Concrete Specification

Bedford Passage Development

Middlesex Annex LLP
RIBA Stage 4

Project reference: 60516144

MHA-ACM-XX-SP-SE-0003

23 October 2020

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Revision History

Revision	Revision date	Details	Authorized	Name	Position
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Distribution List

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1. Introductory Notes

1.1 Essential Requirements

The contractor MUST adhere to the following, and is considered to do so in using this document:-

- This document should be read in conjunction with all the Contract documentation prepared in relation to the Trade Contract.
- It is the Main Contractors responsibility to ensure that the above documentation is circulated and made available to his Trade or Sub Contractors, Specialist Contractors, or any Novated Contractors employed in the works prior to the formal appointment of the Main Contractor. The Main Contractor must act to ensure that the Sub Contractors, Specialist Contractors, and Novated Contractors are aware of the documentation referred to above. ALL contractors must proactively seek out this information at every opportunity.
- The responsibility for circulation of information lies with the Main Contractor and it is their responsibility to ensure that they obtain all advance information relating to the following main contract work in sufficient time. If this is not forthcoming at timings required to undertake their contracted work, this must be clearly flagged to the CA.
- The Specification relates to, and should be read in conjunction with the drawings prepared by AECOM. This specifically means General Arrangement drawings, Section and Detail drawings, Schedule drawings and General Notes drawings. It also specifically means any drawing details or sketches released by AECOM to cater for any Changes on Site – whatever the reason for, or timing of, their production.
- Reference should always be made prior to commencing the works and periodically throughout the course of the works, to all other drawings produced by other disciplines (i.e. Architectural, M&E, Specialist Subcontractor's, etc.). It is the Contractors responsibility to coordinate their package specific work requirements with all the Design Team disciplines – and not rely upon one principle discipline providing all the information to which their contracted works covers.
- The Main Contractor and their contractors are to ensure they have complete sets of the latest information at each stage of the work, and take all proactive steps to ensure they seek out this information.
- The Trade Contractor should review all information thoroughly, in advance of starting the works. Should any discrepancies exist within the information which create contradiction, or differ from the industry standards – this should be highlighted to the Main Contractor and Structural Engineer (SE) well in advance of starting on site. Late notification of such instances is not acceptable as the Contractor is understood to have made themselves fully aware of the contract at the time of tender submission.
- The Contractor is responsible for visiting site and undertaking a thorough visual site survey, in the attendance of the CA. A Full report of observations and discussions at this walk round visual survey is to be prepared and submitted by the Contractor. The contractor, as part of this report, is to provide within, agreement that all elements and features of the site are in agreement with the contract documents (as can be visually verified), or flag any discrepancies to the contrary. This report is an important requirement of the pre-commencement work.
- Monitoring of the surrounding structures and retained structures present on or around the site is critical throughout the course of the contract. At the outset of the Contract, a full record survey is required. This must be followed by continual monitoring of surrounding buildings and structures as the works progress to a conclusion. Refer to AECOM Movement & Tolerances Specification for further details.
- The Demolition Contractor is to provide Monitoring of all these structures through until the completion of their contract – beyond this it is the responsibility of the Main Contractor. Monitoring works should include, but not be limited to, the following items:

1. Retaining structures to the Perimeter of the site.
2. Retained Roadways and Pavements.
3. Directly adjacent building elevations (and their foundations should they be exposed and/or underpinned throughout the course of the works).
4. All installed temporary works (for the life of the temporary works installation).
5. All items supported or shored by the temporary works (in item 4 above).

2. Scheme Description

AECOM have been appointed by Middlesex Annexe LLP as Civil and Structural Engineering consultants and instructed to prepare RIBA Stage 4 technical design information for the proposed redevelopment of the Middlesex Hospital Annex site.

The Middlesex Annex site is located in the Bloomsbury Area of the London Borough of Camden. Situated at 44 Cleveland Street, it lies south of Howland Street, north of Tottenham Street/Mews and west of Charlotte Street. The site is located close to the Camden-Westminster local authority boundary and is situated within the Charlotte Street Conservation Area (CSCA).

The site's northern boundary borders the Sainsbury's Wellcome Centre Building (completed 2015). The 8 storey Astor College and 5 storey Middlesex House form the site's eastern and southern boundaries respectively. The block to the south of Foley Street, opposite the former Workhouse is fronted to the west by the six-storey 1930s red brick Courtauld Institute building.

The site comprises the U-shaped, 18th Century former Strand Union Workhouse which is Grade II listed and on the Historic England Buildings at Risk Register. The Workhouse is comprised of a basement, ground, first, second and third floor plus roof space housing plant. The building fronts onto Cleveland Street, set behind a tall boundary wall. Behind the Workhouse two wings of a similar height extend eastwards forming a courtyard were added in the 19th Century. Two four-storey19th C buildings (including basements), namely the North and South buildings sit on the site boundaries of the site.

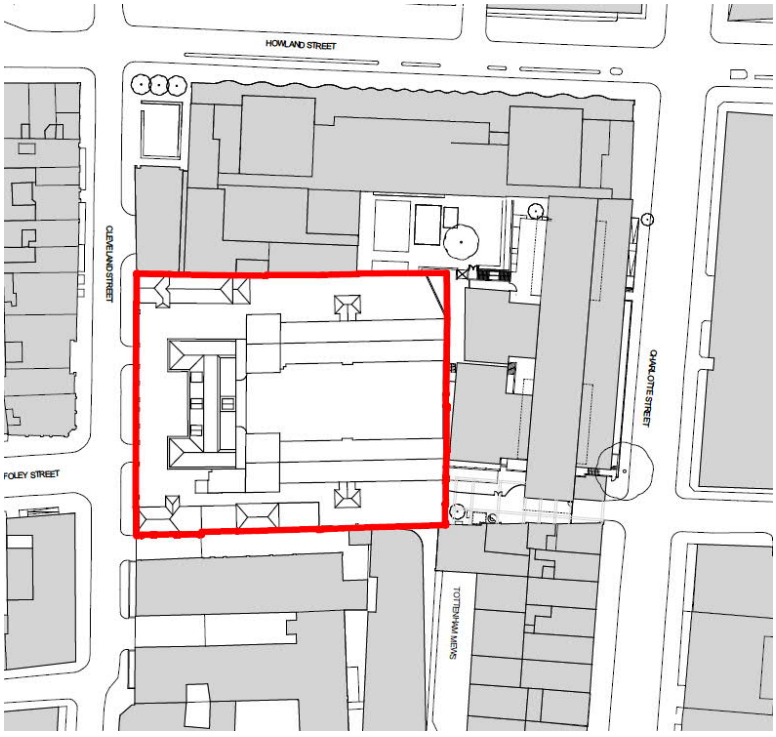

Figure 1 – Site Plan

The proposed development comprises three main elements. Firstly the east-west wings of the hospital annex (the rear of the site) will be demolished with the listed Workhouse building retained and refurbished for market housing units. The existing North and South Houses of the main hospital annex building, also fronting onto Cleveland Street, will be largely retained and refurbished (the eastern section of the South House will be demolished). To the rear of the retained Workhouse and North and South Houses a new 8 storey building is proposed.

2.1 Design Team

Middlesex UCLHC Ltd	Client
Llewelyn Davies Architects	Architect / Lead Designer / Contractor Administrator
Equals	Cost Consultant
AECOM	Structural, Underground Drainage, Geotechnical & Geo-environmental Engineer
Arup	Building Services Engineer / BREEAM Lead Consultant / Vertical Transportation
Delva Patman Redler	Party Wall Surveyors

2.2 Outstanding Design Risks

2.2.1 Party Walls

Research of the Land Registry shows that there are multiple neighbouring properties that fall within the confinements of the Party Wall Act 1996, and a Party Wall Surveyor has been engaged following planning permission for the redevelopment of the building, to mediate with adjoining owners and negotiate access rights and submit proposed Engineering works for agreement.

It will be important to ensure that the technical Engineering solutions for the demolition and re-development of the site are sufficiently robust to ensure the protection of all neighbouring buildings. This applies in particular to the retained buildings, notably the Grade II listed Strand Union Workhouse.

The proposed rear extension to the Astor College site to the east of the Bedford Passage Development site was completed in 2019. The works to the Astor College building comprised of a new basement and significant alterations to the existing structure. AECOM have obtained various drawings for the development which will be useful as a reference to the project at the Bedford Passage Development site to determine viable structural options for the basement and boundary conditions.

AECOM recommends a strategy for the frequent monitoring of adjoining buildings during any demolition and construction phases to safeguard each of these existing buildings against vibration, ground movement, settlement and damage.

2.2.2 Archaeology

There is provision for a Written Scheme of Investigation (WSI) for the archaeological excavation and watching brief at the Bedford Passage Development site. It is pursuant to Condition 6 of Planning Application Number 2018/1584/P which requires archaeological mitigation of the site in advance of the development. The WSI (by Iceni) details the proposed methodology (by LP Archaeology) covering the enabling works and main site bulk excavation.
The archaeological potential of the site includes:
- **Late 18th century building remains / foundations** associated with the construction and occupation of Covent Garden Workhouse (later the Strand Union Workhouse)
- **18th / 19th century burials** relating to the Workhouse and St Pauls Covent Garden Parish

2.2.3 UXO Risk

According to regional unexploded bomb (UXB) mapping published by Zetica, the site lies within a zone that experiences a high risk of UXB. Furthermore, the LCC Bomb Damage Map 61 in publication

no.164 by the London Topographical Society shows that during WW2 the Listed Building and its south wing suffered “general blast damage-not structural”, the north wing and north building were “seriously damaged doubtful if repairable”.

It is recommended that the Client commissions a specialist UXO report in advance of any future intrusive site works or development. The report should be prepared with cognisance of CIRIA publication C681 (Stone and others, 2009).

Post Note: April 2020 – Refer to UXO Desk Study & Risk Assessment by Zetica UXO dated 19th June 2019 Document Ref. P8690-19-R1

Refer to Project Team Risk Register for Design Risk Items.

2.3 Specific Design Responsibilities

2.3.1 Structural Concrete

Throughout the progress of the work, the Trade Contractor should record the position of all concrete elements. This should be recorded clearly and concisely in order to ensure a record of the as-built structure and certify it has been constructed within tolerance. The format for presenting the information should be +/-mm for levels, and +/- N or E for plan locations (both in respect of the required position).

Additional requirements for constructional accuracy are imposed by the architects and reference should be made to their documents as well as the AECOM Movement and Tolerance Report.

The subcontractor is responsible for visiting site and undertaking a thorough visual site survey, in the attendance of the Main Contractor, to ensure that the precluding contractor(s) has made ready any locations that affect his proposed work. By ‘Made-Ready’ it is meant that the precluding contractor(s) has removed finishes local to any adjacent existing structure, or broken off any encasements (concrete or otherwise) at these locations. It is the sub contractors’ responsibility to ensure he is aware of how much breakout at these new-to-old locations is within the demolition contractors’ package and make allowances for any additions or variations from the demolition contractors’ scope of works to ensure no scope gaps.

3. NBS Building Specification

Concrete Specification

23 October 2020

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E05
In situ concrete construction generally

E05 In situ concrete construction generally

To be read with Preliminaries/General conditions.

210 CONTRACTOR'S STRUCTURAL DESIGN Pile Design

- Design responsibility: Contractor's design of piling as section D30_____.
- Requirement:
  - Generally: As section B50.
    Modifications: None.
  - Structure: Complete the design and prepare reinforcement drawings and schedules in accordance with the designated code of practice and to satisfy the specified performance criteria.
  - Additional requirements: None.
- Member sizes and locations: As drawings MHA-ACM-00-B1-DR-SE-01012, MHA-ACM-00-XX-DR-SE-01014, MHA-ACM-XX-P1-DR-S-1001 and MHA-ACM-00-XX-DR-SE-00050.
- Design and production information: As preliminaries.
- Timing of submissions: As preliminaries.

220 STRUCTURAL DESIGN PROVIDED

- Description: The design of all permanent works installations has been carried out by AECOM.
- Requirements:
  - Generally: As section B50.
  - Additional requirements: All temporary works is a CDP item.
- Production/ execution records: In accordance with the designated code of practice..

223 STRUCTURAL DRAWINGS AND SCHEDULES

- Standards:
  - Drawings: To BS EN ISO 3766 and 'Standard method of detailing structural concrete' published by the Institution of Structural Engineers.
  - Reinforcement schedules: To BS EN ISO 3766.

225 TEMPERATURE RECORDS

- Requirement: Throughout period of concrete construction record:
  - Daily: Temperature at intervals of four hours (maximum).
  - Under adverse temperature conditions: Temperature at commencement and end of placing.
- Equipment: Submit proposals.
  - 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 10 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: All out of position/verticality of columns to be limited to +/-10mm see AECOM Movement and Tolerances Report..

300 LEVELS OF STRUCTURAL CONCRETE FLOORS

- Tolerances (maximum):
  - Level of floor: To section 10 of the 'National Structural Concrete Specification for Building Contruction' and Movement and Tolerance Specifcation..
  - Steps in floor level: ±5 mm.

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.

420 LIQUID RETAINING AND CONTAINMENT CONCRETE CONSTRUCTION

- Description: See Appendix A for concrete type/grade diagrams___.
- Form of construction: To BS EN 1992-3, Tightness Class 3.
- Requirement: Work is to be water resistant when tested to clause E05/ 450.

430 SURFACE CRACKING WATERTIGHT CONCRETE CONSTRUCTION

- Method of measurement: Graduated magnifying devices, templates and feeler gauges.
- Maximum crack width: 0.2 mm.
- Action: Should cracks occur that are wider than the maximum crack width:
  - Survey: Frequency and extent of such cracks and investigate cause.
  - Report: Findings together with recommendations for rectification.

450 INSPECTION OF WATER EXCLUDING STRUCTURES

- Notification: Give not less than seven days warning before inspection.
- First inspection:
  - Purpose: To identify any defects which may lead to water penetration or damp patches.
  - Timing: As soon as possible after completion of the work and before backfilling.
- Final inspection:
  - Purpose: To identify any points of water penetration or damp patches.
  - Timing: After backfilling, when the ground water table has returned to normal level.
- Requirement: Exposed faces of the structure must show no signs of leakage and remain apparently dry.

460 TESTING OF WATER RETAINING STRUCTURES

- Timing: To be agreed.
- Recording: Maintain accurate test records at all stages.
- Preparation for testing:
  - Fill completed and clean structure to capacity with water at a uniform rate not exceeding 2 m depth in 24 hours.
  - Maintain level by adding more water for an agreed stabilizing period.
- Filled level: Accurately mark and record.
- Permissible drop in level after allowing for evaporation and rainfall (maximum): 1/500th of the average water depth of the full tank .
  - Test period: 7 days.
  - Intervals for recording drop in level: 24 hours.

E10
Mixing/casting/curing in situ concrete

E10 Mixing/casting/curing in situ concrete

To be read with Preliminaries/General conditions.

CONCRETE

REFER TO APPENDIX A IN THE STRUCTURAL SPECIFICATION, THE ARCHITECT'S WATERPROOFING DRAWINGS AND SPECIALIST'S WATERPROOFING STRATEGY DRAWINGS FOR LOCATIONS OF DIFFERENT TYPES AND GRADES OF 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 MASS CONCRETE
- Designation: GEN1.
- Fibres: Not required.
- Aggregates:
  - Size (maximum): 20 mm.
  - Coarse recycled aggregates: At least 20% by weight and volume.
  - Additional aggregate requirements: None.
- Special requirements for cement/ combinations: None.
- Consistence class: S3.
- Chloride class: Normal.
- Admixtures: Concrete producer's choice.
- Additional mix requirements: Refer BRE Special Digest 1; DC Class = DC-2.

106 DESIGNATED CONCRETE MASS CONCRETE
- Designation: FND2.
- Fibres: Not required.
- Aggregates:
  - Size (maximum): 20 mm.
  - Coarse recycled aggregates: At least 20% by weight and volume.
  - Additional aggregate requirements: None.
- Special requirements for cement/ combinations: None.
- Consistence class: S3.
- Chloride class: Normal.
- Admixtures: Concrete producer's choice.
- Additional mix requirements: Refer BRE Special Digest 1; DC Class = DC-2.

107 DESIGNATED CONCRETE IN CONTACT WITH THE GROUND (NOT PILES)
- Designation: RC40/50.
- Fibres: Not required.
- Aggregates:
  - Size (maximum): 20 mm.
  - Coarse recycled aggregates: Submit proposals .
  - Additional aggregate requirements: None.
- Special requirements for cement/ combinations: None.
- Consistence class: S3.
- Chloride class: Cl 0.40.
- Admixtures: Concrete producer's choice.
- Additional mix requirements: Refer BRE Special Digest 1; DC Class = DC-2.

108 DESIGNATED CONCRETE WATERPROOF CONCRETE

- Designation: RC40/50.
- Fibres: Not required.
- Aggregates:
  - Size (maximum): 20 mm.
  - Coarse recycled aggregates: Submit proposals.
  - Additional aggregate requirements: None.
- Special requirements for cement/ combinations: None.
- Consistence class: S3.
- Chloride class: Cl 0.40.
- Admixtures: Waterproof admixture, refer to specialist's requirements.
- Additional mix requirements: None.

109 DESIGNATED CONCRETE PRIMARY STRUCTURE C40/50

- Designation: RC40/50.
- Fibres: Not required.
- Aggregates:
  - Size (maximum): 20 mm.
  - Coarse recycled aggregates: Submit proposals.
  - Additional aggregate requirements: None.
- Special requirements for cement/ combinations: None.
- Consistence class: S3.
- Chloride class: Normal.
- Admixtures: Concrete producer's choice.
- Additional mix requirements: None.

109A DESIGNATED CONCRETE PRIMARY STRUCTURE C32/40

- Designation: RC32/40.
- Fibres: Not required.
- Aggregates:
  - Size (maximum): 20 mm.
  - Coarse recycled aggregates: Submit proposals.
  - Additional aggregate requirements: None.
- Special requirements for cement/ combinations: None.
- Consistence class: S3.
- Chloride class: Normal.
- Admixtures: Concrete producer's choice.
- Additional mix requirements: None.

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 .

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): Sub mit proposals.

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.

310 RECYCLED AGGREGATE

- Standard: To BS 8500-2, clause 4.3 and BS EN 12620.
- Type: RA or RCA are permitted. Approval Required.
- Source: Contractor to provide details and seek approval.
- Quality control: Contractor to provide details and seek approval.
- Limitations on use:
  - Concrete strength class (maximum): C40/50 for RCA. For RA seek advice from the CA/SE.
  - Permitted exposure classes: X0, XC1, XC2, XC3, XC4, XF1 and DC-1 (for RCA).
- Additional restrictions on content:
  - Acid-soluble sulfate content (maximum): 1.0% for RCA. Based upon the test method for RCA - seek approval. .
  - Alkali-aggregate reactivity: Do not use aggregate containing reactive silica.
- Test method:
  - Determination of chloride content: To BS EN 1744-5.
  - Determination of alkali content: Not applicable.
- Frequency of testing: Submit proposals and seek approval____.
- Other requirements: Category for influence of water-soluble materials on the initial setting time of cement paste - Submit Proposals.

312 PROPRIETARY AGGREGATE

- Manufacturer: Submit proposals.
  - Product reference: Submit proposals.
- Standard: To BS 8500-2: and BS EN 12620.
  - Permitted deviations from standard: None.
- Other requirements: Minimum 10% stent substitution for coarse aggregate, glass sand substitution for fine aggregate.

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 .

418 PROPRIETARY ADMIXTURE

- Type: Submit proposals.
  - Manufacturer: Submit proposals.
    Product reference: Submit proposals.
  - Special requirements: None other than those required by the approved manufacturer.

PROJECT TESTING/ CERTIFICATION

508 REGULAR PROJECT TESTING OF CONCRETE

- Tests: Compressive strength.
- Tests for consistence class of self-compacting concrete: N/A.
- Consistence testing period: N/A.
- Sampling:
  - Point: At point of placing.
  - Rate: One sample per 20 m^3 of concrete used or from 20 batches, whichever represents the lesser pour volume. Not less than one sample for each day of use. .
- Other requirements: 4 No. cubes are to be taken for each sample. 1 cube teted at 7 days, 2 tested at 28 days and 1 kept spare for testing at 60 days.

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: 1 electronic copy to be emailed.
- 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

- Submit proposals .

620 TEMPERATURE OF CONCRETE

- Application: All structural elements.
- 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: Horizontal joints in water resistant construction to be in detailed positions, otherwise pours to be continuous between movement joints and Submit proposals when not shown on drawings.
- Preparation of joint surfaces: Remove surface laitance and expose aggregate by lightly brushing and spraying. Joint surface to be clean and damp immediately before placing fresh concrete.

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. Submit proposals.

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 .

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

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.

120A FORMWORK DETAILS

- Provide the following: Construction joints - positions and types.

- All timber formwork to be FSC/PEFC certified.

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.

170 WORK BELOW GROUND

- - FOUNDATIONS;
- - PILE CAPS; and
- - RETAINING WALLS
- Casting vertical faces against faces of excavation: Not permitted.
  - Requirements: Prevent contamination of concrete by loose soil.

176 TEMPORARY SUPPORTS TO PROFILED STEEL SHEETS

- Nature: Continuous across full width of slab.
  - Number in each span: TBC by temporary works designer and submitted to SE for approval.
  - Location: TBC by temporary works designer and submitted to SE for approval.
- Width of bearing (minimum): TBC by temporary works designer and submitted to SE for approva.
- Deflection of bearer (maximum): TBC by temporary works designer and submitted to SE for approva.
- Removal of temporary supports: Obtain instructions.

182 COLLAPSIBLE BOARD SUBSTRUCTURE FORMWORK

- Type: Plastics cellular core, collapsed by predetermined fail load.
- Manufacturer: Cordek or equivalent.
  - Product reference: Refer to basement structural drawings.
- Thickness: Refer to basement structural drawings.
- Load bearing capacity: As per specified product.

190 SUBSTRUCTURE FORMWORK FOR GROUND BEAMS AND PILE CAPS

- Manufacturer: Submit proposals.
  - Product reference: Submit proposals.
- Ground movement accommodation: Collapsible boards for upward movement, as clause 182.

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.

380 VOID FORMERS
- Manufacturer: Cordek or equivalent .
  - Product reference: Refer to AECOM Structural drawings .

405 COLUMN SHUTTERS
- Manufacturer: Contractor's choice .
  - Product reference: Contractor's choice .

470 RELEASE AGENTS
- Use: All formwork.
- 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): 50% of 28 day strength typically with 75% of 28 day strength for flat slabs.
- Assumptions: Maturity of 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: Submit proposals.

FORMED FINISHES

600 SAMPLES OF FINISHES AVAILABLE FOR INSPECTION
- Quality of finish: Plain finish E20/620.
- Location: Sample benchmark elements of exposed concrete columns/walls required for sign-off, to be agreed with and approved by the Architect.
- Variations: None.

613 ORDINARY FINISH
- Location: All non exposed slab soffits and vertical elements.
- Finish: Faces fully compacted. Formed surfaces free from major blemishes and honeycombing. Steps at joints to be less than 5 mm.

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: As specified by the Architect.
- 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.

630 SPECIAL FINISH

- Location: Fair faced/exposed surfaces. Refer to architects drawings for locations of exposed RC faces.
- Finish: Smooth and even. Formwork panels as large as practicable. Arrange in a regular pattern as a feature of the surface.
  - Special requirements: None.
- 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, grout leakage and replacement of formwork panels.
- Cover spacers: Submit proposals.
- Surface blemishes:
  - Permitted: Blowholes less than 5 mm in diameter and at an agreed frequency.
  - Not permitted: Voids, honeycombing, segregation and other defects.
- Formwork tie holes: In a regular pattern and filled with matching mortar.

E30
Reinforcement for in situ concrete

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).

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

180 STAINLESS STEEL RIBBED BAR REINFORCEMENT
- Standard: To BS 6744.
  - Designation to BS EN 10088-1: 1.4301.
  - Strength grade: 500.

210 STANDARD FABRIC REINFORCEMENT
- Standard: To BS 4483.
- Strength grade: B500A.

240 PROPRIETARY PREFABRICATED REINFORCEMENT FOR SHEAR HEADS
- Manufacturer: Submit proposals.
  - Product reference: Submit proposals.

245 PREFABRICATED REINFORCEMENT Contractor to submit proposals
- Prefabricated elements: Submit proposals.
- Source: Obtain from a manufacturer holding valid certification of approval for welded fabrications issued by the UK Certification Authority for Reinforcing Steels (CARES).
  - Certification required: Achievement of CARES appendix 6 for tack welding and appendix 10 for semi-structural/ structural welding.

250 PROPRIETARY PREFABRICATED CONTINUITY REINFORCEMENT STRIPS
- Manufacturer: Halfen HBT Rebend or equivalent. Refer to structural drawings.
  - Product reference: Submit proposals.

255 PREFABRICATED CONTINUITY REINFORCEMENT STRIPS
- Source: Obtain from a manufacturer holding a valid Technical Product Approval certificate issued by the UK Certification Authority for Reinforcing Steels (CARES) or equivalent.

260 PROPRIETARY MECHANICAL COUPLERS
- Locations: Where laps are not possible in columns with high rebar %. Reinstatement to rebar in existing slabs.
- Manufacturer: Submit proposals.
  - Product reference: Submit proposals.

WORKMANSHIP

310 CUTTING AND BENDING REINFORCEMENT
- General: To schedules and to BS 8666.
- Bending on site, including minor adjustments: Obtain instructions and Continuity reinforcement - use prefabricated strips.

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): Bars in top face 52 x bar diameter and Bars at top of beams 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: 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: 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.
- 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): 10mm .
- Checking specified cover dimensions: Before concreting check that cover dimensions will be achieved.

480 NOMINAL COVER TO REINFORCEMENT

- Nominal cover: Top face generally 25mm mm but 50mm for foundations. Formed faces 35mm.

510 RUST STAINING

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

520 COVER METER SURVEY

- Purpose of survey: To check positions of reinforcement and that the specified cover has been achieved.
- Type of cover meter: A magnetic induction digital display type selected to suit arrangement and type of reinforcement.
  - Use: In accordance with recommendations of BS 1881-204 and manufacturer as appropriate to yield accurate results.
  - Surveyor: Experienced with cover meter surveys.
  - Calibration: At the outset and thereafter regularly at 45 minute (maximum) intervals.
- Locations for checking: Include columns, beams, cantilevers, slab soffits and all faces exposed to the weather in the finished structure.
- Timing: As soon as practicable after casting.
  - Notification: Give adequate notice.
- Results: Submit. Notify immediately where specified cover has not been achieved.

E41
Worked finishes to in situ concrete

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 arrary of panel ribs.

220 SCORED FINISH
- Surface on completion: Roughened, regular pattern.
  - Scoring tool: Metal comb.

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.

320 TROWELLED FINISH
- Surface on completion: Uniform, smooth but not polished, free from trowel marks and blemishes, and suitable to receive specified flooring material.

330 TROWELLED FINISH FOR WEARING SURFACES
- Surface on completion: Uniform and smooth, free from trowel marks and blemishes.

E42
Accessories cast into in situ concrete

E42 Accessories cast into in situ concrete

To be read with Preliminaries/ General conditions.

GENERAL

PRODUCTS

320 CAST-IN SOCKETS CLADDING AND MASONRY SUPPORTS

- Material: Carbon steel.
  - Coating or treatment: Galvanized.
- Manufacturer: Contractor's choice.
  - Product reference: Submit proposals.
- Cleanliness: Plug inside as necessary to prevent ingress of grout during concreting. Cap after concreting to exclude dust and dirt until fixings are installed.
- Safe working load (minimum): Refer to drawings.
- Temporary fixings to shutter/ temporary supports: Contractor's choice.

330 ANCHOR BOLTS

- Material: Carbon steel.
  - Designation: 8.8.
  - Coating or treatment: Galvanized.
- Manufacturer: Contractor's choice.
  - Product reference: Submit proposals.

335 SHEAR LOAD CONNECTORS

- Material: Carbon steel.
  - Designation: S355 to BS EN 10025-2.
- Manufacturer: Contractor's choice.
  - Product reference: Submit proposals.
- Anchors: Welded to back of section.
  - Type/ centres: Refer to drawings.
- Temporary fixings to shutter/ temporary supports: Stainless steel nails.

340 CHANNELS AND SLOTS

- Material: Carbon steel.
  - Designation: S235 to BS EN 10025-2.
  - Coating or treatment: Galvanized.
- Manufacturer: Contractor's choice.
  - Product reference: Submit proposals.
- Anchors: Welded to back of section.
  - Type/ centres: Standard.
- Temporary fixings to shutter/ temporary supports: Stainless steel nails.
- Bolts/ ties: Masonry ties as section F30.
- Other requirements: None.

380 DUCTS THROUGH SLABS

- Material: PVC-U to BS EN 1401-1.
- Shape: As detailed.
  - Size: As detailed.
- Location: Refer to MEP subcontractor's builderswork drawings.
- Other requirements: None.

390 GALVANIZED COATINGS

- Standard: To BS EN ISO 1461.
- Galvanizing: Applied and passivated by component manufacturer. Threaded items tapped after galvanizing.

395 SHERARDIZED COATINGS ON METAL FASTENERS

- Standard: To BS 7371-8.

EXECUTION

610 HOLLOW ACCESSORIES

- Filling/ sealing: Temporally fill or seal accessory to prevent ingress of grout during concreting. Leave filling/ seals in position until accessory is used.

620 TEMPORARY SUPPORTS

- Location: Provide to hold accessories for casting into unshuttered surface of concrete, set at a level that will not adversely affect finish of concrete surface remote from accessory.
- Position: Hold securely to prevent lateral movement or rotation of accessory during concreting.

630 PROTECTIVE COATINGS

- Inspect: Immediately prior to casting concrete.
- Damage to coatings:
  - Minor: Submit proposals for coating repair.
  - Significant: Replace accessory.

640 INSTALLATION

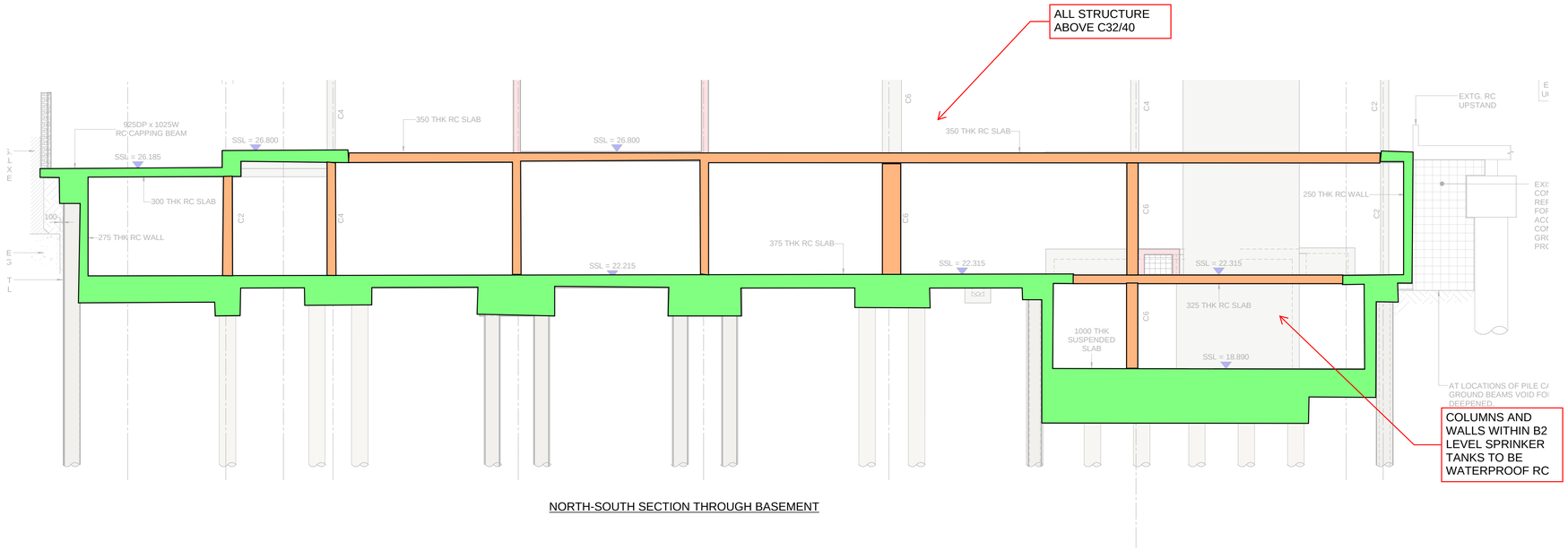
- Cleanliness: At time of casting, surfaces in contact with concrete to be free from contaminants which may adversely affect accessory, reinforcement, concrete, or bond between accessory and concrete.
- Position: Hold accessory firmly in position, preventing displacement during concreting.
- Other requirements: None.

Appendix A – Concrete Type and Grade

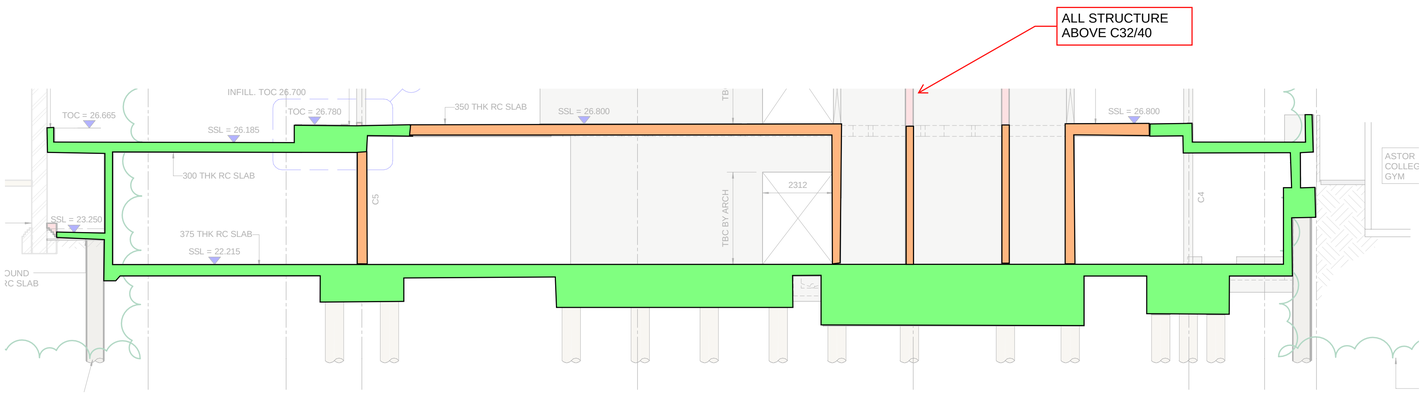
Refer to drawings MHA-ACM-00-XX-DR-SE-05100 and MHA-ACM-00-XX-DR-SE-05101 for location plans showing areas of higher strength and waterproof concrete.

See specialists drawings and specifications for full waterproofing details.

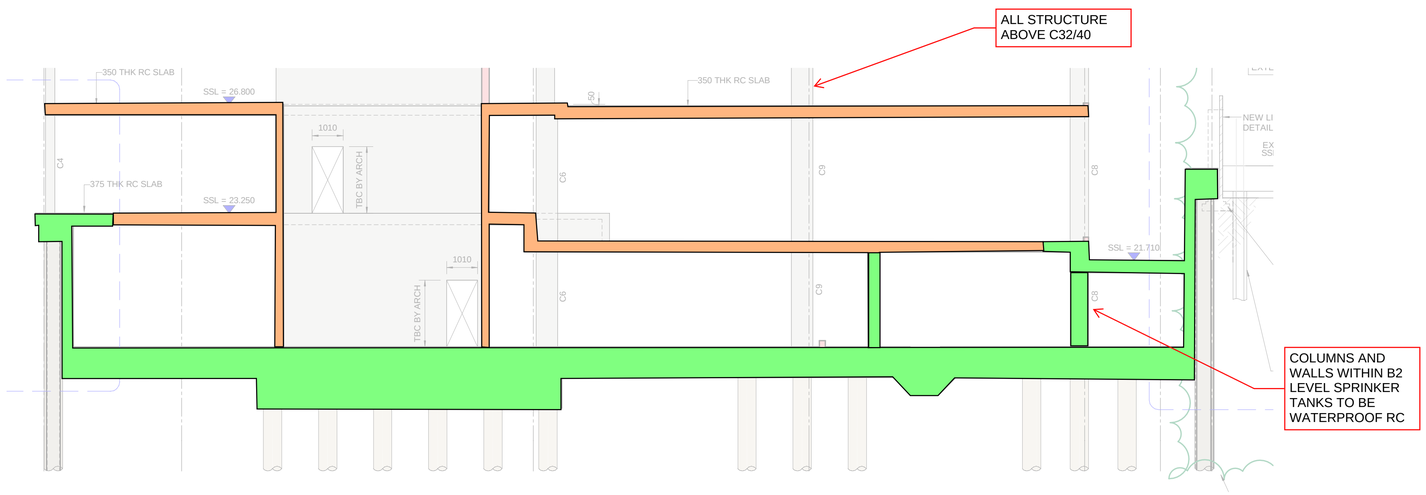
Project Management Initials: Designer: KSF Checked: DW Approved: DW Drawn By: KSF ISO A1 594mm x 841mm



NORTH-SOUTH SECTION THROUGH BASEMENT



EAST-WEST SECTION THROUGH B1 BASEMENT



EAST-WEST SECTION THROUGH B2 BASEMENT

C40/50 GRADE CONCRETE - SLABS, BEAMS, WALLS AND COLUMNS (ALL OTHER AREAS C32/40)

C40/50 GRADE CONCRETE AND WATERPROOF CONCRETE

AECOM

Project

BEDFORD PASSAGE DEVELOPMENT

UK & IRELAND

Client

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Notes

- Do not scale from this drawing. Work to figured dimensions only.
- This drawng is to be read in conjunction with:
  - AECOM Structural Specifications
  - Design reports
  - Survey and Interpretative Reports
  - Project Specifications and Performance Specifications
  - Health and Safety Hazard Register
  - Relevant drawings and documentation issued by the architect, engineers and specialists.
  - Building Information Model (BIM)
  - Movements and Tolerances Report
- All dimensions are in mm except levels which are in metres and relate to [ordance datum].
- Any discrepancies shall be referred to the Designer before work commences.

Issue/Revision

Rev.	Date	Description	Drn/Chk/Apr

Purpose Of Issue

FOR INFORMATION

Project Number

60516144

Sheet Title

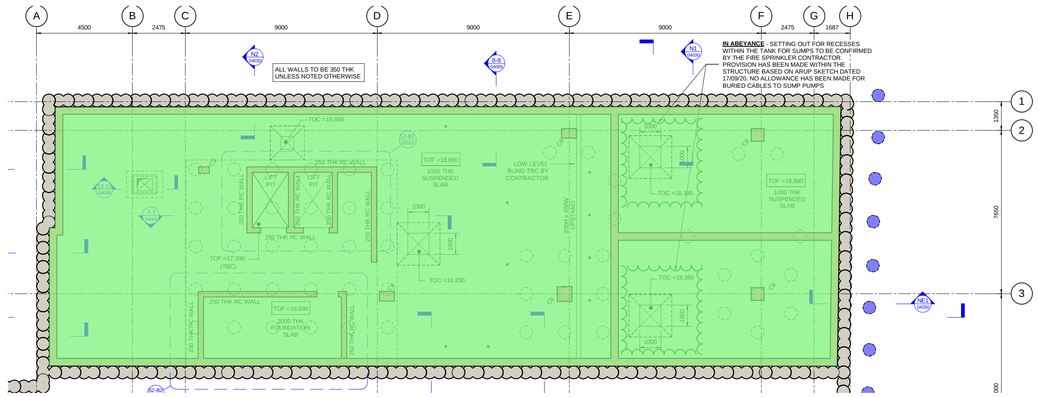
GRADE/TYPE OF CONCRETE LOCATION PLANS

Sheet Number

MHA-ACM-00-XX-DR-SE-05100

Scale: @A1 **Rev:**

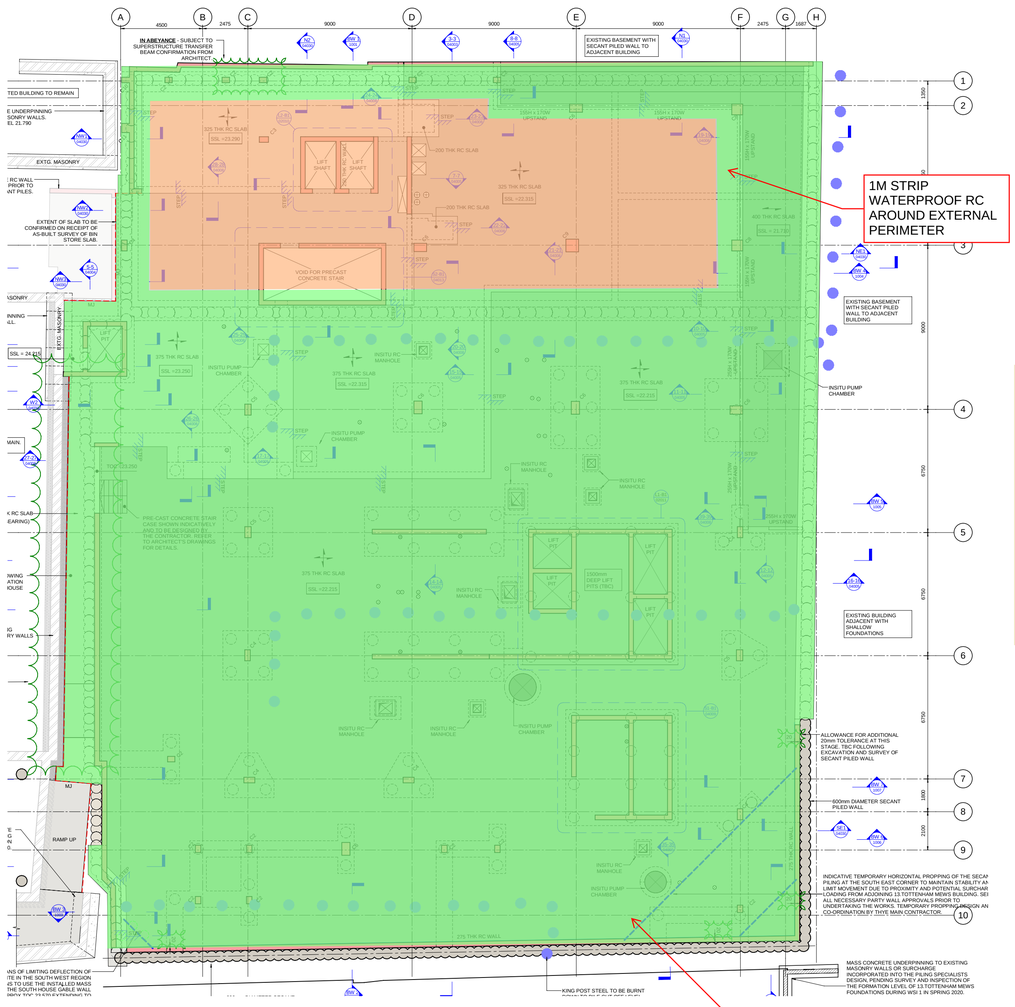
Project Management Initials: Designer: KSF Checked: DW Approved: DW Drawn By: KSF ISO A1 594mm x 841mm



BASEMENT LEVEL B2

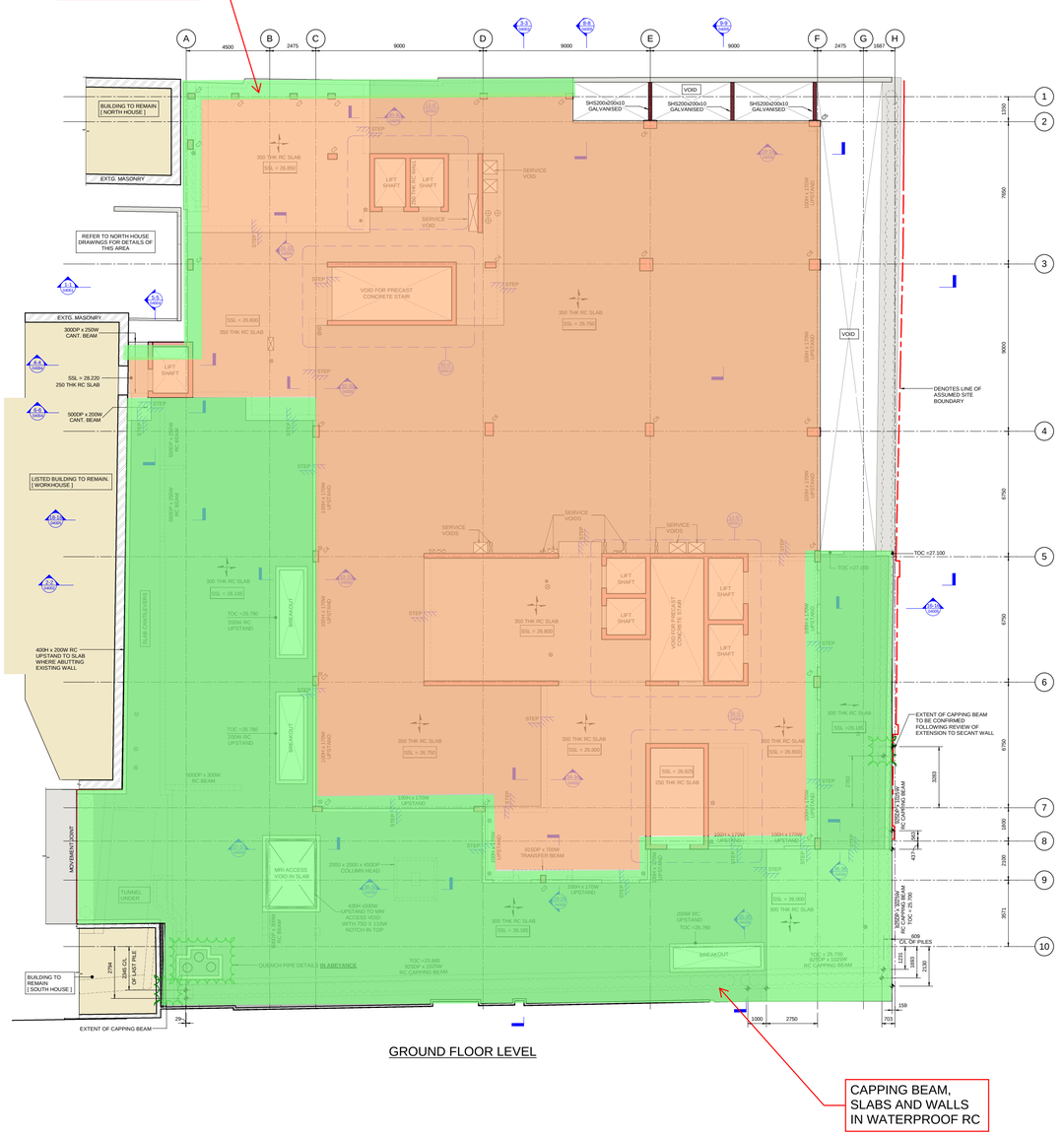
C40/50 GRADE CONCRETE - SLABS, BEAMS, WALLS AND COLUMNS (ALL OTHER AREAS C32/40)

C40/50 GRADE CONCRETE AND WATERPROOF CONCRETE



BASEMENT LEVEL B1

1M STRIP WATERPROOF RC AROUND PERIMETER



GROUND FLOOR LEVEL

AECOM

Project

BEDFORD PASSAGE DEVELOPMENT

UK & IRELAND

Client

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Rev.	Date	Description	Drn/Chk/Apr

Purpose Of Issue

FOR INFORMATION

Project Number

60516144

Sheet Title

GRADE/TYPE OF CONCRETE LOCATION SECTIONS

Sheet Number

MHA-ACM-00-XX-DR-SE-05101

Scale: @A1 **Rev:**