D50 UNDERPINNING

To be read with Preliminaries/ General conditions.

GENERAL

115 UNDERPINNING DESIGN – RC UNDERPIN TO PERIMETER WALLS (PARTY WALLS, ELEVATIONS)
- Purpose: To enable construction of basement.
- Extent: refer to AXIOM STRUCTURES drawings.
- Standards: concrete underpinning to BS 8004.
- Requirement:
  - Working loads: Not applicable.
  - Load factor: Not applicable.
  - Assumed bearing strata: **stiff CLAY**
- Design proposals: Confirm as adequate for the particular ground conditions revealed in the works or submit alternatives.

155 GROUND INVESTIGATION
- Report: Prepared by **Southern Testing, dated January 2015**

170 DISCONNECTION OF SERVICES IN WORKING AREAS
- Disconnections required: refer to specification C20 and specification by M&E / CA / Architects.
- Timing: Before commencing underpinning works within the building.
- Reconnection: Ensure that services cannot be reinstated by site operatives without consent.

TYPES OF UNDERPINNING

211 CONTINUOUS RC UNDERPINNING TO PERIMETER WALLS (PARTY WALLS, ELEVATIONS)
- Underpinning blocks:
  - Depth: Nominal **3.5 metre (multi-stage pinning)**, refer to drawings.
  - Length (maximum): **1.0 metre.**
  - Width on either side of wall centre line (minimum): to suit wall thickness as noted in the drawings. Do not extend beyond line of existing wall above on the adjacent owners land.
  - Depth of hard pack: 50-100mm.
- Materials:
  - Concrete: See specification E10/106.
  - Hard packing against existing brickwork: 1:3 cement:sharp sand mortar with CEBEX 100.
  - Hard packing to multi-stage underpinning: non-shrink grout fully filled across the width of concrete, **contractor to provide method statement for these works**.
    Water content: Sufficient only to ensure that packing binds together.
- Sequence: Submit proposals but no more than 25% of wall length to be unsupported at any time. Proposals to be submitted 28 days before commencement on site to enable agreement with Party Wall surveyor.
- Curing periods (minimum):
  - Between casting underpinning block and pinning up: 24 hours.
  - Between completion of pinning up and commencement of excavation for the next sequence of underpinning: 24 hours.

  Extend curing periods to allow for inclement weather.
- Shear connection between underpinning blocks: shear reinforcement as noted in the drawings.
- Features: underpin not to project further into site than existing footing.
- External surface of each pin to be lined *with outer face of existing wall above*

WATER IN EXCAVATION

220 GROUND WATER
- Ground investigation report by **Southern Testing** and subsequent trial pit excavation works has identified that there could be low/ medium volume ingress of water from localised pockets in CLAY. The contractor should have a contingency plan if larger water flow is expected in the

excavation, especially at depths over the CLAY where ground water is expected and intersecting stratum points (such as but not limited to Made Ground with Sands) .

Contractor to allow for ground water control measures (note that the works are in CLAYS).

- Water, whether ground water, rainwater, or water from any other source shall be removed from excavations, whether blinded or not. Such water can, with the agreement of the Engineer, be taken directly to a storage tank. Alternatively, it can be discharged into the Local Authority sewer via a silt trap, if agreed with the Statutory Authority.
- Where local pumping is employed, precautions shall be taken to prevent disturbance of material in and around the excavations. Proposals for disposal of water shall be agreed with any relevant Authorities, and submitted to the Engineer for approval.
- Where grouting is used as a ground water control measure this will be subject to party wall agreement.

ACCESSORIES FOR UNDERPINNING

435 IN SITU CONCRETE FOR UNDERPINNING
- Standard: To BS 8110-1.
- Concrete: designated as specification E10/105 and 106.
- Embedded metal: None.
- Fibres: None.
- Immature concrete: Protect from drying, frost and loading for a minimum period of 7 days.
- Extend period to allow for inclement weather.
- Cover to reinforcement (minimum):
- Top face: not applicable.
- Faces cast against not applicable.

440 MAKING CONCRETE GENERALLY
- Standard: To BS 8500-2.
- Exchange of information: Provide concrete producer with information required by BS 8500-1, clauses 4 and 5.

442 ADDITIONAL REQUIREMENT FOR CONCRETE QUALITY
- Variation from BS 8500-1: Comply with the requirements of BRE Special Digest 1 where these vary from those of BS 8500-1.

475 STEEL REINFORCEMENT GENERALLY
- Type/ Grade: 460.
- Cutting and bending: To BS 8666.
- Lap lengths (minimum): 40 x bar diameter.
- 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).
- Cleanliness: At time of placing concrete, reinforcement to be clean, free of corrosive pitting and loose millscale or rust.

EXECUTION

609 PROPPING OF OPENINGS ABOVE
- Openings at ground floor level may need to be suitably propped to restrict any cracking during the underpinning works.

610 LOOSE MASONRY/CONCRETE

- Specification: test underside of existing masonry/footing for soundness by tapping with a hammer. Break-out and remove any loose or unsound material to a uniform level soffit.

615 CONSTRUCTION OF CONCRETE UNDERPINNING

- Block and working space: Excavate together.
- Formation:

- Preparation: Remove or compact loose material.
- Protection: Cover with 50 mm thickness of concrete if there will be a delay of more than four hours between completion of excavation and casting of concrete underpinning.
- Keep excavations clean and dry. Remove all soil and loose concrete from adjacent completed pins to form a good key.
- Do not excavate beyond the required width of footing at the rear. Do not excavate more working space than necessary at the front.
- Split sleeves: Provide around drain/ service passing through underpinning. Closely fit a rigid sheet to each side of opening to prevent ingress of fill or vermin.
- Clearance around drain/ service (minimum): 50mm.
- Dowels/ Shear key/ Front shutter: Plain vertical formwork for the inner face of the underpinning with joints sealed to prevent water loss.

Provide shear key via joggled joints or dowels.

- Casting underpinning: In one lift, leaving a gap for packing up beneath existing foundation.
- Packing: On completion of concrete curing period, dry pack the full width of the gap between underpinning block and existing foundation. Pack in strips not exceeding 75mm. Allow packing to cure before commencing excavation for the next sequence of underpinning.

616 PINNING UP – DRY PACKING

- Use a wooden ram to hammer mortar hard, in strips not exceeding 75mm deep into gap working symmetrically from the rear toward the face so as to completely fill all space between underpinning concrete and existing footing / underpinning with mortar.

COMPLETION

910 HEALTH AND SAFETY FILE - CONCRETE UNDERPINNING

- Requirement: Collate and submit a full set of records for inclusion in the health and safety file.
- Number of copies: two.
- Content: For each underpinning block record:
- Date of casting.
- Depth of base below datum.
- Length.
- Width either side of wall.
- Details of drains and services built into block and diameter of sleeving.
- Latest date for submission: 14 days after completion.

E05 IN SITU CONCRETE CONSTRUCTION GENERALLY

To be read with Preliminaries/General conditions

110 ARRANGEMENT OF INFORMATION: The different parts of in situ concrete construction are specified in separate sections as follows:

E10 In situ concrete mixes, castings and curing
E20 Formwork
E30 Reinforcement
E40 Designed Joints

Clauses dealing with particular aspects of certain types of construction may thus be dispersed over several sections.

Where not otherwise specified in this specification all concrete construction shall comply with the NSCS (National Structural Concrete Specification)

220 STRUCTURAL DESIGN PROVIDED

- Description: *All in-situ reinforced concrete.*
- Requirements:
  - Generally: *Designed BS 6399 and BS8110*.

- Additional requirements: *None.*
- Production/ execution records: *In accordance with the designated Code of Practice.*

223 STRUCTURAL DRAWINGS AND SCHEDULES
- Standards:
  - Drawings: To *'Standard method of detailing structural concrete' published by the Institute of Structural Engineers..*
  - Reinforcement schedules: To *BS8666.*

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: *+-10mm as measured from the nearest temporary bench mark*..
  - Steps in floor level: *At steps +-5mm, 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.

315 SURFACE REGULARITY OF CONCRETE FLOORS TO BS 8204 - TOLERANCE CLASS *SR1* .
- Location: *Floors to receive finishes less than 30mm thick.*
- Abrupt changes: *Not permitted.*

410 IN SITU CONCRETE CONSTRUCTION - SUPERVISION/ CHECKING
- Standard: BS EN 206-1/BS 8500.

430 SURFACE CRACKING *FOR VISIBLE REINFORCED CONCRETE*
- Method of measurement: *Contractor's choice*.
- Critical crack width: *0.3mm*.
- Action: Should cracks occur that are wider than the critical crack width:
  - Survey: Frequency and extent of such cracks and investigate cause.
  - Report: Findings together with recommendations for rectification.

E10 IN SITU CONCRETE MIXES, CASTING AND CURING

To be read with Preliminaries/General conditions.

CONCRETE MIXES

100 Full details of all concrete mix designs must be submitted, by the supplier, to the CA allowing a minimum of two weeks for approval.

101 DESIGNATED MIX FOR STRUCTURAL BLINDING (to be placed under all slabs and RC foundations with the exception of underpins).
- Mix FND 3 to BS 8500
- The concrete will be unreinforced
- Nominal maximum size of aggregate: 20 mm
- Admixtures: An accelerator or retarder may not be used.

102 DESIGNATED MIX FOR MASS CONCRETE STRIP, PAD FOUNDATIONS AND MASS CONCRETE UNDERPINS.
- Mix **FND2** (C20/25) to BS 8500 - see clause 110 for below ground concrete
- The concrete will be unreinforced
- Nominal maximum size of aggregate: 20 mm
- Admixtures: An accelerator, retarder or plasticiser may be used only with the prior consent of the CA.

104 DESIGNATED MIX FOR NEW BASEMENT BOX - REINFORCED CONCRETE RAFTS, BASEMENT WALLS, INCLUDING RC UNDERPINNING, ASSOCIATED UPSTANDS, PODIUM SLABS, RETAINING WALLS
- Mix **RC32/40** to BS 8500
- The concrete will be reinforced
- Nominal maximum size of aggregate: 20 mm
- Admixtures; An accelerator, retarder or plasticiser may be used only with the prior consent of the CA.

106 DESIGNATED MIX FOR REINFORCED CONCRETE UPPER FLOOR SLABS ON METAL DECK.
- **Mix RC25/30** to BS 8500
- The concrete will be reinforced
- **Normal Weight Concrete**
- Nominal maximum size of aggregate: 20 mm
- Admixtures; An accelerator, retarder or plasticiser may be used only with the prior consent of the CA.

111 **Concrete cast in contact with ground = all reinforced concrete reinforced concrete pads to be class AC-2 (DS-2) to BS8500 part 1.**

MATERIALS, BATCHING AND MIXING

215 READY-MIXED CONCRETE
- Production plant: Currently certified by a body accredited by UKAS to BS EN 45011 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 3m^3* .
  - Accuracy of measuring devices: To BS EN 206-1, clause 9.6.2.2.
    Tolerances for quantity of constituent material: To BS EN 206-1, table 21.

- Batching by volume:
  - Restrictions: *Maximum pour size 0.5m^3*.
- Mixing: To BS 8000-2.1, subsections 2, 3 and 4.
- **Testing: Each batch to be tested as per clauses below**

221 INFORMATION ABOUT PROPOSED CONCRETES
- Submit when requested:
  - Details listed in BS 8500-1, clause 5.2.
  - Additional information: *None*.

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

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.

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

418 PROPRIETARY ADMIXTURE
- Admixtures; An accelerator, retarder or plasticiser may be used only with the prior consent of the CA.

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

PROJECT TESTING/ CERTIFICATION

508 REGULAR PROJECT TESTING OF CONCRETE *FOR ALL OTHER THAN DESIGNATED CONCRETE MIXES.*
- Tests: *Compressive strength,* ***conformity with DC class***.
- Sampling:
  - Point: *At point of discharge from delivery truck*.
  - Rate: *One sample per 12m3 (columns) 30m^2 (beams and slabs),* ***One sample per each underpinning base and stem.***
- Other requirements: *Cubes for early age strength testing to be stored under the same conditions as the concrete in the 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: *3*.
- 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: To be part of contractor's method statement.
- 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.

645 SPACING OF CONSTRUCTION JOINTS
- Type of construction: Suspended slabs/ Retaining walls/ Raft slabs
  - Distance between joints (maximum): Submit proposals.
  - Area of pour (maximum): Submit proposals.
  - Other requirements: Submit proposals.

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* with CA, *min. 5 days notice*

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 8110-1, table 6.1.*

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.