.

810 PERMANENT BRACING OF TRUSSED RAFTERS

- Bracing and binders:
  - Size: *As specified on drawings*.
  - Method of fixing: To every rafter, strut or tie with not less than two fasteners. Fasteners: *2 75 x 3.35 mm galvanized round wire nails unless specified otherwise on drawings*.
- Lap joints: Extended over and nailed to at least two truss members.

820 VERTICAL RESTRAINT STRAPS *TO TIE DOWN ROOF TO MASONRY WALLS*

- Type: *Bent unless noted otherwise on drawings*.
- Manufacturer: *Simpson Strong-Tie or similar approved*.
  - Product reference: *L strap unless noted otherwise on drawings*.
- Material/ finish: *Galvanized steel*.
- Size:
  - Cross section: Not less than: *30 x 2.5 mm*.
  - Length: *Overall length 1100 mm: end of strap 900 mm below underside of wall plate; bent over top of wall plate and 100 mm down far side. Unless noted otherwise on drawings*.
- Centres: Not more than *1.2 mm*.
- Fixing:
  - To timber members with not less than *2 30 x 3.5 mm galvanized square twist nails*.
  - To masonry with not less than *five 50 mm x 12 gauge sherardized* screws evenly spaced, with at least one screw located within 150 mm of the bottom end of each strap.

830 LATERAL RESTRAINT STRAPS *FLOORS AND ROOFS TO MASONRY WALLS*

- Manufacturer: *Simpson Strong-Tie or similar approved*.
  - Product reference: *H strap unless noted otherwise on the drawings*.
- Material/ finish: *Galvanized steel*.
- Size: Not less than *30 x 5 mm cross section, 150 mm cranked end and spanning over at least three joists, typically 1200 mm*.
- Fixing: To top of joists/ rafters/ ties at not more than *1.2* m centres and as shown on drawings.
  - Ensure that cranked end is in tight contact with cavity face of wall inner leaf and is not pointing upwards.
- Straps spanning joists/ rafter/ ties running parallel to wall: Fix noggings and packs tightly beneath straps.
  - Size of noggings and packs: Not less than three quarters of joist/ rafter/ tie depth and not less than 38 mm thick.
  - Notching: Notch joists so that straps fit flush with surface. Do not notch rafters/ ties.
- Fasteners: *As required by strap manufacturer*.

840 STRUTTING TO FLOOR JOISTS

- Type: One of the following:
  - Herringbone strutting: At least 38 x 38 mm softwood.
  - Solid strutting: At least 38 mm thick softwood and at least three quarters of joist depth.
  - Proprietary metal strutting: *Of approved type*.
- Fixing: Between joists as follows:
  - Joist spans of 2.5 to 4.5 m: One row at centre span.
  - Joist spans over 4.5 m: Two rows equally spaced.
  - Strutting must not project beyond top and bottom edges of joists.
- Outer joists: Blocked solidly to perimeter walls.

850 INSPECTION GENERALLY

- Structural timber-work: Give reasonable notice before covering up.

860 BOLTED JOINTS INSPECTION

- Timing: Inspect all accessible bolts at the end of the Defects Liability Period and tighten if necessary.

870 ANCHOR TESTING

- Standard: To BS 5080-1 and -2.
- Preliminary tests: *Not required*.
- Proof tests: *Test 10% of working fixings to 1.5 times the working load*.
- Test reports: Submit as soon as available.